

**SECTION III**

**RANGE AND**

**PASTURE MANAGEMENT RESEARCH**

**1984**

## TABLE OF CONTENTS

|                                                              | <b>Page</b> |
|--------------------------------------------------------------|-------------|
| Complementary Rotation Grazing System                        | 1           |
| Native Range Fertilization                                   | 159         |
| Alfalfa Interseeding Techniques                              | 225         |
| Row Spacing Trial                                            | 225         |
| Furrow Width Trial                                           | 247         |
| Variety Response to Grazing                                  | 263         |
| Grazing Alfalfa Interseeded Pasture                          | 276         |
| Alfalfa Variety Trial                                        | 281         |
| Alfalfa Variety Trial at Hettinger                           | 287         |
| Bromegrass Variety Trial                                     | 293         |
| Leafy Spurge Control with Tebuthiuron                        | 294         |
| Leafy Spurge Control with Chemical and Mechanical Techniques | 311         |
| Shrub Reduction                                              | 324         |

## Complementary Rotation Grazing System – 1984

### Dickinson Experiment Station

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The 1984 grazing season was the second year of the complementary rotation grazing system at the ranch headquarters of the Dickinson Experiment Station. The complementary rotation grazing system consists of a crested wheatgrass (Agropyron desertorum) pasture for spring grazing, a native range three pasture rotation with twice over on each pasture for summer grazing, and an altai wildrye (Elymus angustus) pasture for fall and early winter grazing. The trial compares animal performance and herbage production between two treatments. The east treatment will be interseeded with a pasture type alfalfa and the west treatment will not be interseeded and used as a control. The east treatment was interseeded in the spring of 1984 but the seedlings failed to become established because of the lack of precipitation in July. Pasture type alfalfas (Medicago falcata) are more difficult to establish and the seedlings are less tolerant of drought conditions than the hay type alfalfas (M. sativa). Within each treatment, the herbage data was compared between the effects of grazing and ungrazing. During the 1983 grazing season both treatments were untreated to establish baseline data.

The soils of the crested wheatgrass and altai wildrye pastures are primarily silt loams and loams. The soils of the native range pastures are primarily fine sandy loams, loams, silty clay loams, silt loams and silty clay.

The crested wheatgrass and altai wildrye pastures were treated as monoculture pastures. The crested wheatgrass pastures were seeded prior to the experiment station occupation. The altai wildrye was seeded into fallow soil in the spring of 1982 at a seeding rate of 8 pounds PLS per acre. Fifty pounds of nitrogen per acre was broadcast applied on each crested wheatgrass and altai wildrye pasture in the spring of 1984.

The native range pastures are on mixed grass prairie with four major range sites which are clayey, sandy, shallow and silty. The dominant graminoids are blue grama (Bouteloua gracilis), threadleaved sedge (Carex filifolia), western wheatgrass (Agropyron smithii) and prairie junegrass (Koeleria pyramidata).

The data that was collected from these pastures were above ground herbage production, species composition by ten pin point frame and 0.1 meter square quadrats, leaf height measurements and phenological phases of eight major graminoid species, and animal performance by weight changes.

Four samples sites were systematically selected for each of the tame grass pastures. Each of the native range pastures had a sample site on each of the four major sites. Each of the respective range site sample sites were selected for similar soil, slope, and aspect in each pasture.

The above ground herbage production was sampled by clipping the vegetation to ground level inside ¼ meter square quadrats both inside and outside enclosure cages. The herbage was separated into nine categories: cool short, warm short, cool mid, western wheatgrass, warm mid, warm tall, sedges, forbs, and shrubs. The samples were oven dried at 80°C. The average herbage production for each category and the total production for each site were determined for each clipping period.

Quantitative species composition data were collected by the ten pin point frame method (Levy and Madden 1933, Tinney, Aamodt, and Ahlgren 1937, Heady and Rader 1958, and Smith 1959). One thousand points were read for each sample site. Forb and shrub density data were collected with a 0.1 meter square quadrat. The forbs and shrubs that were rooted within the frame were counted by species in each of the 25 quadrats per sample site.

Monthly leaf height measurements and phenological development of the flower stalks were collected for nine dominant graminoid species: Agropyron desertorum, Elymus angustus, Agropyron smithii, Bouteloua gracilis, Calamovilfa longifolia, Koeleria pyramidata, Poa pratensis, Stipa comata and Carex filifolia. Twenty four plants of each species were selected at random on each sample site. All of the leaves of each plant were outstretched and measured to the nearest millimeter in sequence from the oldest to youngest. Along with the length measurements, the degree of dryness for the leaf blades were recorded. The categories of dryness used were: 0, 0.1-2, 2.1-25, 25.1-50, 50.1-75, 75.1-98 and 100 percent dry. The highest value of the category was used to record the percentage of dryness for each leaf blade.

If the flower stalks were present, the height was measured and the phenological stage of development was recorded. The categories used were: flower stalk developing, head emergence, anthesis, seeds developing and seeds being shed.

Alfalfa seedling densities per meter of row were collected on each range site of the east treatment both grazed and ungrazed in July and August.

Animal performance was determined by weight gains or losses. Cattle were weighed on and off each pasture during the scheduled rotation periods. These data were converted into mean weight gain in pounds per day per head and mean weight gain in pounds per day per acre for the calves, cows and bulls. Nineteen cow-calf pairs of commercial Hereford and Hereford X Angus were used on each treatment in 1984.

**Figure 1** – Diagram of the Crested Wheatgrass, Native Range and Altai Wildrye Pastures of the West and East Systems for the Complementary Rotation Grazing System at the Ranch Headquarters of the Dickinson Experiment Station.

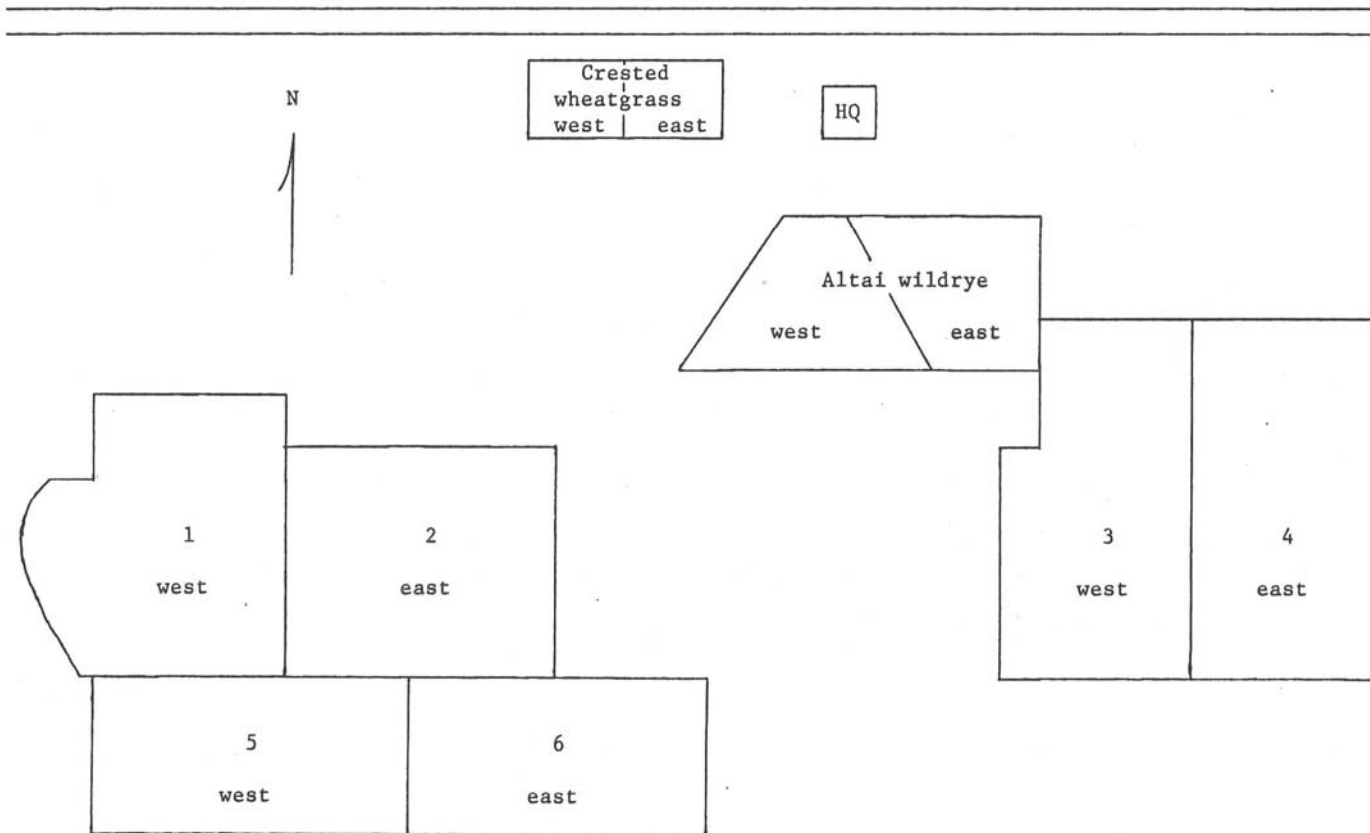


Figure 1. Diagram of the crested wheatgrass, native range and altai wildrye pastures of the west and east systems for the complementary rotation grazing system at the Ranch Headquarters of the Dickinson Experiment Station.

**Table 1. The Rotation Dates and Stocking Pressure Data for the Complementary Rotation Grazing System  
At the Dickinson Experiment Station – 1984**

| <b>Treatment<br/>Pasture</b>    | <b>Pasture<br/>Size in<br/>Acres</b> | <b>Dates Grazed</b>                                                      | <b>Days<br/>In<br/>Period</b> | <b>Total<br/>Days<br/>Grazed</b> | <b>Number of<br/>Head</b>                 | <b>Number of<br/>AUM's</b>     | <b>Stocking<br/>Rate<br/>AUM/Acre</b> |
|---------------------------------|--------------------------------------|--------------------------------------------------------------------------|-------------------------------|----------------------------------|-------------------------------------------|--------------------------------|---------------------------------------|
| <b>WEST SYSTEM:</b>             |                                      |                                                                          |                               |                                  |                                           |                                |                                       |
| Untreated<br>Crested Wheatgrass | 13                                   | 10 May – 01 Jun                                                          | 22                            | 22                               | 20 Cow/calf                               | 14.43                          | 1.11                                  |
| Native Range                    |                                      |                                                                          |                               |                                  |                                           |                                |                                       |
| 5 (C)                           | 80                                   | 01 Jun – 15 Jun<br>01 Aug – 31 Aug                                       | 14<br>30                      | 44                               | 19 Cow/calf<br>1 Bull<br>19 Cow/calf      | 27.87                          | 0.35                                  |
| 3 (A)                           | 75                                   | 15 Jun – 29 Jun<br>31 Aug – 01 Oct                                       | 14<br>31                      | 45                               | 19 Cow/calf<br>1 Bull<br>19 Cow/calf      | 28.49                          | 0.38                                  |
| 1 (B)                           | 85                                   | 29 Jun – 01 Aug<br>01 Oct – 16 Oct                                       | 33<br>15                      | 48                               | 19 Cow/calf<br>1 Bull<br>19 Cow/calf      | 30.98                          | 0.36                                  |
| Altai Wildrye                   | 30                                   | 16 Oct – 03 Dec<br>03 Dec – 18 Dec<br>18 Dec – 31 Dec<br>16 Oct – 31 Dec | 48<br>15<br>13                | 76                               | 19 Cow/calf<br>19 Cow<br>19 Cow<br>19 Cow | 29.90<br>9.34<br>8.10<br>47.34 | 1.00<br>0.31<br>0.27<br>1.58          |

**Table 2. The Rotation Dates and Stocking Pressure Data for the Complementary Rotation Grazing System At the Dickinson Experiment Station – 1984**

| <b>Treatment Pasture</b>               | <b>Pasture Size in Acres</b> | <b>Dates Grazed</b>                                                      | <b>Days In Period</b> | <b>Total Days Grazed</b> | <b>Number of Head</b>                     | <b>Number of AUM's</b>         | <b>Stocking Rate AUM/Acre</b> |
|----------------------------------------|------------------------------|--------------------------------------------------------------------------|-----------------------|--------------------------|-------------------------------------------|--------------------------------|-------------------------------|
| <b>EAST SYSTEM:</b>                    |                              |                                                                          |                       |                          |                                           |                                |                               |
| Alfalfa interseeded Crested Wheatgrass | 13                           | 10 May – 01 Jun                                                          | 22                    | 22                       | 20 Cow/calf                               | 14.43                          | 1.11                          |
| <b>Native Range</b>                    |                              |                                                                          |                       |                          |                                           |                                |                               |
| 6 (C)                                  | 80                           | 01 Jun – 15 Jun<br>01 Aug – 31 Aug                                       | 14<br>30              | 44                       | 19 Cow/calf<br>1 Bull<br>19 Cow/calf      | 27.87                          | 0.35                          |
| 4 (A)                                  | 75                           | 15 Jun – 29 Jun<br>31 Aug – 01 Oct                                       | 14<br>31              | 45                       | 19 Cow/calf<br>1 Bull<br>19 Cow/calf      | 28.49                          | 0.38                          |
| 2 (B)                                  | 80                           | 29 Jun – 01 Aug<br>01 Oct – 16 Oct                                       | 33<br>15              | 48                       | 19 Calf/cow<br>1 Bull<br>19 Cow/calf      | 30.98                          | 0.39                          |
| Altai Wildrye                          | 30                           | 16 Oct – 03 Dec<br>03 Dec – 18 Dec<br>18 Dec – 31 Dec<br>16 Oct – 31 Dec | 48<br>15<br>13        | 76                       | 19 Cow/calf<br>19 Cow<br>19 Cow<br>19 Cow | 29.90<br>9.34<br>8.10<br>47.34 | 1.00<br>0.31<br>0.27<br>1.58  |

**Table 3. Mean Daily Weight Gains for the Calves, Cows and Bulls on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

| <b>Treatment<br/>Animal Class</b> | <b>Crested<br/>Wheatgrass</b> | <b>Native Range</b> |                 |                 | <b>Altai<br/>Wildrye</b> |
|-----------------------------------|-------------------------------|---------------------|-----------------|-----------------|--------------------------|
|                                   |                               | <b><u>C</u></b>     | <b><u>A</u></b> | <b><u>B</u></b> |                          |
| <b>WEST SYSTEM:</b>               |                               | 5                   | 3               | 1               |                          |
| <b><u>Calf</u></b>                |                               |                     |                 |                 |                          |
| Gain/day/head                     | 2.09                          | 2.35                | 1.73            | 1.61            | 1.09                     |
| Gain/day/acre                     | 3.22                          | 0.56                | 0.44            | 0.36            | 0.69                     |
| <b><u>Cow</u></b>                 |                               |                     |                 |                 |                          |
| Gain/day/head                     | 3.29                          | 0.54                | 1.16            | -0.86           | -0.12                    |
| Gain/day/acre                     | 5.07                          | 0.13                | 0.29            | -0.19           | -0.07                    |
| <b><u>Bull</u></b>                |                               |                     |                 |                 |                          |
| Gain/day/head                     |                               | 0.86                | 2.86            | 0.73            |                          |
| Gain/day/acre                     |                               | 0.01                | 0.04            | 0.01            |                          |
| <b>EAST SYSTEM:</b>               |                               | <b><u>C</u></b>     | <b><u>A</u></b> | <b><u>B</u></b> |                          |
|                                   |                               | 6                   | 4               | 2               |                          |
| <b><u>Calf</u></b>                |                               |                     |                 |                 |                          |
| Gain/day/head                     | 2.19                          | 2.53                | 1.65            | 1.88            | 1.14                     |
| Gain/day/acre                     | 3.36                          | 0.60                | 0.42            | 0.45            | 0.72                     |
| <b><u>Cow</u></b>                 |                               |                     |                 |                 |                          |
| Gain/day/head                     | 2.93                          | 0.55                | 0.73            | -0.80           | 0.00                     |
| Gain/day/acre                     | 4.50                          | 0.13                | 0.18            | -0.19           | 0.00                     |
| <b><u>Bull</u></b>                |                               |                     |                 |                 |                          |
| Gain/day/head                     |                               | -6.64               | 2.57            | 3.24            |                          |
| Gain/day/acre                     |                               | -0.08               | 0.03            | 0.04            |                          |

**Table 4. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Crested Wheatgrass on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – WEST | I-----I   |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Crested whtg. | 790.3     | 1049.9    | 1284.5    | 1625.7    | 2036.0    | 2281.7    | 2208.6    | 1950.4    | 1697.0    |          |           |
| Other grasses | 0.0       | 13.4      | 35.2      | 24.1      | 96.8      | 3.6       | 8.0       | 19.6      | 53.5      |          |           |
| Grass Total   | 790.3     | 1063.3    | 1319.7    | 1649.8    | 2132.8    | 2285.3    | 2216.6    | 1970.0    | 1750.6    |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Forbs         | 1.8       | 9.8       | 4.0       | 8.5       | 51.7      | 9.8       | 6.2       | 5.8       | 17.0      |          |           |
| Shrubs        | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         | 792.1     | 1073.1    | 1323.7    | 1658.2    | 2184.5    | 2295.1    | 2222.9    | 1975.8    | 1767.5    |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Crested whtg. |           | 1049.9    | 490.2     | 663.7     | 891.6     | 1202.9    | 944.2     | 807.7     | 747.5     |          |           |
| Other grasses |           | 13.4      | 40.1      | 22.3      | 53.5      | 26.3      | 44.2      | 33.9      | 24.5      |          |           |
| Grass Total   |           | 1063.3    | 530.3     | 686.0     | 945.1     | 1229.2    | 988.3     | 841.6     | 772.0     |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Forbs         |           | 9.8       | 8.9       | 15.6      | 36.6      | 16.5      | 12.0      | 95.9      | 6.7       |          |           |
| Shrubs        |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           | 1073.1    | 539.2     | 701.6     | 981.6     | 1245.7    | 1000.4    | 937.5     | 778.7     |          |           |

**Table 5. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Crested Wheatgrass on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – EAST | I-----I   |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Crested whtg. | 790.3     | 1068.6    | 829.6     | 1372.3    | 1560.1    | 2260.3    | 2805.0    | 2288.0    | 1826.4    |          |           |
| Other grasses | 0.0       | 0.0       | 6.2       | 22.3      | 14.3      | 9.4       | 12.0      | 19.6      | 0.0       |          |           |
| Grass Total   | 790.3     | 1068.6    | 835.8     | 1394.6    | 1574.4    | 2269.7    | 2817.0    | 2307.6    | 1826.4    |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Forbs         | 1.8       | 16.1      | 0.0       | 12.0      | 25.0      | 5.8       | 169.9     | 37.9      | 15.2      |          |           |
| Shrubs        | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         | 792.1     | 1084.7    | 835.8     | 1406.7    | 1599.4    | 2275.5    | 2986.9    | 2345.5    | 1841.5    |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Crested whtg. |           | 1068.6    | 508.0     | 706.9     | 727.4     | 1028.9    | 1019.6    | 1109.7    | 783.6     |          |           |
| Other grasses |           | 0.0       | 20.1      | 17.8      | 15.6      | 21.4      | 56.2      | 44.2      | 3.1       |          |           |
| Grass Total   |           | 1068.6    | 528.1     | 724.8     | 743.0     | 1050.3    | 1075.8    | 1153.8    | 786.7     |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Forbs         |           | 16.1      | 11.2      | 10.7      | 29.0      | 17.8      | 15.2      | 25.4      | 32.6      |          |           |
| Shrubs        |           | 0.0       | 0.0       | 1.8       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           | 1084.7    | 539.2     | 737.2     | 772.0     | 1068.2    | 1090.9    | 1179.2    | 819.3     |          |           |

**Table 6. Mean Above Ground Herbage Production in Lbs./Acre for the Crested Wheatgrass on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | <b>25<br/>Apr</b> | <b>15<br/>May</b> | <b>30<br/>May</b> | <b>15<br/>Jun</b> | <b>30<br/>Jun</b> | <b>15<br/>Jul</b> | <b>31<br/>Jul</b> | <b>15<br/>Aug</b> | <b>30<br/>Aug</b> | <b>2<br/>Oct</b> | <b>15<br/>Oct</b> |
|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| <b>System – West</b> | <b>I-----I</b>    |                   |                   |                   |                   |                   |                   |                   |                   |                  |                   |
| Ungrazed             | 792.1             | 1073.1            | 1323.7            | 1658.2            | 2184.5            | 2295.1            | 2222.9            | 1975.8            | 1767.5            |                  |                   |
| Grazed               |                   | 1073.1            | 539.2             | 701.6             | 981.6             | 1245.7            | 1000.4            | 937.5             | 778.7             |                  |                   |
|                      |                   |                   |                   |                   |                   |                   |                   |                   |                   |                  |                   |
| <b>System – East</b> |                   |                   |                   |                   |                   |                   |                   |                   |                   |                  |                   |
| Ungrazed             | 792.1             | 1084.7            | 835.8             | 1406.7            | 1599.4            | 2275.5            | 2986.9            | 2345.5            | 1841.5            |                  |                   |
| Grazed               |                   | 1084.7            | 539.2             | 737.2             | 772.0             | 1068.2            | 1090.9            | 1179.2            | 819.3             |                  |                   |

**Table 7. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 1          |           |           |           |           |           |           |           |           |           |          |           |
| Site -Clayey         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 190.2     | 168.8     | 64.2      | 128.5     | 233.7     | 124.9     | 92.8      |          |           |
| Warm Short           |           |           | 145.6     | 621.9     | 366.8     | 167.7     | 483.5     | 542.3     | 584.1     |          |           |
| Cool Mid             |           |           | 154.5     | 150.9     | 121.3     | 454.9     | 80.3      | 371.1     | 213.0     |          |           |
| Western whtg.        |           |           | 142.7     | 292.6     | 306.1     | 303.3     | 390.7     | 324.7     | 253.3     |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 118.8     | 17.8      | 8.9       | 0.0       | 0.0       | 17.8      | 7.1       |          |           |
| Grass Total          |           |           | 751.8     | 1252.0    | 867.4     | 1054.4    | 1188.1    | 1380.8    | 1150.3    | 1848.2   | 2251.4    |
| Forbs                |           |           | 109.9     | 174.1     | 317.6     | 410.3     | 631.5     | 446.0     | 792.1     | 529.8    | 927.7     |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 861.7     | 1426.1    | 1184.9    | 1464.7    | 1819.7    | 1826.8    | 1942.4    | 2378.0   | 3179.1    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           |           | 64.2      | 106.0     | 10.7      | 41.8      | 17.8      |          |           |
| Warm Short           |           |           |           |           | 366.8     | 315.1     | 745.7     | 566.2     | 395.0     |          |           |
| Cool Mid             |           |           |           |           | 121.3     | 188.0     | 202.3     | 205.9     | 123.8     |          |           |
| Western whtg.        |           |           |           |           | 306.1     | 227.3     | 295.1     | 78.5      | 129.5     |          |           |
| Warm Mid             |           |           |           |           | 0.0       | 184.5     | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           |           | 8.9       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Grass Total          |           |           |           |           | 867.4     | 1020.8    | 1253.8    | 892.4     | 666.2     | 1550.3   | 1279.1    |
| Forbs                |           |           |           |           | 317.6     | 443.5     | 569.8     | 171.3     | 362.9     | 174.8    | 231.9     |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           |           | 1184.9    | 1464.3    | 1823.6    | 1063.6    | 1029.0    | 1725.1   | 1511.1    |

**Table 8. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 1          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Sandy         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 160.6     | 10.0      | 7.9       | 5.4       | 62.4      | 25.0      | 11.8      |          |           |
| Warm Short           |           |           | 29.6      | 94.6      | 7.9       | 1.8       | 119.5     | 78.5      | 92.8      |          |           |
| Cool Mid             |           |           | 64.2      | 422.1     | 277.6     | 337.2     | 249.8     | 208.0     | 205.9     |          |           |
| Western whtg.        |           |           | 17.8      | 4.6       | 13.6      | 0.0       | 35.7      | 9.6       | 18.9      |          |           |
| Warm Mid             |           |           | 0.0       | 11.8      | 2.9       | 5.4       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 148.1     | 315.8     | 477.4     | 738.6     | 838.5     | 502.0     | 768.2     |          |           |
| Sedge                |           |           | 392.5     | 622.6     | 344.0     | 401.4     | 422.8     | 304.4     | 230.9     |          |           |
| Grass Total          |           |           | 812.8     | 1481.4    | 1131.1    | 1489.6    | 1728.7    | 1127.5    | 1328.4    | 1423.6   | 2044.5    |
| Forbs                |           |           | 41.0      | 84.9      | 97.8      | 92.8      | 66.0      | 38.2      | 8.2       | 173.1    | 28.5      |
| Shrubs               |           |           | 80.3      | 68.9      | 26.4      | 169.5     | 98.1      | 59.6      | 117.7     | 74.9     | 60.7      |
| <b>Total</b>         |           |           | 934.1     | 1635.2    | 1255.2    | 1751.9    | 1892.8    | 1225.3    | 1454.3    | 1671.6   | 2133.7    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           |           | 7.9       | 18.9      | 76.0      | 7.1       | 42.8      |          |           |
| Warm Short           |           |           |           |           | 7.9       | 31.0      | 59.6      | 107.0     | 39.3      |          |           |
| Cool Mid             |           |           |           |           | 277.6     | 334.3     | 418.5     | 241.6     | 256.9     |          |           |
| Western whtg.        |           |           |           |           | 13.6      | 8.2       | 40.3      | 8.2       | 0.0       |          |           |
| Warm Mid             |           |           |           |           | 2.9       | 9.6       | 136.7     | 0.0       | 38.2      |          |           |
| Warm Tall            |           |           |           |           | 477.4     | 422.1     | 650.5     | 211.6     | 304.4     |          |           |
| Sedge                |           |           |           |           | 344.0     | 411.4     | 218.7     | 335.4     | 147.4     |          |           |
| Grass Total          |           |           |           |           | 1131.1    | 1235.6    | 1600.3    | 910.9     | 828.9     | 895.6    | 1971.3    |
| Forbs                |           |           |           |           | 97.8      | 118.8     | 206.9     | 102.4     | 32.1      | 67.8     | 26.8      |
| Shrubs               |           |           |           |           | 26.4      | 20.3      | 56.0      | 96.3      | 23.9      | 14.3     | 105.3     |
| <b>Total</b>         |           |           |           |           | 1255.2    | 1374.7    | 1863.2    | 1109.7    | 884.9     | 977.7    | 2103.3    |

**Table 9. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 1          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Shallow       |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 135.6     | 89.2      | 110.6     | 126.7     | 169.5     | 56.0      | 79.6      |          |           |
| Warm Short           |           |           | 12.5      | 185.5     | 79.6      | 108.8     | 55.3      | 139.2     | 98.8      |          |           |
| Cool Mid             |           |           | 17.1      | 198.0     | 243.7     | 421.0     | 276.5     | 399.6     | 240.1     |          |           |
| Western whtg.        |           |           | 0.0       | 0.0       | 1.1       | 10.7      | 32.1      | 42.8      | 0.0       |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 26.8      | 0.0       | 219.4     | 53.5      | 74.9      |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 324.0     | 192.7     | 198.0     | 255.1     | 124.9     | 135.6     | 64.2      |          |           |
| Grass Total          |           |           | 489.2     | 665.4     | 659.7     | 922.3     | 877.7     | 826.7     | 557.7     | 1066.8   | 512.0     |
| Forbs                |           |           | 165.2     | 115.3     | 51.7      | 117.7     | 160.6     | 183.0     | 234.4     | 130.2    | 44.6      |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 50.0      | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 654.4     | 780.7     | 711.5     | 1040.1    | 1088.2    | 1009.8    | 792.1     | 1197.0   | 556.6     |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           |           | 110.6     | 81.0      | 97.4      | 82.1      | 51.0      |          |           |
| Warm Short           |           |           |           |           | 79.6      | 59.6      | 141.7     | 116.7     | 140.2     |          |           |
| Cool Mid             |           |           |           |           | 243.7     | 516.3     | 384.3     | 229.4     | 148.8     |          |           |
| Western whtg.        |           |           |           |           | 1.1       | 6.1       | 0.0       | 0.0       | 13.2      |          |           |
| Warm Mid             |           |           |           |           | 26.8      | 26.1      | 50.0      | 17.8      | 74.9      |          |           |
| Warm Tall            |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           |           | 198.0     | 155.9     | 206.9     | 57.1      | 67.8      |          |           |
| Grass Total          |           |           |           |           | 659.7     | 844.9     | 880.2     | 503.1     | 496.0     | 635.1    | 433.5     |
| Forbs                |           |           |           |           | 51.7      | 135.6     | 115.3     | 170.2     | 138.1     | 60.7     | 46.4      |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 23.9      | 0.0       | 20.3      | 10.7     | 0.0       |
| <b>Total</b>         |           |           |           |           | 711.5     | 980.5     | 1019.4    | 673.3     | 654.4     | 706.5    | 479.9     |

**Table 10. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – West | I-----I   |           |           |           |           |           |           | I-----I   |           |          |           |
| Pasture – 1   |           |           |           |           |           |           |           |           |           |          |           |
| Site – Silty  |           |           |           |           |           |           |           |           |           |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 29.6      | 38.5      | 72.4      | 1.8       | 0.0       | 47.5      | 6.1       |          |           |
| Warm Short    |           |           | 171.3     | 373.9     | 516.7     | 708.3     | 715.4     | 616.2     | 547.0     |          |           |
| Cool Mid      |           |           | 147.4     | 561.3     | 246.2     | 351.5     | 519.1     | 630.5     | 857.4     |          |           |
| Western whtg. |           |           | 137.4     | 155.2     | 182.0     | 130.2     | 107.0     | 102.4     | 78.5      |          |           |
| Warm Mid      |           |           | 0.0       | 14.3      | 12.5      | 0.0       | 0.0       | 265.1     | 0.0       |          |           |
| Warm Tall     |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           | 151.6     | 142.7     | 85.6      | 3.6       | 14.3      | 21.4      | 33.2      |          |           |
| Grass Total   |           |           | 637.2     | 1285.9    | 1115.4    | 1195.3    | 1355.8    | 1683.0    | 1522.1    | 3300.4   | 2481.5    |
| Forbs         |           |           | 171.3     | 126.0     | 86.7      | 383.6     | 472.8     | 167.7     | 235.5     | 110.6    | 119.5     |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 808.5     | 1411.8    | 1202.1    | 1578.8    | 1828.6    | 1850.7    | 1757.6    | 3411.0   | 2601.1    |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           |           |           | 72.4      | 54.6      | 21.4      | 26.1      | 0.0       |          |           |
| Warm Short    |           |           |           |           | 516.7     | 745.7     | 407.8     | 531.6     | 275.8     |          |           |
| Cool Mid      |           |           |           |           | 246.2     | 418.5     | 331.8     | 321.1     | 252.3     |          |           |
| Western whtg. |           |           |           |           | 182.0     | 178.4     | 215.2     | 103.5     | 97.4      |          |           |
| Warm Mid      |           |           |           |           | 12.5      | 0.0       | 56.0      | 157.0     | 102.4     |          |           |
| Warm Tall     |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           |           |           | 85.6      | 9.6       | 25.0      | 31.0      | 25.0      |          |           |
| Grass Total   |           |           |           |           | 1115.4    | 1406.9    | 1057.2    | 1170.3    | 752.9     | 2378.1   | 1737.6    |
| Forbs         |           |           |           |           | 86.7      | 247.3     | 396.1     | 97.4      | 133.1     | 210.5    | 151.6     |
| Shrubs        |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           |           |           | 1202.1    | 1654.1    | 1453.3    | 1267.7    | 886.0     | 2588.6   | 1889.3    |

**Table 11. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 2          |           |           |           |           |           |           |           |           |           |          |           |
| Site – Clayey        |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 10.7      | 106.3     | 106.3     | 173.1     | 146.3     | 121.3     | 60.7      |          |           |
| Warm Short           |           |           | 155.2     | 181.3     | 293.7     | 296.1     | 205.2     | 413.9     | 348.6     |          |           |
| Cool Mid             |           |           | 137.4     | 281.9     | 344.3     | 223.0     | 326.5     | 260.5     | 349.7     |          |           |
| Western whtg.        |           |           | 63.5      | 206.9     | 163.4     | 356.8     | 273.0     | 198.7     | 174.8     |          |           |
| Warm Mid             |           |           | 6.4       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 20.7      | 18.9      | 8.9       | 10.7      | 62.4      | 6.1       | 9.6       |          |           |
| Grass Total          |           |           | 393.9     | 795.3     | 916.6     | 1059.7    | 1013.3    | 1000.5    | 943.4     | 1305.9   | 1263.1    |
| Forbs                |           |           | 165.9     | 376.4     | 270.5     | 351.5     | 1288.1    | 386.4     | 529.1     | 381.8    | 429.9     |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 559.8     | 1171.7    | 1187.1    | 1411.1    | 2301.4    | 1386.9    | 1472.5    | 1687.7   | 1693.0    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           |           | 106.3     | 71.4      | 77.4      | 15.3      | 63.2      |          |           |
| Warm Short           |           |           |           |           | 293.7     | 216.6     | 418.5     | 285.4     | 291.5     |          |           |
| Cool Mid             |           |           |           |           | 344.3     | 444.9     | 339.0     | 100.0     | 175.9     |          |           |
| Western whtg.        |           |           |           |           | 163.4     | 198.7     | 255.8     | 120.2     | 107.0     |          |           |
| Warm Mid             |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           |           | 8.9       | 0.0       | 28.5      | 0.0       | 10.7      |          |           |
| Grass Total          |           |           |           |           | 916.6     | 931.6     | 1119.3    | 520.9     | 648.3     | 1191.7   | 8.5       |
| Forbs                |           |           |           |           | 270.5     | 368.6     | 599.4     | 472.1     | 318.6     | 139.2    | 344.3     |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           |           | 1187.1    | 1300.2    | 1718.7    | 993.0     | 966.9     | 1330.9   | 1197.1    |

**Table 12. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr      | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct       | 15<br>Oct |
|----------------------|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|-----------|
| <b>System – East</b> | <b>I-----I</b> |           |           |           |           |           |           |           |           | <b>I-----I</b> |           |
| Pasture – 2          |                |           |           |           |           |           |           |           |           |                |           |
| Site – Sandy         |                |           |           |           |           |           |           |           |           |                |           |
| <b>Ungrazed:</b>     |                |           |           |           |           |           |           |           |           |                |           |
| Cool Short           |                |           | 135.6     | 185.5     | 28.5      | 155.2     | 74.9      | 46.4      | 50.0      |                |           |
| Warm Short           |                |           | 27.8      | 26.1      | 63.5      | 14.3      | 46.4      | 41.8      | 113.1     |                |           |
| Cool Mid             |                |           | 6.4       | 281.2     | 183.8     | 645.8     | 92.8      | 120.2     | 174.8     |                |           |
| Western whtg.        |                |           | 14.3      | 55.3      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |                |           |
| Warm Mid             |                |           | 0.0       | 0.0       | 1.8       | 0.0       | 0.0       | 0.0       | 0.0       |                |           |
| Warm Tall            |                |           | 98.1      | 198.0     | 202.7     | 492.4     | 1102.5    | 417.5     | 509.2     |                |           |
| Sedge                |                |           | 735.0     | 373.9     | 401.4     | 421.0     | 187.3     | 353.2     | 361.4     |                |           |
| Grass Total          |                |           | 1017.2    | 1120.0    | 881.6     | 1728.7    | 1503.9    | 979.1     | 1208.0    | 1930.3         | 2098.0    |
| Forbs                |                |           | 50.0      | 54.6      | 71.4      | 41.0      | 267.6     | 86.7      | 51.0      | 87.4           | 1.8       |
| Shrubs               |                |           | 22.5      | 0.0       | 25.0      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0            | 0.0       |
| <b>Total</b>         |                |           | 1089.7    | 1174.6    | 978.0     | 1769.7    | 1771.5    | 1065.8    | 1259.1    | 2017.7         | 2099.8    |
| <b>Grazed:</b>       |                |           |           |           |           |           |           |           |           |                |           |
| Cool Short           |                |           |           |           | 28.5      | 74.9      | 127.4     | 70.3      | 15.3      |                |           |
| Warm Short           |                |           |           |           | 63.5      | 107.0     | 59.6      | 93.8      | 60.7      |                |           |
| Cool Mid             |                |           |           |           | 183.8     | 273.7     | 267.6     | 233.0     | 149.9     |                |           |
| Western whtg.        |                |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |                |           |
| Warm Mid             |                |           |           |           | 1.8       | 11.8      | 424.6     | 0.0       | 0.0       |                |           |
| Warm Tall            |                |           |           |           | 202.7     | 198.7     | 695.8     | 272.2     | 286.5     |                |           |
| Sedge                |                |           |           |           | 401.4     | 224.8     | 0.0       | 233.0     | 362.9     |                |           |
| Grass Total          |                |           |           |           | 881.6     | 890.9     | 1574.9    | 902.3     | 875.2     | 1851.9         | 1420.1    |
| Forbs                |                |           |           |           | 71.4      | 39.3      | 155.9     | 79.6      | 31.0      | 8.9            | 1.8       |
| Shrubs               |                |           |           |           | 25.0      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0            | 0.0       |
| <b>Total</b>         |                |           |           |           | 978.0     | 930.2     | 1730.8    | 981.8     | 906.3     | 1860.8         | 1421.8    |

**Table 13. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 2          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Shallow       |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 108.1     | 161.6     | 145.6     | 165.9     | 153.4     | 111.7     | 60.7      |          |           |
| Warm Short           |           |           | 56.4      | 35.0      | 67.8      | 66.0      | 123.1     | 159.5     | 150.9     |          |           |
| Cool Mid             |           |           | 126.7     | 443.5     | 324.0     | 494.2     | 496.0     | 373.6     | 500.6     |          |           |
| Western whtg.        |           |           | 5.4       | 2.9       | 1.1       | 3.6       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 274.7     | 270.5     | 213.4     | 173.1     | 215.9     | 204.5     | 147.4     |          |           |
| Grass Total          |           |           | 571.2     | 913.4     | 751.8     | 902.7     | 988.3     | 849.2     | 859.5     | 936.4    | 936.6     |
| Forbs                |           |           | 142.7     | 71.4      | 144.5     | 160.6     | 176.6     | 214.1     | 132.0     | 67.8     | 140.9     |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 714.0     | 984.8     | 896.3     | 1063.3    | 1165.0    | 1063.3    | 991.6     | 1006.2   | 1077.5    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           |           | 145.6     | 73.9      | 115.3     | 46.4      | 18.9      |          |           |
| Warm Short           |           |           |           |           | 67.8      | 77.4      | 129.5     | 155.9     | 86.7      |          |           |
| Cool Mid             |           |           |           |           | 324.0     | 388.9     | 377.1     | 160.6     | 222.3     |          |           |
| Western whtg.        |           |           |           |           | 1.1       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Mid             |           |           |           |           | 0.0       | 0.0       | 0.0       | 18.9      | 4.6       |          |           |
| Warm Tall            |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           |           | 213.4     | 171.3     | 209.4     | 186.6     | 72.4      |          |           |
| Grass Total          |           |           |           |           | 751.8     | 711.5     | 831.4     | 568.4     | 405.0     | 694.0    | 506.7     |
| Forbs                |           |           |           |           | 144.5     | 129.5     | 220.2     | 154.5     | 104.5     | 66.0     | 53.5      |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           |           | 896.3     | 841.0     | 1051.5    | 722.9     | 509.5     | 760.0    | 560.2     |

**Table 14. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 2          |           |           |           |           |           |           |           |           |           |          |           |
| Site – Silty         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 0.0       | 56.4      | 83.9      | 30.3      | 16.1      | 27.5      | 17.8      |          |           |
| Warm Short           |           |           | 349.7     | 384.6     | 297.9     | 786.7     | 1015.1    | 455.6     | 468.5     |          |           |
| Cool Mid             |           |           | 26.1      | 263.3     | 343.6     | 0.0       | 545.9     | 161.6     | 146.3     |          |           |
| Western whtg.        |           |           | 190.2     | 175.9     | 140.9     | 119.5     | 319.3     | 147.4     | 77.4      |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 1.8       | 0.0       | 333.6     | 38.2      | 85.6      |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 193.7     | 349.0     | 264.0     | 55.3      | 110.6     | 152.4     | 111.7     |          |           |
| Grass Total          |           |           | 759.6     | 1228.7    | 1132.1    | 991.9     | 2340.6    | 982.5     | 907.4     | 1880.3   | 1657.3    |
| Forbs                |           |           | 187.3     | 92.1      | 233.7     | 294.4     | 465.6     | 342.5     | 564.8     | 128.5    | 3.6       |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 946.9     | 1320.8    | 1365.8    | 1286.3    | 2806.2    | 1325.1    | 1472.2    | 2008.8   | 1661.1    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           |           | 83.9      | 16.8      | 109.5     | 26.1      | 3.6       |          |           |
| Warm Short           |           |           |           |           | 297.9     | 337.9     | 502.0     | 356.8     | 336.5     |          |           |
| Cool Mid             |           |           |           |           | 343.6     | 430.7     | 214.1     | 254.4     | 67.8      |          |           |
| Western whtg.        |           |           |           |           | 140.9     | 200.9     | 124.9     | 66.7      | 45.3      |          |           |
| Warm Mid             |           |           |           |           | 1.8       | 7.1       | 38.2      | 74.9      | 0.0       |          |           |
| Warm Tall            |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           |           | 264.0     | 157.0     | 67.8      | 180.9     | 193.7     |          |           |
| Grass Total          |           |           |           |           | 1132.1    | 1150.3    | 1056.5    | 959.8     | 646.9     | 1625.2   | 974.1     |
| Forbs                |           |           |           |           | 233.7     | 79.6      | 152.4     | 195.2     | 322.2     | 37.5     | 46.4      |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           |           | 1365.8    | 1229.9    | 1208.8    | 1155.0    | 969.1     | 1662.7   | 1020.4    |

**Table 15. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – West |           |           |           | I-----I   |           |           |           | I-----I   |           |          |           |
| Pasture – 3   |           |           |           |           |           |           |           |           |           |          |           |
| Site - Clayey |           |           |           |           |           |           |           |           |           |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 95.6      | 187.3     | 319.3     | 296.1     | 157.0     | 141.7     | 135.6     |          |           |
| Warm Short    |           |           | 194.5     | 340.7     | 276.5     | 299.7     | 852.8     | 384.3     | 327.2     |          |           |
| Cool Mid      |           |           | 18.9      | 258.0     | 198.0     | 219.4     | 139.2     | 129.5     | 139.2     |          |           |
| Western whtg. |           |           | 53.5      | 169.5     | 80.3      | 117.7     | 187.3     | 231.9     | 101.0     |          |           |
| Warm Mid      |           |           | 25.0      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall     |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           | 177.7     | 17.8      | 80.3      | 0.0       | 69.6      | 25.0      | 32.1      |          |           |
| Grass Total   |           |           | 565.2     | 973.4     | 954.4     | 933.0     | 1405.8    | 912.3     | 735.0     | 1040.1   | 1316.6    |
| Forbs         |           |           | 150.9     | 217.7     | 117.7     | 112.4     | 182.0     | 31.0      | 268.7     | 410.3    | 183.8     |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 716.1     | 1191.0    | 1072.2    | 1045.4    | 1587.8    | 943.4     | 1003.7    | 1450.4   | 1500.3    |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           |           | 187.3     | 243.7     | 91.7      | 78.5      | 118.8     | 64.2      |          |           |
| Warm Short    |           |           |           | 340.7     | 189.1     | 132.0     | 399.6     | 404.3     | 346.1     |          |           |
| Cool Mid      |           |           |           | 258.0     | 211.6     | 325.8     | 240.1     | 73.9      | 122.4     |          |           |
| Western whtg. |           |           |           | 169.5     | 132.0     | 95.3      | 57.1      | 158.1     | 36.8      |          |           |
| Warm Mid      |           |           |           | 0.0       | 0.0       | 18.9      | 41.8      | 0.0       | 0.0       |          |           |
| Warm Tall     |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           |           | 17.8      | 31.0      | 54.6      | 122.4     | 33.2      | 63.2      |          |           |
| Grass Total   |           |           |           | 973.4     | 807.4     | 718.3     | 939.5     | 788.2     | 632.6     | 761.8    | 727.9     |
| Forbs         |           |           |           | 217.7     | 98.8      | 54.6      | 199.8     | 222.3     | 157.0     | 235.5    | 76.7      |
| Shrubs        |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           |           | 1191.0    | 906.3     | 844.2     | 1139.3    | 1010.5    | 789.6     | 997.3    | 804.6     |

**Table 16. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – West |           |           |           | I-----I   |           |           |           | I-----I   |           |          |           |
| Pasture – 3   |           |           |           |           |           |           |           |           |           |          |           |
| Site - Sandy  |           |           |           |           |           |           |           |           |           |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 127.7     | 17.8      | 142.7     | 17.8      | 67.8      | 41.8      | 29.6      |          |           |
| Warm Short    |           |           | 85.6      | 26.1      | 119.5     | 17.8      | 42.8      | 56.0      | 45.3      |          |           |
| Cool Mid      |           |           | 84.9      | 204.5     | 795.7     | 185.5     | 485.3     | 285.4     | 188.0     |          |           |
| Western whtg. |           |           | 0.0       | 29.6      | 30.3      | 19.6      | 0.0       | 8.2       | 7.1       |          |           |
| Warm Mid      |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 8.2       | 0.0       |          |           |
| Warm Tall     |           |           | 129.5     | 310.4     | 233.7     | 412.1     | 572.7     | 315.1     | 582.7     |          |           |
| Sedge         |           |           | 579.8     | 702.2     | 547.7     | 356.8     | 155.2     | 520.9     | 247.3     |          |           |
| Grass Total   |           |           | 1007.6    | 1290.6    | 1869.6    | 1009.7    | 1323.7    | 1235.6    | 1100.0    | 1926.7   | 1639.5    |
| Forbs         |           |           | 74.2      | 95.6      | 62.4      | 171.3     | 153.4     | 300.8     | 117.7     | 39.3     | 1.8       |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 1081.8    | 1386.2    | 1932.1    | 1181.0    | 1477.2    | 1536.4    | 1217.7    | 1966.0   | 1641.3    |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           |           | 17.8      | 90.3      | 6.1       | 41.8      | 28.5      | 14.3      |          |           |
| Warm Short    |           |           |           | 26.1      | 58.2      | 13.2      | 63.2      | 61.7      | 132.0     |          |           |
| Cool Mid      |           |           |           | 204.5     | 646.9     | 239.1     | 222.3     | 314.0     | 159.5     |          |           |
| Western whtg. |           |           |           | 29.6      | 7.1       | 0.0       | 10.7      | 0.0       | 0.0       |          |           |
| Warm Mid      |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 18.9      | 0.0       |          |           |
| Warm Tall     |           |           |           | 310.4     | 221.2     | 614.8     | 382.9     | 217.7     | 413.9     |          |           |
| Sedge         |           |           |           | 702.2     | 335.4     | 527.0     | 353.2     | 185.5     | 359.3     |          |           |
| Grass Total   |           |           |           | 1290.6    | 1359.1    | 1400.1    | 1074.0    | 826.4     | 1079.0    | 1625.2   | 1000.8    |
| Forbs         |           |           |           | 95.6      | 54.6      | 63.2      | 84.6      | 238.0     | 73.9      | 64.2     | 69.6      |
| Shrubs        |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           |           | 1386.2    | 1413.7    | 1463.2    | 1058.5    | 1064.3    | 1152.8    | 1689.4   | 1070.4    |

**Table 17. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – West  |           |           |           | I----- I  |           |           |           | I-----I   |           |          |           |
| Pasture – 3    |           |           |           |           |           |           |           |           |           |          |           |
| Site - Shallow |           |           |           |           |           |           |           |           |           |          |           |
|                |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:      |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short     |           |           | 173.1     | 134.9     | 228.4     | 276.5     | 153.4     | 252.3     | 145.2     |          |           |
| Warm Short     |           |           | 76.0      | 131.3     | 233.7     | 14.3      | 171.3     | 190.2     | 134.5     |          |           |
| Cool Mid       |           |           | 397.8     | 411.4     | 454.9     | 479.9     | 367.5     | 605.5     | 384.3     |          |           |
| Western whtg.  |           |           | 7.1       | 8.2       | 7.2       | 0.0       | 26.8      | 7.1       | 2.5       |          |           |
| Warm Mid       |           |           | 0.0       | 7.1       | 0.0       | 50.0      | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall      |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge          |           |           | 61.7      | 53.5      | 23.2      | 58.9      | 42.8      | 4.6       | 79.6      |          |           |
| Grass Total    |           |           | 715.8     | 746.4     | 947.4     | 879.5     | 761.8     | 1059.7    | 746.1     | 1325.5   | 1446.8    |
| Forbs          |           |           | 36.8      | 78.5      | 37.5      | 100.0     | 223.0     | 71.4      | 138.1     | 55.3     | 53.5      |
| Shrubs         |           |           | 8.9       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|                |           |           |           |           |           |           |           |           |           |          |           |
| Total          |           |           | 761.4     | 824.9     | 984.8     | 979.4     | 984.8     | 1131.1    | 884.2     | 1380.8   | 1500.3    |
|                |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:        |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short     |           |           |           | 134.9     | 143.8     | 74.9      | 83.1      | 138.1     | 126.0     |          |           |
| Warm Short     |           |           |           | 131.3     | 345.0     | 143.8     | 405.7     | 150.9     | 127.4     |          |           |
| Cool Mid       |           |           |           | 411.4     | 478.1     | 607.6     | 252.3     | 359.3     | 379.3     |          |           |
| Western whtg.  |           |           |           | 8.2       | 0.0       | 0.0       | 0.0       | 0.0       | 7.1       |          |           |
| Warm Mid       |           |           |           | 7.1       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall      |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge          |           |           |           | 53.5      | 27.5      | 81.0      | 20.3      | 113.1     | 6.1       |          |           |
| Grass Total    |           |           |           | 746.4     | 994.4     | 907.3     | 761.4     | 761.4     | 645.8     | 859.9    | 783.2     |
| Forbs          |           |           |           | 78.5      | 45.3      | 118.8     | 123.8     | 73.9      | 208.0     | 17.8     | 60.7      |
| Shrubs         |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|                |           |           |           |           |           |           |           |           |           |          |           |
| Total          |           |           |           | 824.9     | 1039.7    | 1026.2    | 885.2     | 835.3     | 853.8     | 877.7    | 843.8     |

**Table 18. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> |           |           |           | I-----I   |           |           |           |           | I-----I   |          |           |
| Pasture – 3          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Silty         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 12.5      | 322.2     | 253.3     | 0.0       | 137.4     | 518.4     | 86.7      |          |           |
| Warm Short           |           |           | 118.8     | 67.8      | 0.0       | 160.6     | 83.9      | 0.0       | 202.3     |          |           |
| Cool Mid             |           |           | 222.3     | 297.9     | 545.9     | 1882.1    | 1213.1    | 626.9     | 536.3     |          |           |
| Western whtg.        |           |           | 79.6      | 126.0     | 153.4     | 60.7      | 165.9     | 89.2      | 88.1      |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 263.3     | 72.4      | 19.6      | 0.0       | 7.1       | 17.8      | 10.7      |          |           |
| Grass Total          |           |           | 696.5     | 886.3     | 972.3     | 2103.3    | 1607.4    | 1252.4    | 924.1     | 1541.4   | 1696.6    |
| Forbs                |           |           | 114.2     | 55.3      | 92.8      | 94.6      | 155.2     | 135.6     | 143.8     | 255.7    | 67.8      |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 810.7     | 941.6     | 1065.0    | 2197.9    | 1762.6    | 1388.0    | 1067.9    | 1797.1   | 1764.4    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           | 322.2     | 90.3      | 26.1      | 175.9     | 16.8      | 68.9      |          |           |
| Warm short           |           |           |           | 67.8      | 73.9      | 328.3     | 51.0      | 46.4      | 247.3     |          |           |
| Cool Mid             |           |           |           | 297.9     | 579.1     | 464.9     | 944.5     | 714.7     | 377.1     |          |           |
| Western whtg.        |           |           |           | 126.0     | 108.1     | 155.9     | 36.8      | 52.5      | 85.6      |          |           |
| Warm Mid             |           |           |           | 0.0       | 0.0       | 0.0       | 507.7     | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           | 72.4      | 2.5       | 1.1       | 18.9      | 46.4      | 0.0       |          |           |
| Grass Total          |           |           |           | 886.3     | 853.8     | 976.2     | 1734.8    | 876.7     | 778.9     | 1302.3   | 1177.4    |
| Forbs                |           |           |           | 55.3      | 98.8      | 39.3      | 41.8      | 129.5     | 33.2      | 330.0    | 10.7      |
| Shrubs               |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           | 941.6     | 952.7     | 1015.5    | 1776.5    | 1006.2    | 812.1     | 1632.3   | 1188.1    |

**Table 19. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – East |           |           |           | I-----I   |           |           |           | I-----I   |           |          |           |
| Pasture - 4   |           |           |           |           |           |           |           |           |           |          |           |
| Site - Clayey |           |           |           |           |           |           |           |           |           |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 38.5      | 203.4     | 123.1     | 198.0     | 130.2     | 72.4      | 129.5     |          |           |
| Warm Short    |           |           | 126.7     | 176.6     | 223.0     | 287.2     | 335.4     | 425.7     | 228.4     |          |           |
| Cool Mid      |           |           | 161.6     | 235.5     | 119.5     | 242.6     | 105.3     | 50.0      | 148.8     |          |           |
| Western whtg. |           |           | 22.5      | 33.9      | 139.2     | 96.3      | 57.1      | 228.4     | 74.9      |          |           |
| Warm Mid      |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 64.2      | 67.8      | 46.4      |          |           |
| Warm Tall     |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           | 133.1     | 42.8      | 101.7     | 198.0     | 198.0     | 54.6      | 85.6      |          |           |
| Grass Total   |           |           | 482.4     | 692.2     | 706.5     | 1022.2    | 890.2     | 878.8     | 713.6     | 1411.1   | 849.2     |
| Forbs         |           |           | 105.3     | 214.1     | 331.8     | 749.3     | 160.6     | 452.1     | 275.8     | 415.7    | 116.0     |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 587.7     | 906.3     | 1038.3    | 1771.5    | 1050.8    | 1350.8    | 989.4     | 1826.8   | 965.1     |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           |           | 203.4     | 124.9     | 89.2      | 21.4      | 89.2      | 98.8      |          |           |
| Warm Short    |           |           |           | 176.6     | 224.8     | 320.1     | 381.8     | 235.5     | 292.6     |          |           |
| Cool Mid      |           |           |           | 235.5     | 218.7     | 73.9      | 172.3     | 77.4      | 103.5     |          |           |
| Western whtg. |           |           |           | 33.9      | 61.7      | 52.5      | 82.1      | 78.5      | 58.2      |          |           |
| Warm Mid      |           |           |           | 0.0       | 0.0       | 20.3      | 46.4      | 21.4      | 16.8      |          |           |
| Warm Tall     |           |           |           | 0.0       | 0.0       | 4.6       | 0.0       | 185.5     | 0.0       |          |           |
| Sedge         |           |           |           | 42.8      | 6.1       | 11.8      | 139.2     | 33.2      | 13.2      |          |           |
| Grass Total   |           |           |           | 692.2     | 636.2     | 572.3     | 843.1     | 720.8     | 583.0     | 581.6    | 429.9     |
| Forbs         |           |           |           | 214.1     | 171.3     | 502.0     | 215.2     | 439.9     | 103.5     | 112.4    | 169.5     |
| Shrubs        |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           |           | 906.3     | 807.4     | 1074.3    | 1058.3    | 1160.7    | 686.5     | 694.0    | 599.4     |

**Table 20. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> | I-----I   |           |           |           | I-----I   |           |           |           |           |          |           |
| Pasture – 4          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Sandy         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 31.4      | 32.1      | 103.5     | 10.7      | 103.5     | 9.6       | 36.8      |          |           |
| Warm Short           |           |           | 140.9     | 117.0     | 187.3     | 153.4     | 206.9     | 152.4     | 177.3     |          |           |
| Cool Mid             |           |           | 26.1      | 33.2      | 124.9     | 499.5     | 251.5     | 132.0     | 59.6      |          |           |
| Western whtg.        |           |           | 8.9       | 1.8       | 0.0       | 0.0       | 0.0       | 8.2       | 38.2      |          |           |
| Warm Mid             |           |           | 0.0       | 108.8     | 0.0       | 17.8      | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 79.6      | 230.1     | 469.2     | 428.2     | 1065.1    | 769.6     | 816.0     |          |           |
| Sedge                |           |           | 401.4     | 308.6     | 153.4     | 319.3     | 224.8     | 330.8     | 412.8     |          |           |
| Grass Total          |           |           | 688.3     | 831.7     | 1038.3    | 1429.0    | 1851.8    | 1402.6    | 1540.7    | 2374.5   | 1987.4    |
| Forbs                |           |           | 59.9      | 69.6      | 51.7      | 126.7     | 146.3     | 36.8      | 45.3      | 91.0     | 35.7      |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 748.2     | 901.3     | 1090.0    | 1555.6    | 1998.1    | 1439.3    | 1586.0    | 2465.5   | 2023.1    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           | 32.1      | 7.1       | 20.3      | 21.4      | 10.7      | 34.6      |          |           |
| Warm Short           |           |           |           | 117.0     | 115.3     | 174.8     | 222.3     | 177.3     | 184.5     |          |           |
| Cool Mid             |           |           |           | 33.2      | 84.6      | 153.4     | 83.1      | 89.2      | 116.7     |          |           |
| Western whtg.        |           |           |           | 1.8       | 15.3      | 3.6       | 13.2      | 0.0       | 8.2       |          |           |
| Warm Mid             |           |           |           | 108.8     | 0.0       | 32.1      | 0.0       | 11.8      | 0.0       |          |           |
| Warm Tall            |           |           |           | 230.1     | 189.1     | 417.5     | 384.3     | 343.6     | 554.1     |          |           |
| Sedge                |           |           |           | 308.6     | 292.6     | 377.1     | 295.1     | 215.2     | 115.3     |          |           |
| Grass Total          |           |           |           | 831.7     | 704.0     | 1178.9    | 1019.4    | 847.8     | 1013.3    | 1908.9   | 1643.1    |
| Forbs                |           |           |           | 69.6      | 92.8      | 185.5     | 132.0     | 53.5      | 110.6     | 123.1    | 17.8      |
| Shrubs               |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           | 901.3     | 776.7     | 1364.4    | 1151.4    | 901.3     | 1123.9    | 2032.0   | 1660.9    |

**Table 21. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> |           |           |           | I-----    | I         |           |           |           | I-----    | I        |           |
| Pasture – 4          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Shallow       |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 66.0      | 59.9      | 39.3      | 87.4      | 105.3     | 34.6      | 4.6       |          |           |
| Warm Short           |           |           | 46.4      | 104.5     | 146.3     | 158.8     | 160.6     | 214.1     | 157.0     |          |           |
| Cool Mid             |           |           | 26.8      | 239.1     | 347.9     | 522.7     | 314.0     | 334.3     | 296.1     |          |           |
| Western whtg.        |           |           | 1.1       | 1.8       | 8.9       | 0.0       | 17.8      | 18.9      | 17.8      |          |           |
| Warm Mid             |           |           | 0.0       | 49.2      | 0.0       | 0.0       | 0.0       | 26.1      | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 809.9     | 613.7     | 289.0     | 367.5     | 296.1     | 260.5     | 228.4     |          |           |
| Grass Total          |           |           | 950.2     | 1068.3    | 831.4     | 1136.4    | 893.8     | 888.4     | 704.0     | 1132.8   | 911.6     |
| Forbs                |           |           | 90.3      | 128.5     | 196.2     | 80.3      | 64.2      | 188.0     | 22.5      | 16.1     | 17.8      |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1040.4    | 1196.7    | 1027.6    | 1216.7    | 958.0     | 1076.5    | 726.4     | 1148.9   | 929.5     |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           |           | 59.9      | 135.6     | 66.7      | 149.9     | 59.6      | 0.0       |          |           |
| Warm Short           |           |           |           | 104.5     | 215.2     | 95.3      | 186.6     | 140.2     | 141.7     |          |           |
| Cool Mid             |           |           |           | 239.1     | 447.1     | 434.2     | 335.4     | 252.3     | 378.2     |          |           |
| Western whtg.        |           |           |           | 1.8       | 0.0       | 3.6       | 10.7      | 39.3      | 0.0       |          |           |
| Warm Mid             |           |           |           | 49.2      | 0.0       | 0.0       | 0.0       | 11.8      | 0.0       |          |           |
| Warm Tall            |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           |           | 613.7     | 320.1     | 293.7     | 434.2     | 196.2     | 153.4     |          |           |
| Grass Total          |           |           |           | 1068.3    | 1117.9    | 893.4     | 1116.8    | 699.3     | 673.3     | 811.7    | 581.6     |
| Forbs                |           |           |           | 128.5     | 133.1     | 48.9      | 106.0     | 83.1      | 36.8      | 7.1      | 25.0      |
| Shrubs               |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           |           | 1196.7    | 1250.9    | 942.3     | 1222.8    | 782.5     | 710.0     | 818.9    | 606.6     |

**Table 22. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – East |           |           |           | I-----I   |           |           |           | I-----I   |           |          |           |
| Pasture – 4   |           |           |           |           |           |           |           |           |           |          |           |
| Site - Silty  |           |           |           |           |           |           |           |           |           |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 11.8      | 110.6     | 83.9      | 66.0      | 19.6      | 45.3      | 57.1      |          |           |
| Warm short    |           |           | 322.2     | 366.8     | 503.1     | 155.2     | 788.5     | 463.8     | 314.0     |          |           |
| Cool Mid      |           |           | 47.5      | 105.3     | 192.7     | 528.1     | 233.7     | 203.4     | 170.2     |          |           |
| Western whtg. |           |           | 51.7      | 255.1     | 162.3     | 83.9      | 231.9     | 183.0     | 79.6      |          |           |
| Warm Mid      |           |           | 1.1       | 1.1       | 0.0       | 0.0       | 8.9       | 0.0       | 0.0       |          |           |
| Warm Tall     |           |           | 36.8      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           | 339.0     | 341.8     | 322.9     | 531.6     | 462.1     | 134.5     | 118.8     |          |           |
| Grass Total   |           |           | 809.9     | 1180.7    | 1264.9    | 1364.8    | 1744.8    | 1030.1    | 739.6     | 1880.3   | 1677.0    |
| Forbs         |           |           | 169.5     | 127.7     | 91.0      | 269.4     | 253.3     | 554.1     | 293.7     | 83.9     | 280.1     |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 979.4     | 1308.4    | 1355.8    | 1634.1    | 1998.1    | 1584.2    | 1033.3    | 1964.2   | 1957.1    |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           |           | 110.6     | 76.0      | 31.0      | 32.1      | 38.2      | 38.2      |          |           |
| Warm Short    |           |           |           | 366.8     | 305.8     | 279.4     | 467.4     | 239.1     | 388.9     |          |           |
| Cool Mid      |           |           |           | 105.3     | 131.0     | 149.9     | 177.3     | 109.5     | 97.4      |          |           |
| Western whtg. |           |           |           | 255.1     | 59.6      | 0.0       | 152.4     | 74.9      | 53.5      |          |           |
| Warm Mid      |           |           |           | 1.1       | 0.0       | 26.1      | 6.1       | 0.0       | 0.0       |          |           |
| Warm Tall     |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           |           | 341.8     | 279.4     | 291.5     | 390.0     | 146.3     | 184.5     |          |           |
| Grass Total   |           |           |           | 1180.7    | 851.7     | 882.4     | 1225.3    | 608.0     | 762.5     | 1084.7   | 774.3     |
| Forbs         |           |           |           | 127.7     | 52.5      | 146.3     | 310.4     | 299.7     | 172.3     | 55.3     | 133.8     |
| Shrubs        |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           |           | 1308.4    | 904.1     | 1028.7    | 1535.7    | 907.7     | 934.8     | 1140.0   | 908.1     |

**Table 23. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> | I-----I   |           |           | I-----I   |           |           |           |           |           |          |           |
| Pasture – 5          |           |           |           |           |           |           |           |           |           |          |           |
| Site – Sandy         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 183.8     | 28.5      | 89.2      | 23.2      | 160.6     | 36.8      | 2.5       |          |           |
| Warm short           |           |           | 37.5      | 16.1      | 128.5     | 7.1       | 46.4      | 38.2      | 58.2      |          |           |
| Cool Mid             |           |           | 49.2      | 394.3     | 208.7     | 128.5     | 126.7     | 208.0     | 50.0      |          |           |
| Western whtg.        |           |           | 0.0       | 0.0       | 0.0       | 14.3      | 0.0       | 6.1       | 2.5       |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 12.5      | 10.7      | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 162.3     | 221.2     | 269.4     | 686.8     | 652.9     | 361.4     | 795.6     |          |           |
| Sedge                |           |           | 628.0     | 271.2     | 481.7     | 253.3     | 422.8     | 188.0     | 280.8     |          |           |
| Grass Total          |           |           | 1060.8    | 931.3     | 1177.4    | 1125.7    | 1420.1    | 838.5     | 1189.5    | 1700.2   | 1473.6    |
| Forbs                |           |           | 133.1     | 431.7     | 19.6      | 158.8     | 224.8     | 295.1     | 329.3     | 73.1     | 35.7      |
| Shrubs               |           |           | 0.0       | 26.8      | 0.0       | 0.0       | 58.9      | 0.0       | 45.3      | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1193.8    | 1389.7    | 1197.1    | 1284.5    | 1703.7    | 1133.6    | 1564.1    | 1773.3   | 1509.3    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 183.8     | 3.6       | 0.0       | 26.1      | 129.5     | 36.8      | 0.0       |          |           |
| Warm Short           |           |           | 37.5      | 57.1      | 33.2      | 42.8      | 51.0      | 68.9      | 86.7      |          |           |
| Cool Mid             |           |           | 49.2      | 127.4     | 183.0     | 224.8     | 170.2     | 155.9     | 120.2     |          |           |
| Western whtg.        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Mid             |           |           | 0.0       | 25.0      | 1.1       | 0.0       | 0.0       | 8.2       | 0.0       |          |           |
| Warm Tall            |           |           | 162.3     | 109.5     | 323.6     | 373.6     | 836.0     | 143.8     | 422.1     |          |           |
| Sedge                |           |           | 628.0     | 619.8     | 661.2     | 499.5     | 304.4     | 205.9     | 355.7     |          |           |
| Grass Total          |           |           | 1060.8    | 942.3     | 1202.1    | 1166.7    | 1491.1    | 619.4     | 984.8     | 1104.3   | 999.0     |
| Forbs                |           |           | 133.1     | 90.3      | 34.6      | 59.6      | 170.2     | 190.2     | 79.6      | 139.2    | 0.0       |
| Shrubs               |           |           | 0.0       | 0.0       | 18.9      | 9.6       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1193.8    | 1040.8    | 1255.6    | 1236.0    | 1661.3    | 809.6     | 1064.3    | 1243.5   | 999.0     |

**Table 24. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> |           |           | I-----I   |           |           |           | I-----I   |           |           |          |           |
| Pasture – 5          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Shallow       |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 105.3     | 157.0     | 185.5     | 155.2     | 165.9     | 223.7     | 139.2     |          |           |
| Warm Short           |           |           | 63.5      | 196.2     | 183.8     | 114.2     | 196.2     | 161.6     | 103.5     |          |           |
| Cool Mid             |           |           | 49.2      | 55.7      | 130.2     | 130.2     | 98.1      | 205.9     | 101.0     |          |           |
| Western whtg.        |           |           | 0.0       | 3.6       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Mid             |           |           | 5.4       | 0.0       | 57.1      | 48.2      | 62.4      | 45.3      | 11.8      |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 146.3     | 285.4     | 126.7     | 176.6     | 256.9     | 163.1     | 83.1      |          |           |
| Grass Total          |           |           | 369.7     | 695.9     | 683.3     | 624.4     | 779.6     | 799.6     | 438.5     | 619.1    | 635.1     |
| Forbs                |           |           | 116.0     | 173.1     | 235.5     | 297.9     | 619.1     | 158.1     | 114.2     | 117.7    | 66.0      |
| Shrubs               |           |           | 59.9      | 0.0       | 1.8       | 0.0       | 46.4      | 35.7      | 0.0       | 67.8     | 0.0       |
| <b>Total</b>         |           |           | 545.6     | 869.0     | 920.6     | 922.3     | 1445.0    | 993.3     | 552.7     | 804.6    | 701.1     |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 105.3     | 117.7     | 154.5     | 77.4      | 234.4     | 57.1      | 63.2      |          |           |
| Warm Short           |           |           | 63.5      | 136.7     | 143.8     | 98.8      | 197.3     | 149.9     | 51.0      |          |           |
| Cool Mid             |           |           | 49.2      | 95.3      | 173.8     | 211.6     | 149.9     | 99.9      | 121.3     |          |           |
| Western whtg.        |           |           | 0.0       | 3.6       | 0.0       | 0.0       | 0.0       | 0.0       | 13.2      |          |           |
| Warm Mid             |           |           | 5.4       | 0.0       | 1.1       | 14.3      | 0.0       | 10.7      | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 146.3     | 274.7     | 153.4     | 152.4     | 189.1     | 139.2     | 73.9      |          |           |
| Grass Total          |           |           | 369.7     | 628.0     | 626.5     | 554.5     | 770.7     | 456.7     | 322.5     | 410.3    | 401.4     |
| Forbs                |           |           | 116.0     | 85.6      | 153.4     | 196.2     | 487.8     | 82.1      | 53.5      | 53.5     | 62.4      |
| Shrubs               |           |           | 59.9      | 0.0       | 0.0       | 51.0      | 0.0       | 0.0       | 0.0       | 51.7     | 0.0       |
| <b>Total</b>         |           |           | 545.6     | 713.6     | 780.0     | 801.7     | 1258.4    | 538.8     | 376.1     | 515.6    | 463.8     |

**Table 25. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – West</b> |           |           | I-----I   |           |           |           | I-----I   |           |           |          |           |
| Pasture – 5          |           |           |           |           |           |           |           |           |           |          |           |
| Site – Silty         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 93.8      | 128.5     | 187.3     | 119.5     | 83.9      | 124.9     | 89.2      |          |           |
| Warm Short           |           |           | 188.4     | 274.7     | 162.3     | 173.1     | 73.1      | 247.3     | 341.5     |          |           |
| Cool Mid             |           |           | 13.6      | 433.5     | 255.1     | 479.9     | 547.7     | 203.4     | 211.6     |          |           |
| Western whtg.        |           |           | 248.0     | 278.3     | 474.5     | 180.2     | 196.2     | 150.9     | 117.7     |          |           |
| Warm Mid             |           |           | 0.0       | 1.7       | 0.0       | 0.0       | 205.2     | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 374.6     | 60.7      | 42.8      | 64.2      | 255.1     | 356.8     | 39.3      |          |           |
| Grass Total          |           |           | 918.4     | 1177.4    | 1122.1    | 1016.9    | 1361.2    | 1083.3    | 799.2     | 1967.8   | 1286.3    |
| Forbs                |           |           | 156.3     | 153.4     | 319.3     | 380.0     | 305.1     | 199.8     | 235.5     | 246.2    | 121.3     |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1074.7    | 1330.9    | 1441.5    | 1396.9    | 1666.3    | 1283.1    | 1034.7    | 2214.0   | 1407.6    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 93.8      | 142.7     | 108.1     | 81.0      | 103.5     | 67.8      | 43.9      |          |           |
| Warm Short           |           |           | 188.4     | 161.6     | 173.8     | 109.5     | 324.7     | 372.1     | 292.6     |          |           |
| Cool Mid             |           |           | 13.6      | 195.2     | 203.4     | 290.1     | 609.1     | 230.9     | 108.1     |          |           |
| Western whtg.        |           |           | 248.0     | 193.7     | 264.0     | 93.8      | 152.4     | 71.4      | 155.9     |          |           |
| Warm Mid             |           |           | 0.0       | 39.3      | 0.0       | 0.0       | 7.1       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 374.6     | 70.3      | 127.4     | 104.5     | 243.7     | 115.3     | 70.3      |          |           |
| Grass Total          |           |           | 918.4     | 802.8     | 876.7     | 679.0     | 1440.4    | 857.4     | 670.8     | 1302.3   | 890.2     |
| Forbs                |           |           | 156.8     | 66.7      | 299.7     | 243.7     | 193.7     | 152.4     | 54.6      | 92.8     | 123.1     |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1074.7    | 869.5     | 1176.4    | 922.7     | 1634.1    | 1009.7    | 725.4     | 1395.1   | 1013.3    |

**Table 26. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> | I-----I   |           |           | I-----I   |           |           |           |           |           |          |           |
| Pasture – 6          |           |           |           |           |           |           |           |           |           |          |           |
| Site - Sandy         |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 4.6       | 1.8       | 14.3      | 1.8       | 53.5      | 7.1       | 57.1      |          |           |
| Warm Short           |           |           | 37.5      | 55.3      | 78.5      | 107.0     | 112.4     | 47.5      | 78.5      |          |           |
| Cool Mid             |           |           | 65.3      | 124.9     | 260.5     | 108.8     | 110.6     | 228.4     | 0.0       |          |           |
| Western whtg.        |           |           | 0.0       | 0.0       | 0.0       | 69.6      | 0.0       | 0.0       | 0.0       |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 31.0      |          |           |
| Warm Tall            |           |           | 110.6     | 219.4     | 265.8     | 285.4     | 588.8     | 567.3     | 538.8     |          |           |
| Sedge                |           |           | 786.0     | 827.8     | 494.2     | 517.4     | 362.2     | 579.1     | 366.4     |          |           |
| Grass Total          |           |           | 1004.0    | 1229.2    | 1113.2    | 1090.0    | 1227.4    | 1429.3    | 1071.8    | 1894.6   | 1875.0    |
| Forbs                |           |           | 76.0      | 26.8      | 123.1     | 182.0     | 73.1      | 159.5     | 85.6      | 198.0    | 8.9       |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1080.0    | 1255.9    | 1236.3    | 1272.0    | 1300.6    | 1588.8    | 1157.5    | 2092.6   | 1883.9    |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 4.6       | 2.5       | 7.1       | 31.0      | 60.7      | 1.1       | 0.0       |          |           |
| Warm Short           |           |           | 37.5      | 32.1      | 20.3      | 35.7      | 85.6      | 43.9      | 64.2      |          |           |
| Cool Mid             |           |           | 65.3      | 204.5     | 163.1     | 117.7     | 136.7     | 241.6     | 25.0      |          |           |
| Western whtg.        |           |           | 0.0       | 17.8      | 0.0       | 0.0       | 13.2      | 0.0       | 1.1       |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 8.2       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 110.6     | 127.4     | 352.2     | 224.8     | 471.0     | 261.5     | 254.4     |          |           |
| Sedge                |           |           | 786.0     | 881.3     | 800.3     | 436.4     | 623.3     | 352.2     | 260.5     |          |           |
| Grass Total          |           |           | 1004.0    | 1265.6    | 1343.0    | 853.8     | 1390.5    | 900.2     | 605.1     | 1418.3   | 1027.6    |
| Forbs                |           |           | 76.0      | 32.1      | 52.5      | 111.7     | 174.8     | 53.5      | 32.1      | 92.8     | 0.0       |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 1080.0    | 1297.7    | 1395.5    | 965.5     | 1565.3    | 953.7     | 637.2     | 1511.1   | 1027.6    |

**Table 27. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – East</b> |           |           | I-----I   |           |           |           | I-----I   |           |           |          |           |
| Pasture – 6          |           |           |           |           |           |           |           |           |           |          |           |
| Site – Shallow       |           |           |           |           |           |           |           |           |           |          |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 60.7      | 149.9     | 144.5     | 28.5      | 144.5     | 110.6     | 28.5      |          |           |
| Warm Short           |           |           | 63.5      | 149.9     | 83.9      | 233.7     | 206.9     | 228.4     | 177.3     |          |           |
| Cool Mid             |           |           | 28.5      | 140.9     | 201.6     | 96.3      | 162.3     | 110.6     | 211.6     |          |           |
| Western whtg.        |           |           | 16.1      | 19.6      | 3.5       | 41.0      | 37.5      | 28.5      | 29.6      |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 1.8       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 271.2     | 103.5     | 121.3     | 240.8     | 74.9      | 76.0      | 159.5     |          |           |
| Grass Total          |           |           | 441.7     | 563.8     | 554.8     | 640.5     | 626.2     | 554.1     | 606.6     | 974.1    | 856.3     |
| Forbs                |           |           | 97.4      | 192.7     | 201.6     | 91.0      | 264.0     | 154.5     | 40.3      | 105.3    | 108.8     |
| Shrubs               |           |           | 11.8      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 550.9     | 756.4     | 756.4     | 731.4     | 890.2     | 708.6     | 646.9     | 1079.4   | 965.1     |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short           |           |           | 60.7      | 136.7     | 145.2     | 51.0      | 78.5      | 71.4      | 14.3      |          |           |
| Warm Short           |           |           | 63.5      | 216.6     | 204.5     | 115.3     | 291.5     | 135.6     | 115.3     |          |           |
| Cool Mid             |           |           | 28.5      | 85.6      | 233.0     | 220.2     | 108.1     | 148.8     | 160.6     |          |           |
| Western whtg.        |           |           | 16.1      | 11.8      | 17.8      | 15.3      | 61.7      | 26.1      | 27.5      |          |           |
| Warm Mid             |           |           | 0.0       | 0.0       | 0.0       | 9.6       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall            |           |           | 1.8       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge                |           |           | 271.2     | 293.6     | 185.5     | 321.1     | 185.5     | 83.1      | 139.2     |          |           |
| Grass Total          |           |           | 441.7     | 744.3     | 786.0     | 732.5     | 725.4     | 464.9     | 456.7     | 858.1    | 419.2     |
| Forbs                |           |           | 97.4      | 120.2     | 146.3     | 273.7     | 136.7     | 47.5      | 31.0      | 71.4     | 7.1       |
| Shrubs               |           |           | 11.8      | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
| <b>Total</b>         |           |           | 550.9     | 864.5     | 932.3     | 1006.2    | 862.0     | 512.4     | 487.7     | 929.5    | 426.4     |

**Table 28. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| System – East | I-----I   |           |           | I-----I   |           |           |           |           |           |          |           |
| Pasture – 6   |           |           |           |           |           |           |           |           |           |          |           |
| Site - Silty  |           |           |           |           |           |           |           |           |           |          |           |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed:     |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 78.5      | 58.9      | 58.9      | 44.6      | 41.0      | 68.9      | 90.3      |          |           |
| Warm Short    |           |           | 54.6      | 164.1     | 321.1     | 114.2     | 356.8     | 563.7     | 184.5     |          |           |
| Cool Mid      |           |           | 130.2     | 123.1     | 281.9     | 462.1     | 346.1     | 208.0     | 398.6     |          |           |
| Western whtg. |           |           | 150.9     | 157.0     | 399.6     | 155.2     | 205.2     | 402.1     | 214.1     |          |           |
| Warm Mid      |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall     |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           | 527.4     | 444.2     | 37.5      | 570.9     | 410.3     | 224.8     | 159.5     |          |           |
| Grass Total   |           |           | 941.6     | 947.3     | 1098.9    | 1346.9    | 1359.4    | 1467.5    | 1046.9    | 2076.6   | 1514.6    |
| Forbs         |           |           | 223.0     | 171.3     | 474.5     | 324.7     | 399.6     | 184.5     | 291.5     | 317.6    | 139.2     |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 1164.6    | 1118.6    | 1573.5    | 1671.6    | 1759.0    | 1652.0    | 1338.4    | 2094.2   | 1653.8    |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Grazed:       |           |           |           |           |           |           |           |           |           |          |           |
| Cool Short    |           |           | 78.5      | 104.5     | 28.5      | 38.2      | 39.3      | 35.7      | 14.3      |          |           |
| Warm Short    |           |           | 54.6      | 330.8     | 317.6     | 172.3     | 280.8     | 456.7     | 132.0     |          |           |
| Cool Mid      |           |           | 130.2     | 165.2     | 63.2      | 197.3     | 441.4     | 136.7     | 31.0      |          |           |
| Western whtg. |           |           | 150.9     | 88.1      | 204.5     | 178.4     | 179.5     | 131.0     | 135.6     |          |           |
| Warm Mid      |           |           | 0.0       | 0.0       | 10.7      | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Warm Tall     |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |
| Sedge         |           |           | 527.4     | 282.9     | 135.6     | 357.9     | 331.8     | 225.9     | 102.4     |          |           |
| Grass Total   |           |           | 941.6     | 971.6     | 760.0     | 944.1     | 1272.7    | 985.8     | 415.3     | 801.0    | 933.0     |
| Forbs         |           |           | 223.0     | 142.7     | 164.1     | 198.7     | 172.3     | 74.9      | 120.2     | 66.0     | 121.3     |
| Shrubs        |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |
|               |           |           |           |           |           |           |           |           |           |          |           |
| Total         |           |           | 1164.6    | 1114.3    | 924.1     | 1142.8    | 1445.0    | 1060.8    | 535.6     | 867.0    | 1054.3    |

**Table 29. Mean Total above Ground Herbage Production in Lbs. /Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                              | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – WEST</b>         | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture – 1                  |           |           |           |           |           |           |           |           |           |          |           |
| <b><u>Site – Clayey</u></b>  |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 860.8     | 1425.4    | 1184.6    | 1464.7    | 1819.7    | 1826.8    | 1942.2    | 2378.1   | 3179.1    |
| Grazed                       |           |           |           |           | 1184.6    | 1465.3    | 1845.9    | 1063.3    | 1028.8    | 1725.1   | 1511.1    |
| <b><u>Site – Sandy</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 933.9     | 1634.2    | 1255.2    | 1751.9    | 1892.8    | 1225.0    | 1454.6    | 1671.6   | 2133.7    |
| Grazed                       |           |           |           |           | 1255.2    | 1374.9    | 1863.7    | 1109.7    | 884.9     | 979.4    | 2103.3    |
| <b><u>Site – Shallow</u></b> |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 653.8     | 780.5     | 710.9     | 1040.1    | 1088.2    | 1009.7    | 792.1     | 1197.1   | 556.6     |
| Grazed                       |           |           |           |           | 710.9     | 980.0     | 1019.2    | 673.2     | 654.1     | 706.5    | 479.9     |
| <b><u>Site – Silty</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 808.2     | 1411.1    | 1201.5    | 1578.8    | 1828.6    | 1850.6    | 1757.8    | 3411.0   | 2601.1    |
| Grazed                       |           |           |           |           | 1201.5    | 1654.4    | 1453.4    | 1267.8    | 886.1     | 2588.6   | 1889.3    |
| <b>System - EAST</b>         | I-----I   |           |           |           |           |           | I-----I   |           |           |          |           |
| Pasture - 2                  |           |           |           |           |           |           |           |           |           |          |           |
| <b><u>Site – Clayey</u></b>  |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 559.3     | 1171.2    | 1186.4    | 1411.2    | 2301.4    | 1386.8    | 1472.4    | 1687.7   | 1693.0    |
| Grazed                       |           |           |           |           | 1186.4    | 1299.9    | 1718.6    | 993.1     | 966.9     | 1330.9   | 1197.1    |
| <b><u>Site – Sandy</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 1089.1    | 1173.9    | 975.9     | 1769.7    | 1771.5    | 1065.7    | 1259.5    | 2017.7   | 2099.8    |
| Grazed                       |           |           |           |           | 975.9     | 930.1     | 1730.5    | 975.3     | 906.3     | 1860.7   | 1421.9    |
| <b><u>Site – Shallow</u></b> |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 713.6     | 983.9     | 895.6     | 1063.3    | 1165.0    | 1063.3    | 991.9     | 1006.2   | 1077.5    |
| Grazed                       |           |           |           |           | 895.6     | 840.9     | 1051.4    | 723.1     | 510.2     | 760.0    | 560.2     |
| <b><u>Site – Silty</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 946.4     | 1320.2    | 1365.7    | 1286.3    | 2806.2    | 1324.9    | 1472.4    | 2008.8   | 1660.9    |
| Grazed                       |           |           |           |           | 1365.7    | 1229.8    | 1208.4    | 1154.8    | 969.3     | 1662.7   | 1020.5    |

**Table 30. Mean Total above Ground Herbage Production in Lbs. /Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                              | 25<br>Apr      | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul      | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|------------------------------|----------------|-----------|-----------|-----------|-----------|----------------|-----------|-----------|-----------|----------|-----------|
| <b>System – WEST</b>         | <b>I-----I</b> |           |           |           |           | <b>I-----I</b> |           |           |           |          |           |
| Pasture – 3                  |                |           |           |           |           |                |           |           |           |          |           |
| <b><u>Site – Clayey</u></b>  |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 715.4     | 1190.8    | 1072.2    | 1045.4         | 1587.8    | 943.1     | 1003.8    | 1450.4   | 1500.4    |
| Grazed                       |                |           |           | 1190.8    | 906.3     | 844.4          | 1139.4    | 1010.9    | 789.7     | 997.3    | 804.6     |
| <b><u>Site – Sandy</u></b>   |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 1081.1    | 1385.3    | 1932.1    | 1181.0         | 1477.2    | 1536.6    | 1217.9    | 1966.0   | 1641.3    |
| Grazed                       |                |           |           | 1385.3    | 1414.1    | 1462.9         | 1158.4    | 1064.5    | 1152.5    | 1689.5   | 1070.4    |
| <b><u>Site – Shallow</u></b> |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 760.9     | 824.2     | 984.8     | 979.4          | 984.8     | 1131.1    | 883.7     | 1380.8   | 1500.4    |
| Grazed                       |                |           |           | 824.2     | 1039.5    | 1027.6         | 884.9     | 834.9     | 853.9     | 877.7    | 843.8     |
| <b><u>Site – Silty</u></b>   |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 809.9     | 941.1     | 1065.1    | 2197.9         | 1762.6    | 1388.0    | 1068.0    | 1796.5   | 1764.4    |
| Grazed                       |                |           |           | 941.1     | 952.7     | 1015.7         | 1776.5    | 1006.2    | 812.3     | 1632.4   | 1188.2    |
| <b>System – EAST</b>         | <b>I-----I</b> |           |           |           |           | <b>I-----I</b> |           |           |           |          |           |
| Pasture – 4                  |                |           |           |           |           |                |           |           |           |          |           |
| <b><u>Site – Clayey</u></b>  |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 586.9     | 906.3     | 1038.3    | 1771.5         | 1050.8    | 1351.1    | 989.5     | 1826.8   | 965.2     |
| Grazed                       |                |           |           | 906.3     | 807.6     | 1075.0         | 1058.5    | 1160.8    | 686.2     | 694.0    | 599.4     |
| <b><u>Site – Sandy</u></b>   |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 747.5     | 900.9     | 1090.0    | 1555.7         | 1998.1    | 1439.1    | 1585.4    | 2465.5   | 2023.1    |
| Grazed                       |                |           |           | 900.9     | 796.9     | 1364.2         | 1151.3    | 901.5     | 1123.9    | 2032.0   | 1660.9    |
| <b><u>Site – Shallow</u></b> |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 1039.2    | 1196.2    | 1027.6    | 1216.7         | 958.0     | 1076.4    | 726.7     | 1148.9   | 929.5     |
| Grazed                       |                |           |           | 1196.2    | 1251.2    | 942.0          | 1222.6    | 782.6     | 710.0     | 818.9    | 606.6     |
| <b><u>Site – Silty</u></b>   |                |           |           |           |           |                |           |           |           |          |           |
| Ungrazed                     |                |           | 978.5     | 1308.6    | 1355.8    | 1634.2         | 1998.1    | 1584.2    | 1033.5    | 1964.2   | 1957.1    |
| Grazed                       |                |           |           | 1308.6    | 903.9     | 1028.8         | 1535.4    | 907.5     | 934.8     | 1139.5   | 908.1     |

**Table 31. Mean Total above Ground Herbage Production in Lbs./Acre for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                              | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct |
|------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|
| <b>System – WEST</b>         | I-----I   |           |           |           |           | I-----I   |           |           |           |          |           |
| Pasture - 5                  |           |           |           |           |           |           |           |           |           |          |           |
| <b><u>Site – Clayey</u></b>  |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           |           |           |           |           |           |           |           |          |           |
| Grazed                       |           |           |           |           |           |           |           |           |           |          |           |
| <b><u>Site – Sandy</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 1191.7    | 1389.7    | 1197.1    | 1284.5    | 1703.7    | 1133.4    | 1564.0    | 1773.3   | 1509.3    |
| Grazed                       |           |           | 1191.7    | 1040.7    | 1255.9    | 1235.7    | 1661.5    | 809.9     | 1064.5    | 1243.5   | 999.0     |
| <b><u>Site – Shallow</u></b> |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 545.0     | 868.8     | 920.6     | 922.3     | 1445.0    | 993.1     | 553.0     | 804.6    | 701.1     |
| Grazed                       |           |           | 545.0     | 713.6     | 780.2     | 801.6     | 1258.3    | 538.8     | 375.8     | 515.6    | 463.8     |
| <b><u>Site – Silty</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 1074.0    | 1330.9    | 1441.5    | 1396.9    | 1666.3    | 1283.3    | 1034.7    | 2214.0   | 1407.6    |
| Grazed                       |           |           | 1074.0    | 869.4     | 1176.3    | 922.9     | 1634.1    | 1009.7    | 725.5     | 1395.1   | 1013.3    |
|                              |           |           |           |           |           |           |           |           |           |          |           |
| <b>System – EAST</b>         | I-----I   |           |           |           |           | I-----I   |           |           |           |          |           |
| Pasture - 6                  |           |           |           |           |           |           |           |           |           |          |           |
| <b><u>Site – Clayey</u></b>  |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           |           |           |           |           |           |           |           |          |           |
| Grazed                       |           |           |           |           |           |           |           |           |           |          |           |
| <b><u>Site – Sandy</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 1079.3    | 1255.9    | 1236.3    | 1272.0    | 1300.5    | 1589.0    | 1157.2    | 2092.6   | 1883.9    |
| Grazed                       |           |           | 1079.3    | 1297.7    | 1395.1    | 965.7     | 1565.2    | 953.8     | 637.5     | 1511.1   | 1027.6    |
| <b><u>Site – Shallow</u></b> |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 550.4     | 756.4     | 756.4     | 731.4     | 890.2     | 708.8     | 647.0     | 1079.3   | 965.2     |
| Grazed                       |           |           | 550.4     | 864.5     | 932.4     | 1006.2    | 862.3     | 512.6     | 487.6     | 929.5    | 426.4     |
| <b><u>Site – Silty</u></b>   |           |           |           |           |           |           |           |           |           |          |           |
| Ungrazed                     |           |           | 1164.1    | 1118.6    | 1573.7    | 1671.6    | 1759.0    | 1652.0    | 1338.0    | 2394.1   | 1653.8    |
| Grazed                       |           |           | 1164.1    | 1114.3    | 924.1     | 1143.0    | 1445.0    | 1060.9    | 535.2     | 867.0    | 1054.4    |

**Table 32. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Altai Wildrye on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 15<br>Oct | 14<br>Jan |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>System – WEST</b> |           |           |           |           |           |           |           |           |           | I-----I   |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |           |           |
| Altai Wildrye        |           |           | 2513.2    | 4201.3    | 3894.0    | 6864.7    | 5762.2    | 6477.9    | 3404.2    | 6318.4    |           |
| Other Grasses        |           |           | 21.0      | 42.8      | 68.7      | 22.3      | 11.6      | 2.7       | 26.8      | 0.0       |           |
| Grass Total          |           |           | 2534.2    | 4244.1    | 3962.7    | 6887.0    | 5773.8    | 6480.6    | 3431.0    | 6318.4    |           |
| Forbs                |           |           | 58.0      | 191.3     | 226.1     | 61.1      | 90.1      | 34.3      | 339.4     | 616.4     |           |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |           |
| <b>Total</b>         |           |           | 2592.2    | 4435.5    | 4188.8    | 6948.1    | 5863.9    | 6514.9    | 3770.4    | 6934.8    |           |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |           |           |
| Altai Wildrye        |           |           |           |           |           |           |           |           |           | 6318.4    | 2761.1    |
| Other Grasses        |           |           |           |           |           |           |           |           |           |           | 33.9      |
| Grass Total          |           |           |           |           |           |           |           |           |           | 6318.4    | 2795.0    |
| Forbs                |           |           |           |           |           |           |           |           |           | 616.4     | 145.4     |
| Shrubs               |           |           |           |           |           |           |           |           |           |           |           |
| <b>Total</b>         |           |           |           |           |           |           |           |           |           | 6934.8    | 2940.4    |

**Table 33. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Altai Wildrye on the Complementary Rotation Grazing System at the Dickinson Experiment Station - 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 15<br>Oct | 14<br>Jan |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <b>System – EAST</b> |           |           |           |           |           |           |           |           |           | I-----I   |           |
| <b>Ungrazed:</b>     |           |           |           |           |           |           |           |           |           |           |           |
| Altai Wildrye        |           |           | 3002.9    | 5295.4    | 4134.0    | 4912.6    | 5067.8    | 6135.8    | 2839.6    | 5784.1    |           |
| Other Grasses        |           |           | 0.0       | 32.1      | 40.3      | 42.4      | 2.7       | 1.3       | 24.1      | 0.0       |           |
| Grass Total          |           |           | 3002.9    | 5327.5    | 4174.2    | 4955.0    | 5070.5    | 6137.1    | 2863.7    | 5784.1    |           |
| Forbs                |           |           | 37.0      | 202.5     | 85.2      | 305.5     | 87.9      | 31.2      | 108.4     | 698.4     |           |
| Shrubs               |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |           |
| <b>Total</b>         |           |           | 3039.9    | 5530.0    | 4259.4    | 5260.5    | 5158.4    | 6168.4    | 2972.1    | 6482.5    |           |
| <b>Grazed:</b>       |           |           |           |           |           |           |           |           |           |           |           |
| Altai Wildrye        |           |           |           |           |           |           |           |           |           | 5784.1    | 1890.5    |
| Other Grasses        |           |           |           |           |           |           |           |           |           |           | 0.9       |
| Grass Total          |           |           |           |           |           |           |           |           |           | 5784.1    | 1891.4    |
| Forbs                |           |           |           |           |           |           |           |           |           | 698.4     | 290.8     |
| Shrubs               |           |           |           |           |           |           |           |           |           | 0.0       | 0.0       |
| <b>Total</b>         |           |           |           |           |           |           |           |           |           | 6482.5    | 2182.2    |

**Table 34. Mean Above Ground Herbage Production by Category in Lbs./Acre for the Altai Wildrye on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | <b>25<br/>Apr</b> | <b>15<br/>May</b> | <b>30<br/>May</b> | <b>15<br/>Jun</b> | <b>30<br/>Jun</b> | <b>15<br/>Jul</b> | <b>31<br/>Jul</b> | <b>15<br/>Aug</b> | <b>30<br/>Aug</b> | <b>15<br/>Oct</b> | <b>14<br/>Jan</b> |
|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>System – WEST</b> |                   |                   |                   |                   |                   |                   |                   |                   |                   | I----- I          |                   |
| Ungrazed             |                   |                   | 2592.2            | 4435.5            | 4188.8            | 6948.1            | 5863.9            | 6514.9            | 3770.4            | 6934.8            |                   |
| Grazed               |                   |                   |                   |                   |                   |                   |                   |                   |                   | 6934.8            | 2940.4            |
| <b>System – EAST</b> |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Ungrazed             |                   |                   | 3039.9            | 5530.0            | 4259.4            | 5260.5            | 5158.4            | 6168.4            | 2972.1            | 6482.5            |                   |
| Grazed               |                   |                   |                   |                   |                   |                   |                   |                   |                   | 6482.5            | 2182.2            |

**Table 35. Mean Percentage of Utilization for the Crested Wheatgrass on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | <b>25<br/>Apr</b> | <b>15<br/>May</b> | <b>30<br/>May</b> | <b>15<br/>Jun</b> | <b>30<br/>Jun</b> | <b>15<br/>Jul</b> | <b>31<br/>Jul</b> | <b>15<br/>Aug</b> | <b>30<br/>Aug</b> | <b>2<br/>Oct</b> | <b>15<br/>Oct</b> | <b>14<br/>Jan</b> |
|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|------------------|-------------------|-------------------|
| <b>System – WEST</b> | <b>I-----I</b>    |                   |                   |                   |                   |                   |                   |                   |                   |                  |                   |                   |
| Crested whtg.        |                   |                   | 61.8              | 59.2              | 56.2              | 47.3              | 57.2              | 58.6              | 56.0              |                  |                   |                   |
| Other Grasses        |                   |                   | -13.9             | 7.4               | 44.7              | -637.0            | -449.8            | -72.8             | 54.2              |                  |                   |                   |
| Grass Total          |                   |                   | 59.8              | 58.4              | 55.7              | 46.2              | 55.4              | 57.3              | 55.9              |                  |                   |                   |
| Forbs                |                   |                   | -122.4            | -84.3             | 29.3              | -67.9             | -92.9             | -1533.3           | 60.5              |                  |                   |                   |
| Shrubs               |                   |                   | 0.0               | 0.0               | 0.0               | 0.0               | 0.0               | 0.0               | 0.0               |                  |                   |                   |
| <b>Total</b>         |                   |                   | 59.3              | 57.7              | 55.1              | 45.7              | 55.0              | 52.6              | 55.9              |                  |                   |                   |
| <b>System – EAST</b> | <b>I-----I</b>    |                   |                   |                   |                   |                   |                   |                   |                   |                  |                   |                   |
| Crested whtg.        |                   |                   | 38.8              | 48.5              | 53.4              | 54.5              | 63.7              | 51.5              | 57.1              |                  |                   |                   |
| Other Grasses        |                   |                   | -221.6            | 20.0              | -9.4              | -128.5            | -366.8            | -125.0            | -100.0            |                  |                   |                   |
| Grass Total          |                   |                   | 36.8              | 48.0              | 52.8              | 53.7              | 61.8              | 50.0              | 56.9              |                  |                   |                   |
| Forbs                |                   |                   | -100.0            | 11.1              | -16.1             | -207.6            | 91.1              | 32.9              | -114.8            |                  |                   |                   |
| Shrubs               |                   |                   | 0.0               | -100.0            | 0.0               | 0.0               | 0.0               | 0.0               | 0.0               |                  |                   |                   |
| <b>Total</b>         |                   |                   | 35.5              | 47.6              | 51.7              | 53.1              | 63.5              | 49.7              | 55.5              |                  |                   |                   |

**Table 36. Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – WEST |           |           |           |           | I-----I   |           |           |           | I-----I   |          |           |           |
| Pasture – 1   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site - Clayey |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           |           |           | 17.5      | 95.4      | 66.6      | 80.8      |          |           |           |
| Warm Short    |           |           |           |           |           | -87.9     | -54.2     | -4.4      | 32.4      |          |           |           |
| Cool Mid      |           |           |           |           |           | 58.7      | -152.0    | 44.5      | 41.9      |          |           |           |
| Western whtg. |           |           |           |           |           | 25.1      | 24.5      | 75.8      | 48.9      |          |           |           |
| Warm Mid      |           |           |           |           |           | -100.0    | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall     |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge         |           |           |           |           |           | 0.0       | 0.0       | 100.0     | 100.0     |          |           |           |
| Grass Total   |           |           |           |           |           | 3.2       | -5.5      | 35.4      | 42.1      | 16.1     | 43.2      |           |
| Forbs         |           |           |           |           |           | -8.1      | 9.8       | 61.6      | 54.2      | 67.0     | 75.0      |           |
| Shrubs        |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total         |           |           |           |           |           | 0.1       | -0.2      | 41.8      | 47.0      | 27.5     | 52.5      |           |
| System – WEST |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 1   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Sandy  |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           |           |           | -253.5    | 21.7      | 71.4      | -263.8    |          |           |           |
| Warm Short    |           |           |           |           |           | -1643.8   | 50.2      | -36.4     | 57.7      |          |           |           |
| Cool Mid      |           |           |           |           |           | 0.9       | -67.6     | -16.1     | -24.8     |          |           |           |
| Western whtg. |           |           |           |           |           | -100.0    | -13.0     | 14.8      | 100.0     |          |           |           |
| Warm Mid      |           |           |           |           |           | -80.0     | 0.0       | -100.0    | -100.0    |          |           |           |
| Warm Tall     |           |           |           |           |           | 42.9      | 22.4      | 57.9      | 60.4      |          |           |           |
| Sedge         |           |           |           |           |           | -2.5      | 48.3      | -102.0    | 36.2      |          |           |           |
| Grass Total   |           |           |           |           |           | 17.1      | 7.4       | 19.2      | 37.6      | 37.1     | 3.6       |           |
| Forbs         |           |           |           |           |           | -28.1     | -213.5    | -168.2    | -291.1    | 60.8     | 6.2       |           |
| Shrubs        |           |           |           |           |           | 88.0      | 42.9      | -61.7     | 79.7      | 81.0     | -73.5     |           |
| Total         |           |           |           |           |           | 21.5      | 1.6       | 9.4       | 39.2      | 41.5     | 1.4       |           |

**Table 36. (Cont.) Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station –1984**

|                | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – WEST  |           |           |           |           |           | I-----I   |           |           | I-----I   |          |           |           |
| Pasture – 1    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site - Shallow |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           |           | 36.1      | 42.5      | -46.5     | 35.9      |          |           |           |
| Warm Short     |           |           |           |           |           | 45.2      | 156.2     | 16.2      | -41.9     |          |           |           |
| Cool Mid       |           |           |           |           |           | -22.6     | -39.0     | 43.0      | 38.0      |          |           |           |
| Western whtg.  |           |           |           |           |           | 43.3      | 100.0     | 100.0     | -100.0    |          |           |           |
| Warm Mid       |           |           |           |           |           | -100.0    | 77.2      | 66.7      | 0.0       |          |           |           |
| Warm Tall      |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           |           | 38.9      | -65.7     | 57.9      | -5.6      |          |           |           |
| Grass Total    |           |           |           |           |           | 8.4       | -0.3      | 39.2      | 11.1      | 40.5     | 15.3      |           |
| Forbs          |           |           |           |           |           | -15.2     | 28.2      | 7.0       | 41.1      | 53.4     | -4.0      |           |
| Shrubs         |           |           |           |           |           | 0.0       | 52.1      | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           |           |           | 5.7       | 6.3       | 33.3      | 17.4      | 41.0     | 13.8      |           |
| System – WEST  |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 1    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Silty   |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           |           | -2966.9   | -100.0    | 45.1      | -100.0    |          |           |           |
| Warm Short     |           |           |           |           |           | -5.3      | 43.0      | 13.7      | 49.6      |          |           |           |
| Cool Mid       |           |           |           |           |           | -19.1     | 36.1      | 49.1      | 70.6      |          |           |           |
| Western whtg.  |           |           |           |           |           | -37.0     | -101.0    | 1.0       | -24.1     |          |           |           |
| Warm Mid       |           |           |           |           |           | -100.0    | -100.0    | 40.8      | -100.0    |          |           |           |
| Warm Tall      |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           |           | -169.8    | -75.1     | -45.0     | 24.7      |          |           |           |
| Grass Total    |           |           |           |           |           | -17.7     | 22.0      | 30.5      | 50.5      | 28.0     | 30.0      |           |
| Forbs          |           |           |           |           |           | 11.4      | 16.2      | 41.9      | 43.5      | -90.3    | -26.9     |           |
| Shrubs         |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           |           |           | -4.8      | 20.5      | 31.5      | 49.6      | 24.1     | 27.4      |           |

**Table 37. Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – EAST |           |           |           |           | I-----I   |           |           |           | I-----I   |          |           |           |
| Pasture – 2   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site - Clayey |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           |           |           | 58.8      | 47.1      | 87.4      | 4.1       |          |           |           |
| Warm Short    |           |           |           |           |           | 26.9      | -104.0    | 31.0      | 16.4      |          |           |           |
| Cool Mid      |           |           |           |           |           | -99.5     | -3.8      | 61.6      | 49.7      |          |           |           |
| Western whtg. |           |           |           |           |           | 44.3      | 6.3       | 39.5      | 38.8      |          |           |           |
| Warm Mid      |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall     |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge         |           |           |           |           |           | 100.0     | 54.3      | 100.0     | -11.1     |          |           |           |
| Grass Total   |           |           |           |           |           | 12.1      | -10.5     | 47.9      | 31.3      | 8.7      | 32.5      |           |
| Forbs         |           |           |           |           |           | -4.9      | 53.5      | 22.2      | 39.8      | 63.6     | 26.9      |           |
| Shrubs        |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total         |           |           |           |           |           | 7.9       | 25.3      | 28.4      | 34.3      | 21.1     | 29.3      |           |
| System – EAST |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 2   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Sandy  |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           |           |           | 51.7      | -70.0     | -51.5     | 69.3      |          |           |           |
| Warm Short    |           |           |           |           |           | -650.1    | -28.5     | -124.8    | 46.4      |          |           |           |
| Cool Mid      |           |           |           |           |           | 57.6      | -188.5    | -93.8     | 14.3      |          |           |           |
| Western whtg. |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Mid      |           |           |           |           |           | -100.0    | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall     |           |           |           |           |           | 59.6      | 36.9      | 34.8      | 43.7      |          |           |           |
| Sedge         |           |           |           |           |           | 46.6      | -126.7    | 34.0      | -0.4      |          |           |           |
| Grass Total   |           |           |           |           |           | 48.5      | -4.7      | 7.8       | 27.6      | 4.1      | 32.3      |           |
| Forbs         |           |           |           |           |           | 4.3       | 41.7      | 8.2       | 89.8      | 89.8     | 0.0       |           |
| Shrubs        |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total         |           |           |           |           |           | 47.4      | 2.3       | 16.3      | 28.0      | 7.8      | 32.3      |           |

**Table 37. (Cont.) Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – EAST  |           |           |           |           |           | I-----I   |           |           | I-----I   |          |           |           |
| Pasture – 2    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Shallow |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           |           | 55.5      | 24.9      | 58.5      | 68.8      |          |           |           |
| Warm Short     |           |           |           |           |           | -17.3     | -5.2      | 2.2       | 42.6      |          |           |           |
| Cool Mid       |           |           |           |           |           | 21.3      | 24.0      | 57.0      | 55.6      |          |           |           |
| Western whtg.  |           |           |           |           |           | 100.0     | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Mid       |           |           |           |           |           | 0.0       | 0.0       | -100.0    | -100.0    |          |           |           |
| Warm Tall      |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           |           | 20.7      | 3.0       | 8.7       | 50.9      |          |           |           |
| Grass Total    |           |           |           |           |           | 21.2      | 15.9      | 33.1      | 52.9      | 26.0     | 45.9      |           |
| Forbs          |           |           |           |           |           | 19.3      | -24.7     | 27.8      | 20.8      | 2.6      | 52.0      |           |
| Shrubs         |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
|                |           |           |           |           |           |           |           |           |           |          |           |           |
| Total          |           |           |           |           |           | 20.9      | 9.7       | 32.0      | 49.4      | 24.5     | 48.0      |           |
|                |           |           |           |           |           |           |           |           |           |          |           |           |
| System – EAST  |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 2    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Silty   |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           |           | 44.7      | -582.1    | 5.2       | 80.0      |          |           |           |
| Warm Short     |           |           |           |           |           | 57.1      | 50.5      | 21.7      | 28.2      |          |           |           |
| Cool Mid       |           |           |           |           |           | -100.0    | 60.8      | - 57.4    | 53.7      |          |           |           |
| Western whtg.  |           |           |           |           |           | -68.1     | 60.9      | 54.7      | 41.5      |          |           |           |
| Warm Mid       |           |           |           |           |           | -100.0    | 88.6      | -96.3     | 100.0     |          |           |           |
| Warm Tall      |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           |           | -183.9    | 38.7      | -18.7     | 73.5      |          |           |           |
| Grass Total    |           |           |           |           |           | -16.0     | 54.9      | 2.3       | 28.7      | 13.6     | 41.2      |           |
| Forbs          |           |           |           |           |           | 73.0      | 67.3      | 43.0      | 43.0      | 70.8     | -1199.2   |           |
| Shrubs         |           |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
|                |           |           |           |           |           |           |           |           |           |          |           |           |
| Total          |           |           |           |           |           | 4.4       | 56.9      | 12.8      | 34.2      | 17.2     | 38.6      |           |

**Table 38. Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – WEST |           |           |           | I-----I   |           |           |           | I----- I  |           |          |           |           |
| Pasture – 3   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site - Clayey |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           |           | 23.7      | 69.0      | 50.0      | 16.1      | 52.6      |          |           |           |
| Warm Short    |           |           |           |           | 31.6      | 56.0      | 53.1      | -5.2      | -5.8      |          |           |           |
| Cool Mid      |           |           |           |           | -6.9      | -48.5     | -72.3     | 43.0      | 12.1      |          |           |           |
| Western whtg. |           |           |           |           | -64.5     | 19.1      | 69.5      | 31.9      | 63.6      |          |           |           |
| Warm Mid      |           |           |           |           | 0.0       | -100.0    | -100.0    | 0.0       | 0.0       |          |           |           |
| Warm Tall     |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge         |           |           |           |           | 61.3      | -100.0    | -75.9     | -32.8     | -96.7     |          |           |           |
| Grass Total   |           |           |           |           | 15.4      | 23.0      | 33.2      | 13.6      | 13.9      | 26.8     | 44.7      |           |
| Forbs         |           |           |           |           | 16.1      | 51.4      | -9.8      | -616.1    | 41.6      | 42.6     | 58.3      |           |
| Shrubs        |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total         |           |           |           |           | 15.5      | 19.3      | 28.3      | -7.1      | 21.3      | 31.2     | 46.4      |           |
| System - WEST |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 3   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Sandy  |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           |           | 36.8      | 66.0      | 38.4      | 31.6      | 51.8      |          |           |           |
| Warm Short    |           |           |           |           | 51.3      | 26.0      | -47.5     | -47.9     | -191.4    |          |           |           |
| Cool Mid      |           |           |           |           | 18.7      | -28.9     | 54.2      | -10.0     | 15.2      |          |           |           |
| Western whtg. |           |           |           |           | 76.5      | 100.0     | -100.0    | 100.0     | 100.0     |          |           |           |
| Warm Mid      |           |           |           |           | 0.0       | 0.0       | 0.0       | -130.3    | 0.0       |          |           |           |
| Warm Tall     |           |           |           |           | 5.3       | -49.2     | 33.2      | 30.9      | 29.0      |          |           |           |
| Sedge         |           |           |           |           | 38.8      | -47.7     | -127.6    | 64.4      | -45.3     |          |           |           |
| Grass Total   |           |           |           |           | 27.3      | -38.7     | -18.9     | 33.1      | 1.9       | 15.7     | 39.0      |           |
| Forbs         |           |           |           |           | 12.6      | 63.1      | 44.9      | 20.9      | 37.3      | -63.6    | -38.1     |           |
| Shrubs        |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total         |           |           |           |           | 26.8      | -23.9     | 28.3      | 30.7      | 5.3       | 14.1     | 34.8      |           |

**Table 38. (Cont.) Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – WEST  |           |           |           | I-----I   |           |           |           | I-----I   |           |          |           |           |
| Pasture – 3    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site - Shallow |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           | 37.0      | 72.9      | 45.8      | 45.3      | 13.3      |          |           |           |
| Warm Short     |           |           |           |           | -47.6     | -907.6    | -136.9    | 20.6      | 5.3       |          |           |           |
| Cool Mid       |           |           |           |           | -5.1      | -26.6     | 31.4      | 40.7      | 1.3       |          |           |           |
| Western whtg.  |           |           |           |           | 100.0     | 0.0       | 100.0     | 100.0     | -185.6    |          |           |           |
| Warm Mid       |           |           |           |           | 0.0       | 100.0     | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall      |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           | -18.5     | -37.6     | 52.5      | -2343.0   | 92.4      |          |           |           |
| Grass Total    |           |           |           |           | -5.0      | -3.2      | -0.1      | 28.2      | 13.4      | 35.1     | 45.9      |           |
| Forbs          |           |           |           |           | -21.0     | -18.9     | 44.5      | -3.5      | 50.6      | 67.7     | -13.3     |           |
| Shrubs         |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           |           | -5.6      | -4.8      | 10.1      | 26.2      | 3.4       | 36.4     | 43.8      |           |
| System – WEST  |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 3    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Silty   |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           | 64.4      | -100.0    | -28.1     | 96.8      | 20.6      |          |           |           |
| Warm Short     |           |           |           |           | -100.0    | -104.5    | 39.2      | -100.0    | -22.2     |          |           |           |
| Cool Mid       |           |           |           |           | -6.1      | 75.3      | 22.2      | -14.0     | 29.7      |          |           |           |
| Western whtg.  |           |           |           |           | 29.5      | -157.0    | 77.9      | 41.2      | 2.8       |          |           |           |
| Warm Mid       |           |           |           |           | 0.0       | 0.0       | -100.0    | 0.0       | 0.0       |          |           |           |
| Warm Tall      |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           | 87.3      | -100.0    | -164.9    | -160.0    | 100.0     |          |           |           |
| Grass Total    |           |           |           |           | 12.2      | 53.6      | -7.9      | 30.0      | 15.7      | 15.5     | 30.6      |           |
| Forbs          |           |           |           |           | -6.5      | 58.5      | -26.9     | 4.5       | 76.9      | -29.1    | 84.2      |           |
| Shrubs         |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           |           | 10.6      | 53.8      | -0.8      | 27.5      | 24.0      | 9.2      | 32.7      |           |

**Table 39. Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| <b>System – EAST</b> |           |           |           | I-----I   |           |           |           |           | I-----I   |          |           |           |
| <b>Pasture – 4</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Site – Clayey</b> |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short           |           |           |           |           | -1.5      | 55.0      | 83.6      | 23.2      | 23.7      |          |           |           |
| Warm Short           |           |           |           |           | -0.8      | -11.4     | -13.8     | 44.7      | -28.1     |          |           |           |
| Cool Mid             |           |           |           |           | -83.0     | 69.6      | -63.7     | -55.0     | 30.5      |          |           |           |
| Western whtg.        |           |           |           |           | 55.6      | 45.6      | -43.7     | 65.6      | 22.4      |          |           |           |
| Warm Mid             |           |           |           |           | 0.0       | -100.0    | 27.8      | 68.4      | 63.8      |          |           |           |
| Warm Tall            |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge                |           |           |           |           | 94.0      | 94.1      | 29.7      | 39.2      | 84.6      |          |           |           |
| Grass Total          |           |           |           |           | 10.0      | 44.0      | 5.3       | 19.8      | 18.3      | 58.8     | 49.4      |           |
| Forbs                |           |           |           |           | 48.4      | 33.0      | -34.0     | 2.7       | 62.5      | 73.0     | -46.2     |           |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| <b>Total</b>         |           |           |           |           | 22.2      | 39.4      | -0.7      | 14.1      | 30.6      | 62.0     | 37.9      |           |
| <b>System – EAST</b> |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Pasture – 4</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Site – Sandy</b>  |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short           |           |           |           |           | 93.1      | -90.1     | 79.3      | -11.1     | 5.8       |          |           |           |
| Warm Short           |           |           |           |           | 38.5      | -14.0     | -7.4      | -16.4     | -4.0      |          |           |           |
| Cool Mid             |           |           |           |           | 32.3      | 69.3      | 67.0      | 32.4      | -95.8     |          |           |           |
| Western whtg.        |           |           |           |           | -100.0    | -100.0    | -100.0    | 100.0     | 78.5      |          |           |           |
| Warm Mid             |           |           |           |           | 0.0       | -80.0     | 0.0       | -100.0    | 0.0       |          |           |           |
| Warm Tall            |           |           |           |           | 59.7      | 2.5       | 63.9      | 55.4      | 32.1      |          |           |           |
| Sedge                |           |           |           |           | -90.7     | -18.1     | -31.3     | 35.0      | 72.1      |          |           |           |
| Grass Total          |           |           |           |           | 32.2      | 45.0      | 45.0      | 39.6      | 34.2      | 19.6     | 17.3      |           |
| Forbs                |           |           |           |           | -79.3     | -46.5     | 9.7       | -45.6     | -144.1    | -35.3    | 50.0      |           |
| Shrubs               |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| <b>Total</b>         |           |           |           |           | 26.9      | 12.3      | 42.4      | 37.4      | 29.1      | 17.6     | 17.9      |           |

**Table 39. (Cont.) Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – EAST  |           |           |           | I-----I   |           |           |           | I-----I   |           |          |           |           |
| Pasture – 4    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site - Shallow |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           | -245.4    | 23.7      | -42.4     | -72.2     | 100.0     |          |           |           |
| Warm Short     |           |           |           |           | 47.1      | 40.0      | -16.2     | 34.5      | 9.8       |          |           |           |
| Cool Mid       |           |           |           |           | -28.5     | 16.9      | -6.8      | 24.6      | -27.7     |          |           |           |
| Western whtg.  |           |           |           |           | 100.0     | -100.0    | 40.0      | -107.6    | 100.0     |          |           |           |
| Warm Mid       |           |           |           |           | 0.0       | 0.0       | 0.0       | 54.8      | 0.0       |          |           |           |
| Warm Tall      |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           | -10.7     | 20.1      | -46.6     | 24.7      | 23.8      |          |           |           |
| Grass Total    |           |           |           |           | -34.5     | 21.4      | -25.0     | 21.3      | 4.4       | 28.3     | 36.2      |           |
| Forbs          |           |           |           |           | 32.2      | 39.1      | -65.0     | 55.8      | -63.5     | 55.5     | -40.0     |           |
| Shrubs         |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           |           | -21.7     | 22.6      | -27.6     | 27.3      | 2.3       | 28.7     | 34.7      |           |
| System – EAST  |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 4    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Silty   |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           |           | 9.4       | 53.0      | -63.7     | 15.7      | 33.1      |          |           |           |
| Warm Short     |           |           |           |           | 39.2      | -80.0     | 40.7      | 48.5      | -23.9     |          |           |           |
| Cool Mid       |           |           |           |           | 32.0      | 71.6      | 24.1      | 46.1      | 42.8      |          |           |           |
| Western whtg.  |           |           |           |           | 63.3      | -24.7     | 34.3      | 59.1      | 32.7      |          |           |           |
| Warm Mid       |           |           |           |           | 0.0       | -100.0    | 32.0      | 0.0       | 0.0       |          |           |           |
| Warm Tall      |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           |           | 13.5      | 45.2      | 15.6      | -8.8      | -55.3     |          |           |           |
| Grass Total    |           |           |           |           | 32.7      | 35.4      | 29.8      | 41.0      | -3.1      | 42.3     | 53.8      |           |
| Forbs          |           |           |           |           | 42.4      | 45.7      | -22.5     | 45.9      | 41.3      | 34.1     | 52.2      |           |
| Shrubs         |           |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           |           | 33.3      | 37.1      | 23.1      | 42.7      | 9.5       | 42.0     | 53.6      |           |

**Table 40. Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – WEST  |           |           | I-----I   |           |           |           | I-----I   |           |           |          |           |           |
| Pasture – 5    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Sandy   |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           | 87.5      | 100.0     | -12.3     | 19.3      | 100.0     | 100.0     |          |           |           |
| Warm Short     |           |           |           | -255.5    | 74.2      | -499.7    | -10.0     | -80.4     | -49.1     |          |           |           |
| Cool Mid       |           |           |           | 67.7      | 12.3      | -75.0     | -34.4     | 25.0      | -140.7    |          |           |           |
| Western whtg.  |           |           |           | 0.0       | 0.0       | 100.0     | 0.0       | 100.0     | 100.0     |          |           |           |
| Warm Mid       |           |           |           | -100.0    | -100.0    | 100.0     | 100.0     | 0.0       | 0.0       |          |           |           |
| Warm Tall      |           |           |           | 50.5      | -20.1     | 45.6      | -28.0     | 60.2      | 46.9      |          |           |           |
| Sedge          |           |           |           | -128.6    | -37.3     | -97.2     | 28.0      | -9.5      | -26.7     |          |           |           |
| Grass Total    |           |           |           | -1.2      | -2.1      | 89.6      | -5.0      | 26.1      | 17.2      | 35.1     | 32.2      |           |
| Forbs          |           |           |           | 79.1      | -76.4     | 62.5      | 24.3      | 35.6      | 75.8      | -90.3    | 100.0     |           |
| Shrubs         |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| Total          |           |           |           | 25.1      | -4.9      | 3.8       | 2.5       | 28.6      | 32.0      | 29.9     | 33.8      |           |
| System – WEST  |           |           |           |           |           |           |           |           |           |          |           |           |
| Pasture – 5    |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Shallow |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short     |           |           |           | 25.0      | 16.7      | 50.1      | -41.3     | 74.5      | 54.6      |          |           |           |
| Warm Short     |           |           |           | 30.4      | 21.8      | 13.4      | -0.6      | 7.3       | 50.7      |          |           |           |
| Cool Mid       |           |           |           | -71.2     | 33.4      | -62.5     | -52.7     | 51.5      | -20.1     |          |           |           |
| Western whtg.  |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | -100.0    |          |           |           |
| Warm Mid       |           |           |           | 0.0       | 98.1      | 70.4      | 100.0     | 76.4      | 100.0     |          |           |           |
| Warm Tall      |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge          |           |           |           | 3.8       | -21.1     | 13.7      | 26.4      | 14.7      | 11.2      |          |           |           |
| Grass Total    |           |           |           | 9.8       | 8.3       | 11.2      | 1.1       | 42.9      | 26.4      | 33.7     | 36.8      |           |
| Forbs          |           |           |           | 50.5      | 34.9      | 34.1      | 21.2      | 48.1      | 53.1      | 54.5     | 5.4       |           |
| Shrubs         |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 23.7     | 0.0       |           |
| Total          |           |           |           | 17.9      | 15.3      | 13.1      | 12.9      | 45.8      | 32.0      | 5.9      | 33.8      |           |

**Table 40. (Cont.) Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – WEST | I-----I   |           |           | I-----I   |           |           |           |           |           |          |           |           |
| Pasture – 5   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Silty  |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           | -11.1     | 42.3      | 32.2      | -23.4     | 45.7      | 50.8      |          |           |           |
| Warm Short    |           |           |           | 41.2      | -7.0      | 36.7      | -313.9    | -50.5     | 14.3      |          |           |           |
| Cool Mid      |           |           |           | 55.0      | 20.3      | 40.0      | -11.2     | -13.5     | 48.9      |          |           |           |
| Western whtg. |           |           |           | 30.4      | 44.4      | 47.9      | 22.4      | 52.7      | -32.4     |          |           |           |
| Warm Mid      |           |           |           | -2105.1   | 0.0       | 0.0       | 96.5      | 0.0       | 0.0       |          |           |           |
| Warm Tall     |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge         |           |           |           | -15.9     | -197.5    | -62.8     | 4.5       | 67.7      | -79.1     |          |           |           |
| Grass Total   |           |           |           | 31.8      | 21.9      | 33.2      | -5.8      | 20.9      | 16.1      | 33.8     | 30.8      |           |
| Forbs         |           |           |           | 56.5      | 6.2       | 35.9      | 36.5      | 23.8      | 76.8      | 62.3     | -1.5      |           |
| Shrubs        |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
|               |           |           |           |           |           |           |           |           |           |          |           |           |
| Total         |           |           |           | 34.7      | 18.4      | 34.0      | 1.9       | 21.3      | 29.9      | 37.0     | 28.0      |           |

**Table 41. Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                       | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| <b>System – EAST</b>  |           |           | I-----I   |           |           |           | I-----I   |           |           |          |           |           |
| <b>Pasture – 6</b>    |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Site – Sandy</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short            |           |           |           | -40.5     | 50.0      | -1643.8   | -13.3     | 85.0      | 100.0     |          |           |           |
| Warm Short            |           |           |           | 41.9      | 74.1      | 66.7      | 23.8      | 7.5       | 18.2      |          |           |           |
| Cool Mid              |           |           |           | -63.7     | 37.4      | -8.2      | -19.1     | -5.8      | -100.0    |          |           |           |
| Western whtg.         |           |           |           | -100.0    | 0.0       | 100.0     | -100.0    | 0.0       | -100.0    |          |           |           |
| Warm Mid              |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall             |           |           |           | 42.0      | -32.5     | 21.3      | 20.0      | 53.9      | 52.8      |          |           |           |
| Sedge                 |           |           |           | -6.5      | -62.0     | 15.7      | 72.1      | 39.2      | 28.9      |          |           |           |
| Grass Total           |           |           |           | -3.0      | -20.6     | 21.7      | -13.3     | 37.0      | 43.5      | 25.1     | 45.2      |           |
| Forbs                 |           |           |           | -20.0     | 57.4      | 38.6      | -139.0    | 66.4      | 62.5      | 53.2     | 100.0     |           |
| Shrubs                |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| <b>Total</b>          |           |           |           | -3.3      | -12.9     | 24.1      | -20.4     | 40.0      | 44.9      | 27.8     | 45.5      |           |
| <b>System – EAST</b>  |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Pasture – 6</b>    |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Site – Shallow</b> |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short            |           |           |           | 8.8       | -0.5      | -78.8     | 45.7      | 35.5      | 50.0      |          |           |           |
| Warm Short            |           |           |           | -44.5     | -143.8    | 50.7      | -40.9     | 40.6      | 35.0      |          |           |           |
| Cool Mid              |           |           |           | 39.2      | -15.6     | -128.5    | 33.4      | -34.5     | 24.1      |          |           |           |
| Western whtg.         |           |           |           | 40.0      | -399.7    | 62.6      | -64.8     | 8.7       | 7.2       |          |           |           |
| Warm Mid              |           |           |           | 0.0       | 0.0       | -100.0    | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall             |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge                 |           |           |           | -183.8    | -53.0     | -33.3     | -147.6    | -9.4      | 12.8      |          |           |           |
| Grass Total           |           |           |           | 32.0      | -41.7     | -14.4     | -15.9     | 16.1      | 24.7      | 11.9     | 51.0      |           |
| Forbs                 |           |           |           | 37.6      | -27.4     | -200.8    | 48.2      | 69.3      | 23.0      | 32.2     | 93.4      |           |
| Shrubs                |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
| <b>Total</b>          |           |           |           | -14.3     | -23.3     | -37.6     | 3.2       | 27.7      | 24.6      | 13.9     | 55.8      |           |

**Table 41. (Cont.) Mean Percentage of Utilization for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|               | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| System – EAST | I-----I   |           |           | I-----I   |           |           |           |           |           |          |           |           |
| Pasture – 6   |           |           |           |           |           |           |           |           |           |          |           |           |
| Site – Silty  |           |           |           |           |           |           |           |           |           |          |           |           |
| Cool Short    |           |           |           | -77.6     | 51.5      | 14.4      | 4.3       | 48.2      | 84.2      |          |           |           |
|               |           |           |           |           |           |           |           |           |           |          |           |           |
| Warm Short    |           |           |           | -101.5    | 1.1       | -50.9     | 21.3      | 19.0      | 28.4      |          |           |           |
| Cool Mid      |           |           |           | -34.2     | 77.6      | 57.3      | -27.5     | 34.3      | 92.2      |          |           |           |
| Western whtg. |           |           |           | 43.9      | 48.8      | -14.9     | 12.5      | 67.4      | 36.7      |          |           |           |
| Warm Mid      |           |           |           | 0.0       | -100.0    | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Warm Tall     |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       |          |           |           |
| Sedge         |           |           |           | 36.3      | -261.9    | 37.3      | 19.1      | -0.5      | 35.8      |          |           |           |
| Grass Total   |           |           |           | -2.6      | 30.8      | 29.9      | 6.4       | 32.8      | 60.3      | 61.4     | 38.4      |           |
| Forbs         |           |           |           | 16.7      | 65.4      | 38.8      | 56.9      | 59.4      | 58.8      | 79.2     | 12.8      |           |
| Shrubs        |           |           |           | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0       | 0.0      | 0.0       |           |
|               |           |           |           |           |           |           |           |           |           |          |           |           |
| Total         |           |           |           | 0.4       | 41.3      | 31.6      | 17.9      | 35.8      | 60.0      | 58.6     | 36.3      |           |

**Table 42. Mean Percentage of Utilization of Total Herbage for the Native Range on the Complementary Rotation Grazing System at the Dickinson Experiment Station – 1984**

|                      | 25<br>Apr | 15<br>May | 30<br>May | 15<br>Jun | 30<br>Jun | 15<br>Jul | 31<br>Jul | 15<br>Aug | 30<br>Aug | 2<br>Oct | 15<br>Oct | 14<br>Jan |
|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|
| <b>System – WEST</b> |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Pasture – 1</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Clayey               |           |           |           |           |           | 0.1       | -0.2      | 41.8      | 47.0      | 27.5     | 52.5      |           |
| Sandy                |           |           |           |           |           | 21.5      | 1.6       | 9.4       | 39.2      | 41.5     | 1.4       |           |
| Shallow              |           |           |           |           |           | 5.7       | 6.3       | 33.3      | 17.4      | 41.0     | 13.8      |           |
| Silty                |           |           |           |           |           | -4.8      | 20.5      | 31.5      | 49.6      | 24.1     | 27.4      |           |
| <b>Pasture – 3</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Clayey               |           |           |           |           | 15.5      | 19.3      | 28.3      | -7.1      | 21.3      | 31.2     | 46.4      |           |
| Sandy                |           |           |           |           | 26.8      | -23.9     | 28.3      | 30.7      | 5.3       | 14.1     | 34.8      |           |
| Shallow              |           |           |           |           | -5.6      | -4.8      | 10.1      | 26.2      | 3.4       | 36.4     | 43.8      |           |
| Silty                |           |           |           |           | 10.6      | 53.8      | -0.8      | 27.5      | 24.0      | 9.2      | 32.7      |           |
| <b>Pasture – 5</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Clayey               |           |           |           |           |           |           |           |           |           |          |           |           |
| Sandy                |           |           |           | 25.1      | -4.9      | 3.8       | 2.5       | 28.6      | 32.0      | 29.9     | 33.8      |           |
| Shallow              |           |           |           | 17.9      | 15.3      | 13.1      | 12.9      | 45.8      | 32.0      | 35.9     | 33.8      |           |
| Silty                |           |           |           | 34.7      | 18.4      | 34.0      | 1.9       | 21.3      | 29.9      | 37.0     | 28.0      |           |
| <b>System – EAST</b> |           |           |           |           |           |           |           |           |           |          |           |           |
| <b>Pasture – 2</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Clayey               |           |           |           |           |           | 7.9       | 25.3      | 28.4      | 34.3      | 21.1     | 29.3      |           |
| Sandy                |           |           |           |           |           | 47.4      | 2.3       | 16.3      | 28.0      | 7.8      | 32.3      |           |
| Shallow              |           |           |           |           |           | 20.9      | 9.7       | 32.0      | 49.4      | 24.5     | 48.0      |           |
| Silty                |           |           |           |           |           | 4.4       | 56.9      | 12.8      | 34.2      | 17.2     | 38.6      |           |
| <b>Pasture – 4</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Clayey               |           |           |           |           | 22.2      | 39.4      | -0.7      | 14.1      | 30.6      | 62.0     | 37.9      |           |
| Sandy                |           |           |           |           | 26.9      | 12.3      | 42.4      | 37.4      | 29.1      | 17.6     | 17.9      |           |
| Shallow              |           |           |           |           | -21.7     | 22.6      | -27.6     | 27.3      | 2.3       | 28.7     | 34.7      |           |
| Silty                |           |           |           |           | 33.3      | 37.1      | 23.1      | 42.7      | 9.5       | 42.0     | 53.6      |           |
| <b>Pasture – 6</b>   |           |           |           |           |           |           |           |           |           |          |           |           |
| Clayey               |           |           |           |           |           |           |           |           |           |          |           |           |
| Sandy                |           |           |           | -3.3      | -12.9     | 24.1      | -20.4     | 40.0      | 44.9      | 27.8     | 45.5      |           |
| Shallow              |           |           |           | -14.3     | -23.3     | -37.6     | 3.2       | 27.7      | 24.6      | 13.9     | 55.8      |           |
| Silty                |           |           |           | 0.4       | 41.3      | 31.6      | 17.9      | 35.8      | 60.0      | 58.6     | 36.3      |           |

**Table 43. Points Analysis of the Ungrazed West Pasture on the Crested Wheatgrass for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>            | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|---------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron desertorum      | 23.20                  | 83.45                               | 95.50                        | 73.75                                     | 157.20                      |
| Agropyron smithii         | 0.05                   | 0.18                                | 0.50                         | 0.39                                      | 0.57                        |
| Bouteloua gracilis        | 1.95                   | 7.01                                | 13.00                        | 10.04                                     | 17.05                       |
| Koeleria pyramidata       | 0.35                   | 1.26                                | 3.00                         | 2.32                                      | 3.58                        |
| Schedonnardus paniculatus | 0.50                   | 1.80                                | 2.50                         | 1.93                                      | 3.73                        |
| Stipa comata              | 0.10                   | 0.36                                | 1.00                         | 0.77                                      | 1.13                        |
|                           |                        |                                     |                              |                                           |                             |
| Carex filifolia           | 0.20                   | 0.72                                | 1.50                         | 1.16                                      | 1.88                        |
| Carex heliophila          | 0.45                   | 1.62                                | 4.00                         | 3.09                                      | 4.71                        |
|                           |                        |                                     |                              |                                           |                             |
| Hedeoma hispida           | 0.45                   | 1.62                                | 4.50                         | 3.47                                      | 5.09                        |
| Opuntia fragilis          | 0.35                   | 1.26                                | 2.00                         | 1.54                                      | 2.80                        |
| Sphaeralcea coccinea      | 0.10                   | 0.36                                | 1.00                         | 0.77                                      | 1.13                        |
|                           |                        |                                     |                              |                                           |                             |
| Lichen spp.               | 0.10                   | 0.36                                | 1.00                         | 0.77                                      | 1.13                        |
|                           |                        |                                     |                              |                                           |                             |
| Litter                    | 71.15                  |                                     | 100.00                       |                                           |                             |
| Rock                      | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                      | 1.05                   |                                     | 5.50                         |                                           |                             |

**Table 44. Points Analysis of the Grazed West Pasture on the Crested Wheatgrass for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>            | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|---------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron desertorum      | 24.70              | 75.65                       | 95.00                    | 63.33                             | 138.98                  |
| Agropyron smithii         | 0.10               | 0.31                        | 1.00                     | 0.67                              | 0.98                    |
| Bouteloua gracilis        | 2.90               | 8.88                        | 14.00                    | 9.33                              | 18.21                   |
| Koeleria pyramidata       | 0.50               | 1.53                        | 4.50                     | 3.00                              | 4.53                    |
| Schedonnardus paniculatus | 1.10               | 3.37                        | 5.00                     | 3.33                              | 6.70                    |
| Stipa comate              | 0.35               | 1.07                        | 2.50                     | 1.67                              | 2.74                    |
| Carex heliophila          | 0.30               | 0.92                        | 2.50                     | 1.67                              | 2.59                    |
| Conyza canadensis         | 0.20               | 0.61                        | 2.00                     | 1.33                              | 1.94                    |
| Hedeoma hispida           | 0.85               | 2.60                        | 7.50                     | 5.00                              | 7.60                    |
| Lepidium densiflorum      | 0.15               | 0.46                        | 1.50                     | 1.00                              | 1.46                    |
| Opuntia fragilis          | 0.10               | 0.31                        | 1.00                     | 0.67                              | 0.98                    |
| Phlox hoodii              | 0.05               | 0.15                        | 0.50                     | 0.33                              | 0.48                    |
| Plantago purshii          | 0.40               | 1.23                        | 4.00                     | 2.67                              | 3.90                    |
| Ratibida columnifera      | 0.05               | 0.15                        | 0.50                     | 0.33                              | 0.48                    |
| Sphaeralcea coccinea      | 0.60               | 1.84                        | 6.00                     | 4.00                              | 5.84                    |
| Lichen spp.               | 0.30               | 0.92                        | 2.50                     | 1.67                              | 2.59                    |
| Litter                    | 66.20              |                             | 100.00                   |                                   |                         |
| Rock                      | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                      | 1.15               |                             | 8.50                     |                                   |                         |

**Table 45. Points Analysis of the Ungrazed East Pasture on the Crested Wheatgrass for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron desertorum    | 25.00              | 90.58                       | 98.50                    | 82.77                             | 173.35                  |
| Agropyron smithii       | 0.15               | 0.54                        | 1.50                     | 1.26                              | 1.80                    |
| Bouteloua gracilis      | 0.90               | 3.26                        | 5.00                     | 4.20                              | 7.46                    |
| Koeleria pyramidata     | 0.25               | 0.91                        | 2.00                     | 1.68                              | 2.59                    |
| Stipa comate            | 0.35               | 1.27                        | 2.50                     | 2.10                              | 3.37                    |
| Carex heliophila        | 0.15               | 0.54                        | 1.50                     | 1.26                              | 1.80                    |
| Achillea millefolium    | 0.05               | 0.18                        | 0.50                     | 0.42                              | 0.60                    |
| Conyza canadensis       | 0.10               | 0.36                        | 1.00                     | 0.84                              | 1.20                    |
| Lygodesmia juncea       | 0.20               | 0.72                        | 2.00                     | 1.68                              | 2.40                    |
| Potentilla pensylvanica | 0.15               | 0.54                        | 1.50                     | 1.26                              | 1.80                    |
| Sphaeralcea coccinea    | 0.05               | 0.18                        | 0.50                     | 0.42                              | 0.60                    |
| Lichen spp.             | 0.25               | 0.91                        | 2.50                     | 2.10                              | 3.01                    |
| Litter                  | 71.20              |                             | 100.00                   |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                    | 1.15               |                             | 9.50                     |                                   |                         |

**Table 46. Points Analysis of the Grazed East Pasture on the Crested Wheatgrass for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron desertorum    | 26.20              | 89.57                       | 83.50                    | 79.90                             | 169.47                  |
| Agropyron smithii       | 0.10               | 0.34                        | 1.00                     | 0.96                              | 1.30                    |
| Bouteloua gracilis      | 1.20               | 4.10                        | 6.00                     | 5.74                              | 9.84                    |
| Koeleria pyramidata     | 0.30               | 1.03                        | 2.00                     | 1.91                              | 2.94                    |
| Stipa comata            | 0.35               | 1.20                        | 2.50                     | 2.39                              | 3.59                    |
| Achillea millefolium    | 0.05               | 0.17                        | 0.50                     | 0.48                              | 0.65                    |
| Antennaria parvifolia   | 0.10               | 0.34                        | 0.50                     | 0.48                              | 0.82                    |
| Artemisia frigida       | 0.35               | 1.20                        | 2.50                     | 2.39                              | 3.59                    |
| Cirsium undulatum       | 0.05               | 0.17                        | 0.50                     | 0.48                              | 0.65                    |
| Commandra umbellata     | 0.05               | 0.17                        | 0.50                     | 0.48                              | 0.65                    |
| Lepidium densiflorum    | 0.05               | 0.17                        | 0.50                     | 0.48                              | 0.65                    |
| Lygodesmia juncea       | 0.25               | 0.85                        | 2.50                     | 2.39                              | 3.24                    |
| Phlox hoodii            | 0.05               | 0.17                        | 0.50                     | 0.48                              | 0.65                    |
| Potentilla pensylvanica | 0.10               | 0.34                        | 1.00                     | 0.96                              | 1.30                    |
| Lichen spp.             | 0.05               | 0.17                        | 0.50                     | 0.48                              | 0.65                    |
| Litter                  | 68.55              |                             | 100.00                   |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                    | 2.15               |                             | 8.50                     |                                   |                         |

**Table 47. Points Analysis of the Ungrazed Clayey Range Site on the Native Range, Pasture 1, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii       | 2.50                   | 7.51                                | 21.00                        | 11.11                                     | 18.62                       |
| Bouteloua gracilis      | 23.10                  | 69.37                               | 96.00                        | 50.79                                     | 120.16                      |
| Koeleria pyramidata     | 0.70                   | 2.10                                | 7.00                         | 3.70                                      | 5.80                        |
| Poa pratensis           | 0.10                   | 0.30                                | 1.00                         | 0.53                                      | 0.83                        |
| Stipa comate            | 1.30                   | 3.90                                | 13.00                        | 6.88                                      | 10.78                       |
| Stipa viridula          | 2.20                   | 6.61                                | 18.00                        | 9.52                                      | 16.13                       |
| Carex heliophila        | 0.40                   | 1.20                                | 4.00                         | 2.12                                      | 3.32                        |
| Achillea millefolium    | 0.50                   | 1.50                                | 4.00                         | 2.12                                      | 3.62                        |
| Androsace occidentalis  | 0.10                   | 0.30                                | 1.00                         | 0.53                                      | 0.83                        |
| Artemisia frigida       | 0.30                   | 0.90                                | 3.00                         | 1.59                                      | 2.49                        |
| Conyza canadensis       | 0.20                   | 0.60                                | 2.00                         | 1.06                                      | 1.66                        |
| Grindelia squarrosa     | 0.20                   | 0.60                                | 2.00                         | 1.06                                      | 1.66                        |
| Phlox hoodia            | 0.50                   | 1.50                                | 5.00                         | 2.65                                      | 4.15                        |
| Potentilla pensylvanica | 0.20                   | 0.60                                | 2.00                         | 1.06                                      | 1.66                        |
| Psoralea esculenta      | 0.10                   | 0.30                                | 1.00                         | 0.53                                      | 0.83                        |
| Ratibida columnifera    | 0.80                   | 2.40                                | 8.00                         | 4.23                                      | 6.63                        |
| Lichen spp.             | 0.10                   | 0.30                                | 1.00                         | 0.53                                      | 0.83                        |
| Litter                  | 66.40                  |                                     | 100.00                       |                                           |                             |
| Rock                    | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                    | 0.30                   |                                     | 3.00                         |                                           |                             |

**Table 48. Points Analysis of the Grazed Clayey Range Site on the Native Range, Pasture 1, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>       | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|----------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii    | 1.60                   | 5.05                                | 16.00                        | 8.84                                      | 13.89                       |
| Bouteloua gracilis   | 22.00                  | 69.40                               | 90.00                        | 49.72                                     | 119.12                      |
| Koeleria pyramidata  | 1.70                   | 5.36                                | 15.00                        | 8.29                                      | 13.65                       |
| Poa pratensis        | 0.20                   | 0.63                                | 2.00                         | 1.10                                      | 1.73                        |
| Stipa comata         | 1.70                   | 5.36                                | 16.00                        | 8.84                                      | 14.20                       |
| Stipa viridula       | 1.90                   | 5.99                                | 18.00                        | 9.94                                      | 15.93                       |
| Carex heliophila     | 0.70                   | 2.21                                | 6.00                         | 3.31                                      | 5.52                        |
| Achillea millefolium | 0.20                   | 0.63                                | 2.00                         | 1.10                                      | 1.73                        |
| Artemisia frigida    | 0.50                   | 1.58                                | 5.00                         | 2.76                                      | 4.34                        |
| Grindelia squarrosa  | 0.50                   | 1.58                                | 4.00                         | 2.21                                      | 3.79                        |
| Opuntia fragilis     | 0.10                   | 0.32                                | 1.00                         | 0.55                                      | 0.87                        |
| Phlox hoodii         | 0.10                   | 0.32                                | 1.00                         | 0.55                                      | 0.87                        |
| Ratibida columnifera | 0.40                   | 1.26                                | 4.00                         | 2.21                                      | 3.47                        |
| Sphaeralcea coccinea | 0.10                   | 0.32                                | 1.00                         | 0.55                                      | 0.87                        |
| Litter               | 67.70                  |                                     | 100.00                       |                                           |                             |
| Rock                 | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                 | 0.60                   |                                     | 5.00                         |                                           |                             |

**Table 49. Points Analysis of the Ungrazed Sandy Range Site on the Native Range, Pasture 1, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii       | 0.10                   | 0.26                                | 1.00                         | 0.46                                      | 0.72                        |
| Bouteloua gracilis      | 2.90                   | 7.46                                | 17.00                        | 7.76                                      | 15.22                       |
| Calamovilfa longifolia  | 5.50                   | 14.14                               | 42.00                        | 19.18                                     | 33.32                       |
| Koeleria pyramidata     | 0.20                   | 0.51                                | 2.00                         | 0.91                                      | 1.42                        |
| Muhlenbergia cuspidata  | 0.10                   | 0.26                                | 1.00                         | 0.46                                      | 0.72                        |
| Stipa comate            | 2.60                   | 6.68                                | 20.00                        | 9.13                                      | 15.81                       |
| Stipa viridula          | 0.40                   | 1.03                                | 4.00                         | 1.83                                      | 2.86                        |
|                         |                        |                                     |                              |                                           |                             |
| Carex filifolia         | 17.60                  | 45.24                               | 68.00                        | 31.05                                     | 76.29                       |
| Carex heliophila        | 7.70                   | 19.79                               | 48.00                        | 21.92                                     | 41.71                       |
|                         |                        |                                     |                              |                                           |                             |
| Artemisia dracunculus   | 0.10                   | 0.26                                | 1.00                         | 0.46                                      | 0.72                        |
| Asclepias verticillata  | 0.50                   | 1.29                                | 5.00                         | 2.28                                      | 3.57                        |
| Chrysopsis villosa      | 0.10                   | 0.26                                | 1.00                         | 0.46                                      | 0.72                        |
| Lygodesmia juncea       | 0.40                   | 1.03                                | 4.00                         | 1.83                                      | 2.86                        |
| Opuntia fragilis        | 0.30                   | 0.77                                | 1.00                         | 0.46                                      | 1.23                        |
| Potentilla pensylvanica | 0.10                   | 0.26                                | 1.00                         | 0.46                                      | 0.72                        |
| Psoralea argophylla     | 0.10                   | 0.26                                | 1.00                         | 0.46                                      | 0.72                        |
|                         |                        |                                     |                              |                                           |                             |
| Rosa arkansana          | 0.20                   | 0.51                                | 2.00                         | 0.91                                      | 1.42                        |
|                         |                        |                                     |                              |                                           |                             |
| Litter                  | 61.10                  |                                     | 100.00                       |                                           |                             |
| Rock                    | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                    | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 50. Points Analysis of the Grazed Sandy Range Site on the Native Range, Pasture 1, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii      | 0.20                   | 0.49                                | 2.00                         | 0.80                                      | 1.29                        |
| Bouteloua gracilis     | 4.50                   | 10.92                               | 30.00                        | 12.00                                     | 22.92                       |
| Calamovilfa longifolia | 6.60                   | 16.02                               | 46.00                        | 18.40                                     | 34.42                       |
| Koeleria pyramidata    | 1.30                   | 3.16                                | 12.00                        | 4.80                                      | 7.96                        |
| Stipa comata           | 1.10                   | 2.67                                | 10.00                        | 4.00                                      | 6.67                        |
| Stipa viridula         | 0.60                   | 1.46                                | 6.00                         | 2.40                                      | 3.86                        |
| Carex filifolia        | 8.90                   | 21.60                               | 52.00                        | 20.80                                     | 42.40                       |
| Carex heliophila       | 16.80                  | 40.78                               | 81.00                        | 32.40                                     | 73.18                       |
| Artemisia ludoviciana  | 0.10                   | 0.24                                | 1.00                         | 0.40                                      | 0.64                        |
| Asclepias verticillata | 0.20                   | 0.49                                | 2.00                         | 0.80                                      | 1.29                        |
| Liatris punctata       | 0.10                   | 0.24                                | 1.00                         | 0.40                                      | 0.64                        |
| Lygodesmia juncea      | 0.40                   | 0.97                                | 3.00                         | 1.20                                      | 2.17                        |
| Rosa arkansana         | 0.40                   | 0.97                                | 4.00                         | 1.60                                      | 2.57                        |
| Litter                 | 58.80                  |                                     | 100.00                       |                                           |                             |
| Rock                   | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                   | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 51. Points Analysis of the Ungrazed Shallow Range Site on the Native Range, Pasture 1, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Andropogon scoparius   | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Aristida longiseta     | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Bouteloua gracilis     | 12.60              | 37.28                       | 75.00                    | 29.41                             | 66.69                   |
| Koeleria pyramidata    | 4.30               | 12.72                       | 36.00                    | 14.12                             | 26.84                   |
| Muhlenbergia cuspidata | 3.40               | 10.06                       | 28.00                    | 10.98                             | 21.04                   |
| Stipa comata           | 3.60               | 10.65                       | 31.00                    | 12.16                             | 22.81                   |
| Carex filifolia        | 5.60               | 16.57                       | 47.00                    | 18.43                             | 35.00                   |
| Carex heliophila       | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Antennaria parvifolia  | 0.40               | 1.18                        | 2.00                     | 0.78                              | 1.96                    |
| Artemisia frigida      | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Aster ericoides        | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Commandra umbellata    | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Conyza canadensis      | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Echinacea angustifolia | 0.20               | 0.59                        | 2.00                     | 0.78                              | 1.37                    |
| Hedeoma hispida        | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Liatris punctata       | 0.50               | 1.48                        | 5.00                     | 1.96                              | 3.44                    |
| Linum rigidum          | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Lotus americanus       | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Phlox hoodii           | 1.10               | 3.25                        | 9.00                     | 3.53                              | 6.78                    |
| Polygala alba          | 0.20               | 0.59                        | 2.00                     | 0.78                              | 1.37                    |
| Psoralea argophylla    | 0.10               | 0.30                        | 1.00                     | 0.39                              | 0.69                    |
| Lichen spp.            | 0.80               | 2.37                        | 7.00                     | 2.75                              | 5.12                    |
| Litter                 | 65.90              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.30               |                             | 2.00                     |                                   |                         |

**Table 52. Point Analysis of the Grazed Shallow Range Site on the Native Range, Pasture 1, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.10               | 0.27                        | 1.00                     | 0.41                              | 0.68                    |
| Andropogon scoparius   | 0.10               | 0.27                        | 1.00                     | 0.41                              | 0.68                    |
| Bouteloua gracilis     | 17.90              | 48.91                       | 90.00                    | 36.89                             | 85.80                   |
| Koeleria pyramidata    | 1.90               | 5.19                        | 15.00                    | 6.15                              | 11.34                   |
| Muhlenbergia cuspidata | 2.80               | 7.65                        | 23.00                    | 9.43                              | 17.08                   |
| Munroa squarrosa       | 0.20               | 0.55                        | 2.00                     | 0.82                              | 1.37                    |
| Stipa comata           | 3.70               | 10.11                       | 33.00                    | 13.52                             | 23.63                   |
| Stipa viridula         | 0.20               | 0.55                        | 2.00                     | 0.82                              | 1.37                    |
| Carex filifolia        | 6.50               | 17.76                       | 47.00                    | 19.26                             | 37.02                   |
| Carex heliophila       | 0.60               | 1.64                        | 6.00                     | 2.46                              | 4.10                    |
| Antennaria parvifolia  | 0.10               | 0.27                        | 1.00                     | 0.41                              | 0.68                    |
| Artemisia dracunculus  | 0.20               | 0.55                        | 2.00                     | 0.82                              | 1.37                    |
| Artemisia frigida      | 0.40               | 1.09                        | 4.00                     | 1.64                              | 2.73                    |
| Aster ericoides        | 0.20               | 0.55                        | 2.00                     | 0.82                              | 1.37                    |
| Commandra umbellata    | 0.10               | 0.27                        | 1.00                     | 0.41                              | 0.68                    |
| Echinacea angustifolia | 0.10               | 0.27                        | 1.00                     | 0.41                              | 0.68                    |
| Haplopappus spinulosus | 0.10               | 0.27                        | 1.00                     | 0.41                              | 0.68                    |
| Liatris punctata       | 0.20               | 0.55                        | 2.00                     | 0.82                              | 1.37                    |
| Phlox hoodii           | 1.20               | 3.28                        | 10.00                    | 4.10                              | 7.38                    |
| Litter                 | 61.40              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 2.00               |                             | 16.00                    |                                   |                         |

**Table 53. Points Analysis of the Ungrazed Silty Range Site on the Native Range, Pasture 1,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii      | 4.00                   | 9.93                                | 34.00                        | 13.44                                     | 23.37                       |
| Bouteloua gracilis     | 21.40                  | 53.10                               | 93.00                        | 36.76                                     | 89.86                       |
| Muhlenbergia cuspidata | 0.10                   | 0.25                                | 1.00                         | 0.40                                      | 0.65                        |
| Stipa comata           | 2.60                   | 6.45                                | 22.00                        | 8.70                                      | 15.15                       |
| Stipa viridula         | 5.20                   | 12.90                               | 42.00                        | 16.60                                     | 29.50                       |
| Carex filifolia        | 1.00                   | 2.48                                | 6.00                         | 2.37                                      | 4.85                        |
| Carex heliophila       | 1.30                   | 3.23                                | 12.00                        | 4.74                                      | 7.97                        |
| Achillea millefolium   | 0.80                   | 1.99                                | 8.00                         | 3.16                                      | 5.15                        |
| Artemisia frigida      | 2.10                   | 5.21                                | 19.00                        | 7.51                                      | 12.72                       |
| Cirsium undulatum      | 0.10                   | 0.25                                | 1.00                         | 0.40                                      | 0.65                        |
| Conyza canadensis      | 0.30                   | 0.74                                | 3.00                         | 1.19                                      | 1.93                        |
| Grindelia squarrosa    | 0.30                   | 0.74                                | 2.00                         | 0.79                                      | 1.53                        |
| Opuntia fragilis       | 0.40                   | 0.99                                | 3.00                         | 1.19                                      | 2.18                        |
| Ratibida columnifera   | 0.40                   | 0.99                                | 4.00                         | 1.58                                      | 2.57                        |
| Sphaeralcea coccinea   | 0.30                   | 0.74                                | 3.00                         | 1.19                                      | 1.93                        |
| Litter                 | 59.70                  |                                     | 100.00                       |                                           |                             |
| Rock                   | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                   | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 54. Points Analysis of the Grazed Silty Range Site on the Native Range, Pasture 1,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii       | 5.80                   | 15.18                               | 48.00                        | 20.78                                     | 35.96                       |
| Bouteloua gracilis      | 20.80                  | 54.45                               | 89.00                        | 38.53                                     | 92.98                       |
| Muhlenbergia cuspidata  | 0.40                   | 1.05                                | 3.00                         | 1.30                                      | 2.35                        |
| Munroa squarrosa        | 0.10                   | 0.26                                | 1.00                         | 0.43                                      | 0.69                        |
| Stipa comata            | 3.50                   | 9.16                                | 24.00                        | 10.39                                     | 19.55                       |
| Stipa viridula          | 4.10                   | 10.73                               | 32.00                        | 13.85                                     | 24.58                       |
| Carex heliophila        | 1.30                   | 3.40                                | 12.00                        | 5.19                                      | 8.59                        |
| Achillea millefolium    | 0.40                   | 1.05                                | 4.00                         | 1.73                                      | 2.78                        |
| Artemisia frigida       | 1.10                   | 2.88                                | 11.00                        | 4.76                                      | 7.64                        |
| Grindelia squarrosa     | 0.20                   | 0.52                                | 2.00                         | 0.87                                      | 1.39                        |
| Hedeoma hispida         | 0.10                   | 0.26                                | 1.00                         | 0.43                                      | 0.69                        |
| Opuntia fragilis        | 0.20                   | 0.52                                | 2.00                         | 0.87                                      | 1.39                        |
| Potentilla pensylvanica | 0.10                   | 0.26                                | 1.00                         | 0.43                                      | 0.69                        |
| Lichen spp.             | 0.10                   | 0.26                                | 1.00                         | 0.43                                      | 0.69                        |
| Litter                  | 61.80                  |                                     | 100.00                       |                                           |                             |
| Rock                    | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                    | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 55. Points Analysis of the Ungrazed Clayey Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 3.00               | 8.82                        | 25.00                    | 10.12                             | 18.94                   |
| Bouteloua gracilis      | 14.50              | 42.65                       | 75.00                    | 30.36                             | 73.01                   |
| Koeleria pyramidata     | 2.80               | 8.24                        | 22.00                    | 8.91                              | 17.15                   |
| Munroa squarrosa        | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Stipa comata            | 1.20               | 3.53                        | 11.00                    | 4.45                              | 7.98                    |
| Stipa viridula          | 3.00               | 8.82                        | 27.00                    | 10.93                             | 19.75                   |
| Carex filifolia         | 1.00               | 2.94                        | 8.00                     | 3.24                              | 6.18                    |
| Carex heliophila        | 1.30               | 3.82                        | 13.00                    | 5.26                              | 9.08                    |
| Achillea millefolium    | 2.10               | 6.18                        | 19.00                    | 7.69                              | 13.87                   |
| Antennaria parvifolia   | 0.50               | 1.47                        | 4.00                     | 1.62                              | 3.09                    |
| Artemisia dracunculus   | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Artemisia frigida       | 1.70               | 5.00                        | 17.00                    | 6.88                              | 11.88                   |
| Aster ericoides         | 0.30               | 0.88                        | 2.00                     | 0.81                              | 1.69                    |
| Conyza canadensis       | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Erysimum asperum        | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Grindelia squarrosa     | 0.40               | 1.18                        | 4.00                     | 1.62                              | 2.80                    |
| Potentilla pensylvanica | 0.30               | 0.88                        | 2.00                     | 0.81                              | 1.69                    |
| Psoralea argophylla     | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Ratibida columnifera    | 0.80               | 2.35                        | 7.00                     | 2.83                              | 5.18                    |
| Vicia americana         | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Lichen spp.             | 0.50               | 1.47                        | 5.00                     | 2.02                              | 3.49                    |
| Furrow                  | 5.10               |                             | 9.00                     |                                   |                         |
| Litter                  | 54.40              |                             | 99.00                    |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                     | 6.50               |                             | 17.00                    |                                   |                         |
| Soil                    | 0.00               |                             | 0.00                     |                                   |                         |

**Table 56. Points Analysis of the Grazed Clayey Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii       | 4.30                   | 10.80                               | 39.00                        | 15.42                                     | 26.22                       |
| Bouteloua gracilis      | 18.80                  | 47.24                               | 79.00                        | 31.23                                     | 78.47                       |
| Koeleria pyramidata     | 0.70                   | 1.76                                | 7.00                         | 2.77                                      | 4.53                        |
| Stipa comata            | 3.40                   | 8.54                                | 29.00                        | 11.46                                     | 20.00                       |
| Stipa viridula          | 4.10                   | 10.30                               | 25.00                        | 9.88                                      | 20.18                       |
| Carex filifolia         | 0.30                   | 0.75                                | 3.00                         | 1.19                                      | 1.94                        |
| Carex heliophila        | 0.20                   | 0.50                                | 2.00                         | 0.79                                      | 1.29                        |
| Achillea millefolium    | 2.30                   | 5.78                                | 19.00                        | 7.51                                      | 13.29                       |
| Antennaria parvifolia   | 0.10                   | 0.25                                | 1.00                         | 0.40                                      | 0.65                        |
| Artemisia dracunculus   | 0.10                   | 0.25                                | 1.00                         | 0.40                                      | 0.65                        |
| Artemisia frigida       | 2.50                   | 6.28                                | 20.00                        | 7.91                                      | 14.19                       |
| Cirsium undulatum       | 0.30                   | 0.75                                | 3.00                         | 1.19                                      | 1.94                        |
| Conyza canadensis       | 0.40                   | 1.01                                | 4.00                         | 1.58                                      | 2.59                        |
| Grindelia squarrosa     | 0.80                   | 2.01                                | 7.00                         | 2.77                                      | 4.78                        |
| Hedeoma hispida         | 0.10                   | 0.25                                | 1.00                         | 0.40                                      | 0.65                        |
| Opuntia fragilis        | 0.40                   | 1.01                                | 3.00                         | 1.19                                      | 2.20                        |
| Potentilla pensylvanica | 0.60                   | 1.51                                | 6.00                         | 2.37                                      | 3.88                        |
| Ratibida columnifera    | 0.20                   | 0.50                                | 2.00                         | 0.79                                      | 1.29                        |
| Sphaeralcea coccinea    | 0.20                   | 0.50                                | 2.00                         | 0.79                                      | 1.29                        |
| Furrow                  | 3.50                   |                                     | 6.00                         |                                           |                             |
| Litter                  | 52.20                  |                                     | 96.00                        |                                           |                             |
| Rock                    | 0.00                   |                                     | 0.00                         |                                           |                             |
| Sod                     | 4.50                   |                                     | 10.00                        |                                           |                             |
| Soil                    | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 57. Points Analysis of the Ungrazed Sandy Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| <i>Bouteloua gracilis</i>     | 6.10               | 30.20                       | 48.00                    | 28.07                             | 58.27                   |
| <i>Calamovilfa longifolia</i> | 1.80               | 8.91                        | 16.00                    | 9.36                              | 18.27                   |
| <i>Koeleria pyramidata</i>    | 0.80               | 3.96                        | 7.00                     | 4.09                              | 8.05                    |
| <i>Panicum oligosanthos</i>   | 0.90               | 4.46                        | 8.00                     | 4.68                              | 9.14                    |
| <i>Stipa comata</i>           | 1.10               | 5.45                        | 11.00                    | 6.43                              | 11.88                   |
| <i>Stipa viridula</i>         | 0.10               | 0.50                        | 1.00                     | 0.58                              | 1.08                    |
|                               |                    |                             |                          |                                   |                         |
| <i>Carex filifolia</i>        | 5.40               | 26.73                       | 45.00                    | 26.32                             | 53.05                   |
| <i>Carex heliophila</i>       | 2.90               | 14.36                       | 25.00                    | 14.62                             | 28.98                   |
|                               |                    |                             |                          |                                   |                         |
| <i>Antennaria parvifolia</i>  | 0.10               | 0.50                        | 1.00                     | 0.58                              | 1.08                    |
| <i>Artemisia dracunculus</i>  | 0.10               | 0.50                        | 1.00                     | 0.58                              | 1.08                    |
| <i>Artemisia frigida</i>      | 0.20               | 0.99                        | 2.00                     | 1.17                              | 2.16                    |
| <i>Artemisia ludoviciana</i>  | 0.10               | 0.50                        | 1.00                     | 0.58                              | 1.08                    |
| <i>Phlox hoodii</i>           | 0.10               | 0.50                        | 1.00                     | 0.58                              | 1.08                    |
|                               |                    |                             |                          |                                   |                         |
| Lichen spp.                   | 0.50               | 2.48                        | 4.00                     | 2.34                              | 4.82                    |
|                               |                    |                             |                          |                                   |                         |
| Furrow                        | 4.80               |                             | 10.00                    |                                   |                         |
| Litter                        | 67.80              |                             | 100.00                   |                                   |                         |
| Rock                          | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                           | 6.80               |                             | 14.00                    |                                   |                         |
| Soil                          | 0.40               |                             | 4.00                     |                                   |                         |

**Table 58. Points Analysis of the Grazed Sandy Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis     | 3.70               | 18.05                       | 32.00                    | 18.18                             | 36.23                   |
| Calamovilfa longifolia | 1.90               | 9.27                        | 17.00                    | 9.66                              | 18.93                   |
| Koeleria pyramidata    | 0.80               | 3.90                        | 8.00                     | 4.55                              | 8.45                    |
| Panicum oligosanthos   | 0.90               | 4.39                        | 9.00                     | 5.11                              | 9.50                    |
| Stipa comata           | 3.10               | 15.12                       | 30.00                    | 17.05                             | 32.17                   |
| Stipa viridula         | 0.40               | 1.95                        | 4.00                     | 2.27                              | 4.22                    |
|                        |                    |                             |                          |                                   |                         |
| Carex filifolia        | 7.40               | 36.10                       | 54.00                    | 30.68                             | 66.78                   |
| Carex heliophila       | 1.50               | 7.32                        | 14.00                    | 7.95                              | 15.27                   |
|                        |                    |                             |                          |                                   |                         |
| Artemisia dracunculus  | 0.20               | 0.98                        | 2.00                     | 1.14                              | 2.12                    |
| Artemisia frigida      | 0.10               | 0.49                        | 1.00                     | 0.57                              | 1.06                    |
| Artemisia ludoviciana  | 0.10               | 0.49                        | 1.00                     | 0.57                              | 1.06                    |
| Oxytropis lambertii    | 0.10               | 0.49                        | 1.00                     | 0.57                              | 1.06                    |
| Phlox hoodii           | 0.20               | 0.98                        | 2.00                     | 1.14                              | 2.12                    |
|                        |                    |                             |                          |                                   |                         |
| Lichen spp.            | 0.10               | 0.49                        | 1.00                     | 0.57                              | 1.06                    |
|                        |                    |                             |                          |                                   |                         |
| Furrow                 | 3.80               |                             | 9.00                     |                                   |                         |
| Litter                 | 69.30              |                             | 99.00                    |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 4.30               |                             | 10.00                    |                                   |                         |
| Soil                   | 2.10               |                             | 16.00                    |                                   |                         |

**Table 59. Points Analysis of the Ungrazed Shallow Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>            | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|---------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis        | 9.10               | 27.16                       | 56.00                    | 23.24                             | 50.40                   |
| Calamagrostis montanensis | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Koeleria pyramidata       | 3.80               | 11.34                       | 28.00                    | 11.62                             | 22.96                   |
| Muhlenbergia cuspidata    | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Stipa comata              | 7.40               | 22.09                       | 53.00                    | 21.99                             | 44.08                   |
| Carex filifolia           | 9.30               | 27.76                       | 66.00                    | 27.39                             | 55.15                   |
| Carex heliophila          | 0.30               | 0.90                        | 3.00                     | 1.24                              | 2.14                    |
| Artemisia dracunculus     | 0.40               | 1.19                        | 4.00                     | 1.66                              | 2.85                    |
| Artemisia frigida         | 0.50               | 1.49                        | 5.00                     | 2.07                              | 3.56                    |
| Erysimum asperum          | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Grindelia squarrosa       | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Haplopappus spinulosus    | 0.20               | 0.60                        | 2.00                     | 0.83                              | 1.43                    |
| Lotus americanus          | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Oxytropis lambertii       | 0.50               | 1.49                        | 4.00                     | 1.66                              | 3.15                    |
| Phlox hoodii              | 0.50               | 1.49                        | 5.00                     | 2.07                              | 3.56                    |
| Potentilla pensylvanica   | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Psoralea argophylla       | 0.10               | 0.30                        | 1.00                     | 0.41                              | 0.71                    |
| Sphaeralcea coccinea      | 0.60               | 1.79                        | 6.00                     | 2.49                              | 4.28                    |
| Lichen spp.               | 0.20               | 0.60                        | 2.00                     | 0.83                              | 1.43                    |
| Furrow                    | 4.10               |                             | 13.00                    |                                   |                         |
| Litter                    | 54.10              |                             | 100.00                   |                                   |                         |
| Rock                      | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                       | 7.00               |                             | 25.00                    |                                   |                         |
| Soil                      | 1.30               |                             | 9.00                     |                                   |                         |

**Table 60. Points Analysis of the Grazed Shallow Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.10               | 0.31                        | 1.00                     | 0.43                              | 0.74                    |
| Bouteloua gracilis     | 6.90               | 21.70                       | 47.00                    | 20.43                             | 42.13                   |
| Koeleria pyramidata    | 2.60               | 8.18                        | 25.00                    | 10.87                             | 19.05                   |
| Muhlenbergia cuspidata | 0.10               | 0.31                        | 1.00                     | 0.43                              | 0.74                    |
| Stipa comata           | 8.50               | 26.73                       | 61.00                    | 26.52                             | 53.25                   |
| Carex filifolia        | 10.10              | 31.76                       | 62.00                    | 26.96                             | 58.72                   |
| Allionia albida        | 0.10               | 0.31                        | 1.00                     | 0.43                              | 0.74                    |
| Artemisia dracunculus  | 0.30               | 0.94                        | 3.00                     | 1.30                              | 2.24                    |
| Echinacea angustifolia | 0.10               | 0.31                        | 1.00                     | 0.43                              | 0.74                    |
| Haplopappus spinulosus | 0.20               | 0.63                        | 2.00                     | 0.87                              | 1.50                    |
| Liatris punctata       | 0.20               | 0.63                        | 2.00                     | 0.87                              | 1.50                    |
| Oxytropis lambertii    | 0.60               | 1.89                        | 4.00                     | 1.74                              | 3.63                    |
| Phlox hoodii           | 1.00               | 3.14                        | 10.00                    | 4.35                              | 7.49                    |
| Psoralea argophylla    | 0.10               | 0.31                        | 1.00                     | 0.43                              | 0.74                    |
| Sphaeralcea coccinea   | 0.20               | 0.63                        | 2.00                     | 0.87                              | 1.50                    |
| Lichen spp.            | 0.70               | 2.20                        | 7.00                     | 3.04                              | 5.24                    |
| Furrow                 | 3.10               |                             | 10.00                    |                                   |                         |
| Litter                 | 57.50              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 6.50               |                             | 18.00                    |                                   |                         |
| Soil                   | 1.10               |                             | 9.00                     |                                   |                         |

**Table 61. Points Analysis of the Ungrazed Silty Range Site on the Native Range, Pasture 2, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-----------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii     | 5.20               | 10.32                       | 42.00                    | 18.58                             | 28.90                   |
| Bouteloua gracilis    | 32.30              | 64.09                       | 94.00                    | 41.59                             | 105.68                  |
| Koeleria pyramidata   | 0.30               | 0.60                        | 2.00                     | 0.88                              | 1.48                    |
| Stipa comata          | 1.00               | 1.98                        | 8.00                     | 3.54                              | 5.52                    |
| Stipa viridula        | 1.50               | 2.98                        | 13.00                    | 5.75                              | 8.73                    |
| Carex filifolia       | 6.10               | 12.10                       | 35.00                    | 15.49                             | 27.59                   |
| Antennaria parvifolia | 0.30               | 0.60                        | 1.00                     | 0.44                              | 1.04                    |
| Arabis holboellii     | 0.30               | 0.60                        | 3.00                     | 1.33                              | 1.93                    |
| Artemisia dracunculus | 0.10               | 0.20                        | 1.00                     | 0.44                              | 0.64                    |
| Artemisia frigida     | 1.30               | 2.58                        | 11.00                    | 4.87                              | 7.45                    |
| Conyza canadensis     | 0.10               | 0.20                        | 1.00                     | 0.44                              | 0.64                    |
| Hedeoma hispida       | 0.10               | 0.20                        | 1.00                     | 0.44                              | 0.64                    |
| Lotus americanus      | 0.20               | 0.40                        | 2.00                     | 0.88                              | 1.28                    |
| Medicago spp.         | 0.60               | 1.19                        | 3.00                     | 1.33                              | 2.52                    |
| Plantago purshii      | 0.20               | 0.40                        | 2.00                     | 0.88                              | 1.28                    |
| Ratibida columnifera  | 0.10               | 0.20                        | 1.00                     | 0.44                              | 0.64                    |
| Sphaeralcea coccinea  | 0.40               | 0.79                        | 4.00                     | 1.77                              | 2.56                    |
| Selaginella densa     | 0.10               | 0.20                        | 1.00                     | 0.44                              | 0.64                    |
| Lichen spp.           | 0.20               | 0.40                        | 1.00                     | 0.44                              | 0.84                    |
| Furrow                | 5.80               |                             | 16.00                    |                                   |                         |
| Litter                | 39.00              |                             | 94.00                    |                                   |                         |
| Rock                  | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                   | 4.80               |                             | 13.00                    |                                   |                         |
| Soil                  | 0.00               |                             | 0.00                     |                                   |                         |

**Table 62. Points Analysis of the Grazed Silty Range Site on the Native Range, Pasture 2,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii       | 4.40                   | 8.37                                | 37.00                        | 16.30                                     | 24.67                       |
| Bouteloua gracilis      | 36.00                  | 68.44                               | 97.00                        | 42.73                                     | 111.17                      |
| Koeleria pyramidata     | 0.80                   | 1.52                                | 5.00                         | 2.20                                      | 3.72                        |
| Stipa comata            | 0.60                   | 1.14                                | 6.00                         | 2.64                                      | 3.78                        |
| Stipa viridula          | 1.70                   | 3.23                                | 13.00                        | 5.73                                      | 8.96                        |
| Carex filifolia         | 5.20                   | 9.89                                | 33.00                        | 14.54                                     | 24.43                       |
| Carex heliophila        | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Achillea millefolium    | 0.50                   | 0.95                                | 3.00                         | 1.32                                      | 2.27                        |
| Agoseris glauca         | 0.20                   | 0.38                                | 2.00                         | 0.88                                      | 1.26                        |
| Allium textile          | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Antennaria parvifolia   | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Artemisia frigida       | 1.00                   | 1.90                                | 10.00                        | 4.41                                      | 6.31                        |
| Astragalus crassicaupus | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Grindelia squarrosa     | 0.20                   | 0.38                                | 2.00                         | 0.88                                      | 1.26                        |
| Lotus americanus        | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Potentilla pensylvanica | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Ratibida columnifera    | 0.40                   | 0.76                                | 3.00                         | 1.32                                      | 2.08                        |
| Sphaeralcea coccinea    | 0.90                   | 1.71                                | 9.00                         | 3.96                                      | 5.67                        |
| Lichen spp.             | 0.10                   | 0.19                                | 1.00                         | 0.44                                      | 0.63                        |
| Furrow                  | 4.30                   |                                     | 12.00                        |                                           |                             |
| Litter                  | 38.50                  |                                     | 97.00                        |                                           |                             |
| Rock                    | 0.00                   |                                     | 0.00                         |                                           |                             |
| Sod                     | 4.50                   |                                     | 14.00                        |                                           |                             |
| Soil                    | 0.10                   |                                     | 1.00                         |                                           |                             |

**Table 63. Points Analysis of the Ungrazed Clayey Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-----------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii     | 3.40               | 6.80                        | 27.00                    | 10.38                             | 17.18                   |
| Bouteloua gracilis    | 24.40              | 48.80                       | 86.00                    | 33.08                             | 81.88                   |
| Buchloe dactyloides   | 3.10               | 6.20                        | 11.00                    | 4.23                              | 10.43                   |
| Koeleria pyramidata   | 6.00               | 12.00                       | 41.00                    | 15.77                             | 27.77                   |
| Stipa comata          | 0.40               | 0.80                        | 4.00                     | 1.54                              | 2.34                    |
| Stipa viridula        | 0.80               | 1.60                        | 6.00                     | 2.31                              | 3.91                    |
| Carex filifolia       | 0.80               | 1.60                        | 6.00                     | 2.31                              | 3.91                    |
| Carex heliophila      | 2.70               | 5.40                        | 22.00                    | 8.46                              | 13.86                   |
| Achillea millefolium  | 0.90               | 1.80                        | 9.00                     | 3.46                              | 5.26                    |
| Antennaria parvifolia | 2.50               | 5.00                        | 9.00                     | 3.46                              | 8.46                    |
| Arabis holboellii     | 0.20               | 0.40                        | 2.00                     | 0.77                              | 1.17                    |
| Artemisia dracunculus | 0.80               | 1.60                        | 6.00                     | 2.31                              | 3.91                    |
| Artemisia frigida     | 0.10               | 0.20                        | 1.00                     | 0.38                              | 0.58                    |
| Artemisia ludoviciana | 0.60               | 1.20                        | 5.00                     | 1.92                              | 3.12                    |
| Grindelia squarrosa   | 0.60               | 1.20                        | 6.00                     | 2.31                              | 3.51                    |
| Linum rigidum         | 0.20               | 0.40                        | 2.00                     | 0.77                              | 1.17                    |
| Phlox hoodii          | 0.90               | 1.80                        | 3.00                     | 1.15                              | 2.95                    |
| Polygala alba         | 0.30               | 0.60                        | 2.00                     | 0.77                              | 1.37                    |
| Psoralea argophylla   | 0.20               | 0.40                        | 2.00                     | 0.77                              | 1.17                    |
| Ratibida columnifera  | 0.30               | 0.60                        | 3.00                     | 1.15                              | 1.75                    |
| Lichen spp.           | 0.80               | 1.60                        | 7.00                     | 2.69                              | 4.29                    |
| Litter                | 50.00              |                             | 98.00                    |                                   |                         |
| Rock                  | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                  | 0.00               |                             | 0.00                     |                                   |                         |

**Table 64. Points Analysis of the Grazed Clayey Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 3.60               | 7.91                        | 31.00                    | 11.79                             | 19.70                   |
| Bouteloua gracilis     | 23.30              | 51.21                       | 91.00                    | 34.60                             | 85.81                   |
| Koeleria pyramidata    | 6.80               | 14.95                       | 51.00                    | 19.39                             | 34.34                   |
| Stipa comata           | 1.60               | 3.52                        | 12.00                    | 4.56                              | 8.08                    |
| Carex filifolia        | 1.00               | 2.20                        | 5.00                     | 1.90                              | 4.10                    |
| Carex heliophila       | 2.70               | 5.93                        | 18.00                    | 6.84                              | 12.77                   |
| Antennaria parvifolia  | 0.70               | 1.54                        | 3.00                     | 1.14                              | 2.68                    |
| Artemisia dracunculus  | 0.70               | 1.54                        | 7.00                     | 2.66                              | 4.20                    |
| Artemisia frigida      | 0.10               | 0.22                        | 1.00                     | 0.38                              | 0.60                    |
| Artemisia ludoviciana  | 0.10               | 0.22                        | 1.00                     | 0.38                              | 0.60                    |
| Aster ericoides        | 0.20               | 0.44                        | 2.00                     | 0.76                              | 1.20                    |
| Grindelia squarrosa    | 0.30               | 0.66                        | 3.00                     | 1.14                              | 1.80                    |
| Hedeoma hispida        | 0.30               | 0.66                        | 3.00                     | 1.14                              | 1.80                    |
| Liatris punctata       | 0.10               | 0.22                        | 1.00                     | 0.38                              | 0.60                    |
| Lotus americanus       | 0.10               | 0.22                        | 1.00                     | 0.38                              | 0.60                    |
| Oxytropis lambertii    | 0.30               | 0.66                        | 3.00                     | 1.14                              | 1.80                    |
| Phlox hoodii           | 0.20               | 0.44                        | 2.00                     | 0.76                              | 1.20                    |
| Psoralea argophylla    | 0.30               | 0.66                        | 3.00                     | 1.14                              | 1.80                    |
| Ratibida columnifera   | 0.10               | 0.22                        | 1.00                     | 0.38                              | 0.60                    |
| Solidago missouriensis | 0.10               | 0.22                        | 1.00                     | 0.38                              | 0.60                    |
| Rosa arkansana         | 0.20               | 0.44                        | 2.00                     | 0.76                              | 1.20                    |
| Lichen spp.            | 2.70               | 5.93                        | 21.00                    | 7.98                              | 13.91                   |
| Litter                 | 54.40              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.10               |                             | 1.00                     |                                   |                         |

**Table 65. Points Analysis of the Ungrazed Sandy Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.10               | 0.41                        | 1.00                     | 0.47                              | 0.88                    |
| Bouteloua gracilis     | 3.20               | 13.01                       | 31.00                    | 14.69                             | 27.70                   |
| Calamovilfa longifolia | 3.10               | 12.60                       | 28.00                    | 13.27                             | 25.87                   |
| Koeleria pyramidata    | 0.40               | 1.63                        | 4.00                     | 1.90                              | 3.53                    |
| Stipa comata           | 1.50               | 6.10                        | 15.00                    | 7.11                              | 13.21                   |
| Stipa viridula         | 0.60               | 2.44                        | 6.00                     | 2.84                              | 5.28                    |
|                        |                    |                             |                          |                                   |                         |
| Carex filifolia        | 7.70               | 31.30                       | 57.00                    | 27.01                             | 58.31                   |
| Carex heliophila       | 6.80               | 27.64                       | 57.00                    | 27.01                             | 54.65                   |
|                        |                    |                             |                          |                                   |                         |
| Antennaria parvifolia  | 0.30               | 1.22                        | 3.00                     | 1.42                              | 2.64                    |
| Artemisia dracunculus  | 0.40               | 1.63                        | 4.00                     | 1.90                              | 3.53                    |
| Artemisia frigida      | 0.10               | 0.41                        | 1.00                     | 0.47                              | 0.88                    |
| Artemisia ludoviciana  | 0.20               | 0.81                        | 2.00                     | 0.95                              | 1.76                    |
| Lygodesmia juncea      | 0.10               | 0.41                        | 1.00                     | 0.47                              | 0.88                    |
| Phlox hoodii           | 0.10               | 0.41                        | 1.00                     | 0.47                              | 0.88                    |
|                        |                    |                             |                          |                                   |                         |
| Litter                 | 75.20              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.20               |                             | 1.00                     |                                   |                         |

**Table 66. Points Analysis of the Grazed Sandy Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis     | 1.90               | 7.36                        | 19.00                    | 9.50                              | 16.86                   |
| Calamovilfa longifolia | 4.10               | 15.89                       | 35.00                    | 17.50                             | 33.39                   |
| Koeleria pyramidata    | 1.00               | 3.88                        | 8.00                     | 4.00                              | 7.88                    |
| Stipa comata           | 2.20               | 8.53                        | 19.00                    | 9.50                              | 18.03                   |
| Carex filifolia        | 9.00               | 34.88                       | 59.00                    | 29.50                             | 64.38                   |
| Carex heliophila       | 6.50               | 25.19                       | 49.00                    | 24.50                             | 49.69                   |
| Artemisia dracunculus  | 0.30               | 1.16                        | 3.00                     | 1.50                              | 2.66                    |
| Artemisia ludoviciana  | 0.20               | 0.78                        | 2.00                     | 1.00                              | 1.78                    |
| Psoralea argophylla    | 0.10               | 0.39                        | 1.00                     | 0.50                              | 0.89                    |
| Sphaeralcea coccinea   | 0.10               | 0.39                        | 1.00                     | 0.50                              | 0.89                    |
| Tragopogon dubius      | 0.10               | 0.39                        | 1.00                     | 0.50                              | 0.89                    |
| Rosa arkansana         | 0.10               | 0.39                        | 1.00                     | 0.50                              | 0.89                    |
| Lichen spp.            | 0.20               | 0.78                        | 2.00                     | 1.00                              | 1.78                    |
| Litter                 | 74.20              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.00               |                             | 0.00                     |                                   |                         |

**Table 67. Points Analysis of the Ungrazed Shallow Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-----------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis    | 22.10              | 49.33                       | 64.00                    | 29.09                             | 78.42                   |
| Koeleria pyramidata   | 11.10              | 24.78                       | 72.00                    | 32.73                             | 57.51                   |
| Stipa comata          | 6.80               | 15.18                       | 44.00                    | 20.00                             | 35.18                   |
| Stipa viridula        | 0.40               | 0.89                        | 2.00                     | 0.91                              | 1.80                    |
| Carex filifolia       | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Carex heliophila      | 2.10               | 4.69                        | 16.00                    | 7.27                              | 11.96                   |
| Artemisia dracunculus | 0.60               | 1.34                        | 5.00                     | 2.27                              | 3.61                    |
| Erysimum asperum      | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Grindelia squarrosa   | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Hedeoma hispida       | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Kochia scoparia       | 0.20               | 0.45                        | 2.00                     | 0.91                              | 1.36                    |
| Lotus americanus      | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Lygodesmia juncea     | 0.20               | 0.45                        | 2.00                     | 0.91                              | 1.36                    |
| Melilotus officinalis | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Oxytropis lambertii   | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Phlox hoodii          | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Psoralea argophylla   | 0.20               | 0.45                        | 2.00                     | 0.91                              | 1.36                    |
| Psoralea esculenta    | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Ratibida columnifera  | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Rosa arkansana        | 0.10               | 0.22                        | 1.00                     | 0.45                              | 0.67                    |
| Litter                | 55.00              |                             | 98.00                    |                                   |                         |
| Rock                  | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                  | 0.20               |                             | 2.00                     |                                   |                         |

**Table 68. Points Analysis of the Grazed Shallow Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis     | 21.60              | 47.68                       | 65.00                    | 28.26                             | 75.94                   |
| Koeleria pyramidata    | 7.70               | 17.00                       | 56.00                    | 24.35                             | 41.35                   |
| Stipa comata           | 11.20              | 24.72                       | 65.00                    | 28.26                             | 52.98                   |
| Stipa viridula         | 0.60               | 1.32                        | 5.00                     | 2.17                              | 3.49                    |
| Carex filifolia        | 0.30               | 0.66                        | 2.00                     | 0.87                              | 1.53                    |
| Carex heliophila       | 1.70               | 3.75                        | 15.00                    | 6.52                              | 10.27                   |
| Artemisia dracunculus  | 0.40               | 0.88                        | 4.00                     | 1.74                              | 2.62                    |
| Artemisia frigida      | 0.30               | 0.66                        | 3.00                     | 1.30                              | 1.96                    |
| Hedeoma hispida        | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Kochia scoparia        | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Linum rigidum          | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Lotus americanus       | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Opuntia fragilis       | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Psoralea esculenta     | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Solidago missouriensis | 0.40               | 0.88                        | 4.00                     | 1.74                              | 2.62                    |
| Rosa arkansana         | 0.10               | 0.22                        | 1.00                     | 0.43                              | 0.65                    |
| Lichen spp.            | 0.40               | 0.88                        | 4.00                     | 1.74                              | 2.62                    |
| Litter                 | 54.70              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.00               |                             | 0.00                     |                                   |                         |

**Table 69. Points Analysis of the Ungrazed Silty Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii       | 3.60                   | 12.00                               | 32.00                        | 14.95                                     | 26.95                       |
| Bouteloua gracilis      | 1.10                   | 3.67                                | 6.00                         | 2.80                                      | 6.47                        |
| Koeleria pyramidata     | 4.10                   | 13.67                               | 29.00                        | 13.55                                     | 27.22                       |
| Stipa comata            | 10.40                  | 34.67                               | 61.00                        | 28.50                                     | 63.17                       |
| Stipa viridula          | 7.40                   | 24.67                               | 55.00                        | 25.70                                     | 50.37                       |
| Achillea millefolium    | 0.10                   | 0.33                                | 1.00                         | 0.47                                      | 0.80                        |
| Antennaria parvifolia   | 0.10                   | 0.33                                | 1.00                         | 0.47                                      | 0.80                        |
| Artemisia frigida       | 1.90                   | 6.33                                | 17.00                        | 7.94                                      | 14.27                       |
| Erigeron glabellus      | 0.20                   | 0.67                                | 1.00                         | 0.47                                      | 1.14                        |
| Grindelia squarrosa     | 0.10                   | 0.33                                | 1.00                         | 0.47                                      | 0.80                        |
| Hedeoma hispida         | 0.40                   | 1.33                                | 4.00                         | 1.87                                      | 3.20                        |
| Lotus americanus        | 0.10                   | 0.33                                | 1.00                         | 0.47                                      | 0.80                        |
| Opuntia fragilis        | 0.10                   | 0.33                                | 1.00                         | 0.47                                      | 0.80                        |
| Potentilla pensylvanica | 0.10                   | 0.33                                | 1.00                         | 0.47                                      | 0.80                        |
| Sphaeralcea coccinea    | 0.30                   | 1.00                                | 3.00                         | 1.40                                      | 2.40                        |
| Litter                  | 70.00                  |                                     | 100.00                       |                                           |                             |
| Rock                    | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                    | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 70. Points Analysis of the Grazed Silty Range Site on the Native Range, Pasture 3, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species               | Basal<br>Cover | Relative<br>Basal<br>Cover | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-----------------------|----------------|----------------------------|----------------------|----------------------------------|---------------------|
| Agropyron smithii     | 3.90           | 11.93                      | 32.00                | 15.61                            | 27.54               |
| Bouteloua gracilis    | 1.80           | 5.50                       | 8.00                 | 3.90                             | 9.40                |
| Koeleria pyramidata   | 2.00           | 6.12                       | 13.00                | 6.34                             | 12.46               |
| Stipa comata          | 9.80           | 29.97                      | 53.00                | 25.85                            | 55.82               |
| Stipa viridula        | 11.50          | 35.17                      | 68.00                | 33.17                            | 68.34               |
| Carex heliophila      | 0.70           | 2.14                       | 5.00                 | 2.44                             | 4.58                |
| Achillea millefolium  | 0.10           | 0.31                       | 1.00                 | 0.49                             | 0.80                |
| Antennaria parvifolia | 0.50           | 1.53                       | 2.00                 | 0.98                             | 2.51                |
| Artemisia dracunculus | 0.10           | 0.31                       | 1.00                 | 0.49                             | 0.80                |
| Artemisia frigida     | 0.80           | 2.45                       | 7.00                 | 3.41                             | 5.86                |
| Grindelia squarrosa   | 0.20           | 0.61                       | 2.00                 | 0.98                             | 1.59                |
| Hedeoma hispida       | 0.40           | 1.22                       | 4.00                 | 1.95                             | 3.17                |
| Linum rigidum         | 0.10           | 0.31                       | 1.00                 | 0.49                             | 0.80                |
| Lotus americanus      | 0.30           | 0.92                       | 3.00                 | 1.46                             | 2.38                |
| Psoralea esculenta    | 0.10           | 0.31                       | 1.00                 | 0.49                             | 0.80                |
| Ratibida columnifera  | 0.20           | 0.61                       | 2.00                 | 0.98                             | 1.59                |
| Sphaeralcea coccinea  | 0.20           | 0.61                       | 2.00                 | 0.98                             | 1.59                |
| Litter                | 67.30          |                            | 100.00               |                                  |                     |
| Rock                  | 0.00           |                            | 0.00                 |                                  |                     |
| Soil                  | 0.00           |                            | 0.00                 |                                  |                     |

**Table 71. Points Analysis of the Ungrazed Clayey Range Site on the Native Range, Pasture 4, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 2.80               | 7.93                        | 27.00                    | 12.56                             | 20.49                   |
| Bouteloua gracilis      | 15.70              | 44.48                       | 65.00                    | 30.23                             | 74.71                   |
| Koeleria pyramidata     | 5.60               | 15.86                       | 36.00                    | 16.74                             | 32.60                   |
| Stipa comata            | 0.30               | 0.85                        | 3.00                     | 1.40                              | 2.25                    |
| Stipa viridula          | 0.50               | 1.42                        | 4.00                     | 1.86                              | 3.28                    |
| Carex filifolia         | 0.40               | 1.13                        | 3.00                     | 1.40                              | 2.53                    |
| Carex heliophila        | 2.90               | 8.22                        | 21.00                    | 9.77                              | 17.99                   |
| Achillea millefolium    | 0.70               | 1.98                        | 6.00                     | 2.79                              | 4.77                    |
| Agoseris glauca         | 0.10               | 0.28                        | 1.00                     | 0.47                              | 0.75                    |
| Antennaria parvifolia   | 2.00               | 5.67                        | 9.00                     | 4.19                              | 9.86                    |
| Artemisia dracunculus   | 0.70               | 1.98                        | 6.00                     | 2.79                              | 4.77                    |
| Artemisia frigida       | 0.40               | 1.13                        | 4.00                     | 1.86                              | 2.99                    |
| Artemisia ludoviciana   | 0.10               | 0.28                        | 1.00                     | 0.47                              | 0.75                    |
| Grindelia squarrosa     | 0.30               | 0.85                        | 3.00                     | 1.40                              | 2.25                    |
| Oxytropis lambertii     | 0.10               | 0.28                        | 1.00                     | 0.47                              | 0.75                    |
| Phlox hoodii            | 0.10               | 0.28                        | 1.00                     | 0.47                              | 0.75                    |
| Potentilla pensylvanica | 0.20               | 0.57                        | 2.00                     | 0.93                              | 1.50                    |
| Psoralea argophylla     | 0.10               | 0.28                        | 1.00                     | 0.47                              | 0.75                    |
| Ratibida columnifera    | 0.40               | 1.13                        | 4.00                     | 1.86                              | 2.99                    |
| Sphaeralcea coccinea    | 0.20               | 0.57                        | 2.00                     | 0.93                              | 1.50                    |
| Lichen spp.             | 1.70               | 4.82                        | 15.00                    | 6.98                              | 11.80                   |
| Furrow                  | 10.00              |                             | 15.00                    |                                   |                         |
| Litter                  | 41.90              |                             | 86.00                    |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                     | 12.80              |                             | 25.00                    |                                   |                         |
| Soil                    | 0.00               |                             | 0.00                     |                                   |                         |

**Table 72. Points Analysis of the Grazed Clayey Range Site on the Native Range, Pasture 4, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 1.70               | 7.94                        | 15.00                    | 10.87                             | 18.81                   |
| Bouteloua gracilis      | 10.40              | 48.60                       | 47.00                    | 34.06                             | 82.66                   |
| Koeleria pyramidata     | 2.20               | 10.28                       | 18.00                    | 13.04                             | 23.32                   |
| Stipa comata            | 0.60               | 2.80                        | 6.00                     | 4.35                              | 7.15                    |
| Stipa viridula          | 1.10               | 5.14                        | 9.00                     | 6.52                              | 11.66                   |
| Carex filifolia         | 0.20               | 0.93                        | 2.00                     | 1.45                              | 2.38                    |
| Carex heliophila        | 0.20               | 0.93                        | 2.00                     | 1.45                              | 2.38                    |
| Achillea millefolium    | 0.30               | 1.40                        | 3.00                     | 2.17                              | 3.57                    |
| Antennaria parvifolia   | 0.50               | 2.34                        | 2.00                     | 1.45                              | 3.79                    |
| Artemisia dracunculus   | 0.70               | 3.27                        | 4.00                     | 2.90                              | 6.17                    |
| Aster ericoides         | 0.20               | 0.93                        | 2.00                     | 1.45                              | 2.38                    |
| Grindelia squarrosa     | 0.40               | 1.87                        | 4.00                     | 2.90                              | 4.77                    |
| Linum rigidum           | 0.10               | 0.47                        | 1.00                     | 0.72                              | 1.19                    |
| Phlox hoodii            | 0.10               | 0.47                        | 1.00                     | 0.72                              | 1.19                    |
| Potentilla pensylvanica | 0.10               | 0.47                        | 1.00                     | 0.72                              | 1.19                    |
| Sphaeralcea coccinea    | 0.10               | 0.47                        | 1.00                     | 0.72                              | 1.19                    |
| Lichen spp.             | 2.50               | 11.68                       | 20.00                    | 14.49                             | 26.17                   |
| Furrow                  | 9.90               |                             | 70.00                    |                                   |                         |
| Litter                  | 51.50              |                             | 84.00                    |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                     | 16.10              |                             | 30.00                    |                                   |                         |
| Soil                    | 1.10               |                             | 8.00                     |                                   |                         |

**Table 73. Points Analysis of the Ungrazed Sandy Range Site on the Native Range, Pasture 4, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Andropogon scoparius   | 0.20               | 0.57                        | 2.00                     | 0.81                              | 1.38                    |
| Bouteloua gracilis     | 6.50               | 18.62                       | 46.00                    | 18.55                             | 37.17                   |
| Calamovilfa longifolia | 7.20               | 20.63                       | 55.00                    | 22.18                             | 42.81                   |
| Koeleria pyramidata    | 1.20               | 3.44                        | 11.00                    | 4.44                              | 7.88                    |
| Muhlenbergia cuspidata | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Panicum oligosanthos   | 1.30               | 3.72                        | 10.00                    | 4.03                              | 7.75                    |
| Setaria viridis        | 0.20               | 0.57                        | 2.00                     | 0.81                              | 1.38                    |
| Stipa comata           | 1.10               | 3.15                        | 9.00                     | 3.63                              | 6.78                    |
| Stipa viridula         | 1.20               | 3.44                        | 11.00                    | 4.44                              | 7.88                    |
| Carex filifolia        | 0.20               | 0.57                        | 2.00                     | 0.81                              | 1.38                    |
| Carex heliophila       | 12.60              | 36.10                       | 75.00                    | 30.24                             | 66.34                   |
| Antennaria parvifolia  | 1.00               | 2.87                        | 4.00                     | 1.61                              | 4.48                    |
| Artemisia dracunculus  | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Artemisia ludoviciana  | 1.10               | 3.15                        | 10.00                    | 4.03                              | 7.18                    |
| Lactuca oblongifolia   | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Lygodesmia juncea      | 0.30               | 0.86                        | 3.00                     | 1.21                              | 2.07                    |
| Oxytropis lambertii    | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Rosa arkansana         | 0.30               | 0.86                        | 3.00                     | 1.21                              | 2.07                    |
| Lichen spp.            | 0.10               | 0.29                        | 1.00                     | 0.40                              | 0.69                    |
| Furrow                 | 3.80               |                             | 10.00                    |                                   |                         |
| Litter                 | 55.80              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 5.20               |                             | 11.00                    |                                   |                         |
| Soil                   | 0.30               |                             | 2.00                     |                                   |                         |

**Table 74. Points Analysis of the Grazed Sandy Range Site on the Native Range, Pasture 4, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.10               | 0.33                        | 1.00                     | 0.48                              | 0.81                    |
| Bouteloua gracilis     | 6.50               | 21.38                       | 40.00                    | 19.05                             | 40.43                   |
| Calamovilfa longifolia | 6.60               | 21.71                       | 51.00                    | 24.29                             | 46.00                   |
| Koeleria pyramidata    | 0.50               | 1.64                        | 5.00                     | 2.38                              | 4.02                    |
| Panicum oligosanthos   | 2.00               | 6.58                        | 18.00                    | 8.57                              | 15.15                   |
| Setaria viridis        | 0.50               | 1.64                        | 5.00                     | 2.38                              | 4.02                    |
| Stipa comata           | 0.10               | 0.33                        | 1.00                     | 0.48                              | 0.81                    |
| Stipa viridula         | 1.60               | 5.26                        | 14.00                    | 6.67                              | 11.93                   |
| Carex filifolia        | 0.10               | 0.33                        | 1.00                     | 0.48                              | 0.81                    |
| Carex heliophila       | 10.60              | 34.87                       | 58.00                    | 27.62                             | 62.49                   |
| Antennaria parvifolia  | 0.30               | 0.99                        | 2.00                     | 0.95                              | 1.94                    |
| Artemisia frigida      | 0.10               | 0.33                        | 1.00                     | 0.48                              | 0.81                    |
| Artemisia ludoviciana  | 0.60               | 1.97                        | 6.00                     | 2.86                              | 4.83                    |
| Chrysopsis villosa     | 0.10               | 0.33                        | 1.00                     | 0.48                              | 0.81                    |
| Lactuca oblongifolia   | 0.20               | 0.66                        | 1.00                     | 0.48                              | 1.14                    |
| Lygodesmia juncea      | 0.10               | 0.33                        | 1.00                     | 0.48                              | 0.81                    |
| Oxytropis lambertii    | 0.40               | 1.32                        | 4.00                     | 1.90                              | 3.22                    |
| Furrow                 | 5.60               |                             | 13.00                    |                                   |                         |
| Litter                 | 53.20              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 10.80              |                             | 20.00                    |                                   |                         |
| Soil                   | 0.00               |                             | 0.00                     |                                   |                         |

**Table 75. Points Analysis of the Ungrazed Shallow Range Site on the Native Range, Pasture 4, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis     | 15.70              | 48.46                       | 72.00                    | 34.62                             | 83.08                   |
| Koeleria pyramidata    | 1.80               | 5.56                        | 16.00                    | 7.69                              | 13.25                   |
| Stipa comata           | 3.80               | 11.73                       | 36.00                    | 17.31                             | 29.04                   |
| Carex filifolia        | 7.40               | 22.84                       | 49.00                    | 23.56                             | 46.40                   |
| Artemisia dracunculus  | 0.20               | 0.62                        | 2.00                     | 0.96                              | 1.58                    |
| Aster ericoides        | 0.50               | 1.54                        | 5.00                     | 2.40                              | 3.94                    |
| Echinacea angustifolia | 0.10               | 0.31                        | 1.00                     | 0.48                              | 0.79                    |
| Grindelia squarrosa    | 0.20               | 0.62                        | 2.00                     | 0.96                              | 1.58                    |
| Liatris punctata       | 0.20               | 0.62                        | 2.00                     | 0.96                              | 1.58                    |
| Lygodesmia juncea      | 0.10               | 0.31                        | 1.00                     | 0.48                              | 0.79                    |
| Opuntia fragilis       | 0.10               | 0.31                        | 1.00                     | 0.48                              | 0.79                    |
| Phlox hoodii           | 0.80               | 2.47                        | 7.00                     | 3.37                              | 5.84                    |
| Psoralea esculenta     | 0.10               | 0.31                        | 1.00                     | 0.48                              | 0.79                    |
| Ratibida columnifera   | 0.30               | 0.93                        | 3.00                     | 1.44                              | 2.37                    |
| Sphaeralcea coccinea   | 0.20               | 0.62                        | 2.00                     | 0.96                              | 1.58                    |
| Lichen spp.            | 0.90               | 2.78                        | 8.00                     | 3.85                              | 6.63                    |
| Furrow                 | 4.20               |                             | 5.00                     |                                   |                         |
| Litter                 | 55.80              |                             | 93.00                    |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 5.40               |                             | 15.00                    |                                   |                         |
| Soil                   | 2.20               |                             | 11.00                    |                                   |                         |

**Table 76. Points Analysis of the Grazed Shallow Range Site on the Native Range, Pasture 4, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-----------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Bouteloua gracilis    | 13.10              | 44.86                       | 73.00                    | 35.78                             | 80.64                   |
| Koeleria pyramidata   | 1.30               | 4.45                        | 11.00                    | 5.39                              | 9.84                    |
| Stipa comata          | 4.90               | 16.78                       | 43.00                    | 21.08                             | 37.86                   |
| Carex filifolia       | 7.50               | 25.68                       | 53.00                    | 25.98                             | 51.66                   |
| Artemisia frigida     | 0.10               | 0.34                        | 1.00                     | 0.49                              | 0.83                    |
| Artemisia ludoviciana | 0.50               | 1.71                        | 5.00                     | 2.45                              | 4.16                    |
| Aster ericoides       | 0.40               | 1.37                        | 4.00                     | 1.96                              | 3.33                    |
| Grindelia squarrosa   | 0.10               | 0.34                        | 1.00                     | 0.49                              | 0.83                    |
| Opuntia fragilis      | 0.10               | 0.34                        | 1.00                     | 0.49                              | 0.83                    |
| Phlox hoodii          | 0.50               | 1.71                        | 5.00                     | 2.45                              | 4.16                    |
| Psoralea argophylla   | 0.10               | 0.34                        | 1.00                     | 0.49                              | 0.83                    |
| Ratibida columnifera  | 0.20               | 0.68                        | 2.00                     | 0.98                              | 1.66                    |
| Lichen spp.           | 0.40               | 1.37                        | 4.00                     | 1.96                              | 3.33                    |
| Furrow                | 4.80               |                             | 5.00                     |                                   |                         |
| Litter                | 59.50              |                             | 100.00                   |                                   |                         |
| Rock                  | 0.10               |                             | 1.00                     |                                   |                         |
| Sod                   | 2.70               |                             | 8.00                     |                                   |                         |
| Soil                  | 3.70               |                             | 12.00                    |                                   |                         |

**Table 77. Points Analysis of the Ungrazed Silty Range Site on the Native Range, Pasture 4,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii     | 3.30                   | 9.38                                | 28.00                        | 13.66                                     | 23.04                       |
| Bouteloua gracilis    | 20.80                  | 59.09                               | 90.00                        | 43.90                                     | 102.99                      |
| Koeleria pyramidata   | 0.60                   | 1.70                                | 6.00                         | 2.93                                      | 4.63                        |
| Munroa squarrosa      | 0.10                   | 0.28                                | 1.00                         | 0.49                                      | 0.77                        |
| Stipa comata          | 3.00                   | 8.52                                | 26.00                        | 12.68                                     | 21.20                       |
| Stipa viridula        | 0.40                   | 1.14                                | 4.00                         | 1.95                                      | 3.09                        |
| Carex filifolia       | 4.20                   | 11.93                               | 29.00                        | 14.15                                     | 26.08                       |
| Carex heliophila      | 0.20                   | 0.57                                | 2.00                         | 0.98                                      | 1.55                        |
| Artemisia dracunculus | 0.40                   | 1.14                                | 4.00                         | 1.95                                      | 3.09                        |
| Artemisia frigida     | 0.30                   | 0.85                                | 2.00                         | 0.98                                      | 1.83                        |
| Grindelia squarrosa   | 0.30                   | 0.85                                | 3.00                         | 1.46                                      | 2.31                        |
| Opuntia fragilis      | 1.10                   | 3.13                                | 5.00                         | 2.44                                      | 5.57                        |
| Ratibida columnifera  | 0.10                   | 0.28                                | 1.00                         | 0.49                                      | 0.77                        |
| Sphaeralcea coccinea  | 0.40                   | 1.14                                | 4.00                         | 1.95                                      | 3.09                        |
| Furrow                | 2.20                   |                                     | 3.00                         |                                           |                             |
| Litter                | 60.40                  |                                     | 98.00                        |                                           |                             |
| Rock                  | 0.00                   |                                     | 0.00                         |                                           |                             |
| Sod                   | 1.80                   |                                     | 5.00                         |                                           |                             |
| Soil                  | 0.40                   |                                     | 4.00                         |                                           |                             |

**Table 78. Points Analysis of the Grazed Silty Range Site on the Native Range, Pasture 4,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii     | 2.00                   | 5.41                                | 17.00                        | 8.25                                      | 13.66                       |
| Bouteloua gracilis    | 23.20                  | 62.70                               | 93.00                        | 45.15                                     | 107.85                      |
| Koeleria pyramidata   | 1.10                   | 2.97                                | 11.00                        | 5.34                                      | 8.31                        |
| Munroa squarrosa      | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Stipa comata          | 1.40                   | 3.78                                | 11.00                        | 5.34                                      | 9.12                        |
| Stipa viridula        | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Carex filifolia       | 6.20                   | 16.76                               | 45.00                        | 21.84                                     | 38.60                       |
| Antennaria parvifolia | 0.20                   | 0.54                                | 1.00                         | 0.49                                      | 1.03                        |
| Artemisia dracunculus | 0.20                   | 0.54                                | 2.00                         | 0.97                                      | 1.51                        |
| Artemisia frigida     | 0.40                   | 1.08                                | 4.00                         | 1.94                                      | 3.02                        |
| Ceratoides lanata     | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Grindelia squarrosa   | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Medicago spp.         | 0.20                   | 0.54                                | 2.00                         | 0.97                                      | 1.51                        |
| Opuntia fragilis      | 0.50                   | 1.35                                | 4.00                         | 1.94                                      | 3.29                        |
| Phlox hoodii          | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Polygala alba         | 0.50                   | 1.35                                | 5.00                         | 2.43                                      | 3.78                        |
| Ratibida columnifera  | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Sphaeralcea coccinea  | 0.40                   | 1.08                                | 4.00                         | 1.94                                      | 3.02                        |
| Lichen spp.           | 0.10                   | 0.27                                | 1.00                         | 0.49                                      | 0.76                        |
| Furrow                | 3.80                   |                                     | 5.00                         |                                           |                             |
| Litter                | 55.20                  |                                     | 95.00                        |                                           |                             |
| Rock                  | 0.00                   |                                     | 0.00                         |                                           |                             |
| Sod                   | 3.10                   |                                     | 6.00                         |                                           |                             |
| Soil                  | 0.90                   |                                     | 7.00                         |                                           |                             |

**Table 79. Points Analysis of the Ungrazed Sandy Range Site on the Native Range, Pasture 5, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Andropogon scoparius   | 0.10                   | 0.32                                | 1.00                         | 0.43                                      | 0.75                        |
| Bouteloua gracilis     | 3.80                   | 12.26                               | 29.00                        | 12.39                                     | 24.65                       |
| Calamovilfa longifolia | 5.20                   | 16.77                               | 40.00                        | 17.09                                     | 33.86                       |
| Koeleria pyramidata    | 0.80                   | 2.58                                | 8.00                         | 3.42                                      | 6.00                        |
| Panicum oligosanthos   | 1.30                   | 4.19                                | 13.00                        | 5.56                                      | 9.75                        |
| Stipa comata           | 5.50                   | 17.74                               | 50.00                        | 21.37                                     | 39.11                       |
| Carex filifolia        | 1.20                   | 3.87                                | 9.00                         | 3.85                                      | 7.72                        |
| Carex heliophila       | 10.20                  | 32.90                               | 61.00                        | 26.07                                     | 58.97                       |
| Artemisia dracunculus  | 0.90                   | 2.90                                | 5.00                         | 2.14                                      | 5.04                        |
| Artemisia ludoviciana  | 1.00                   | 3.23                                | 9.00                         | 3.85                                      | 7.08                        |
| Cirsium undulatum      | 0.30                   | 0.97                                | 2.00                         | 0.85                                      | 1.82                        |
| Opuntia fragilis       | 0.30                   | 0.97                                | 3.00                         | 1.28                                      | 2.25                        |
| Psoralea argophylla    | 0.10                   | 0.32                                | 1.00                         | 0.43                                      | 0.75                        |
| Solidago rigida        | 0.20                   | 0.65                                | 2.00                         | 0.85                                      | 1.50                        |
| Rosa arkansana         | 0.10                   | 0.32                                | 1.00                         | 0.43                                      | 0.75                        |
| Litter                 | 69.00                  |                                     | 100.00                       |                                           |                             |
| Rock                   | 0.00                   |                                     | 0.00                         |                                           |                             |
| Soil                   | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 80. Points Analysis of the Grazed Sandy Range Site on the Native Range, Pasture 5, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Andropogon scoparius   | 0.90               | 2.91                        | 8.00                     | 3.28                              | 6.19                    |
| Bouteloua gracilis     | 4.40               | 14.24                       | 32.00                    | 13.11                             | 27.35                   |
| Calamovilfa longifolia | 3.90               | 12.62                       | 33.00                    | 13.52                             | 26.14                   |
| Koeleria pyramidata    | 2.60               | 8.41                        | 22.00                    | 9.02                              | 17.43                   |
| Panicum oligosanthos   | 0.10               | 0.32                        | 1.00                     | 0.41                              | 0.73                    |
| Stipa comata           | 4.90               | 15.86                       | 40.00                    | 16.39                             | 32.25                   |
| Carex filifolia        | 0.30               | 0.97                        | 3.00                     | 1.23                              | 2.20                    |
| Carex heliophila       | 9.60               | 31.07                       | 67.00                    | 27.46                             | 58.53                   |
| Artemisia dracunculus  | 0.40               | 1.29                        | 4.00                     | 1.64                              | 2.93                    |
| Artemisia ludoviciana  | 1.20               | 3.88                        | 12.00                    | 4.92                              | 8.80                    |
| Aster ericoides        | 0.10               | 0.32                        | 1.00                     | 0.41                              | 0.73                    |
| Chrysopsis villosa     | 0.10               | 0.32                        | 1.00                     | 0.41                              | 0.73                    |
| Cirsium undulatum      | 0.40               | 1.29                        | 4.00                     | 1.64                              | 2.93                    |
| Lygodesmia juncea      | 0.10               | 0.32                        | 1.00                     | 0.41                              | 0.73                    |
| Opuntia fragilis       | 1.00               | 3.24                        | 6.00                     | 2.46                              | 5.70                    |
| Phlox hoodii           | 0.10               | 0.32                        | 1.00                     | 0.41                              | 0.73                    |
| Solidago rigida        | 0.30               | 0.97                        | 3.00                     | 1.23                              | 2.20                    |
| Rosa arkansana         | 0.40               | 1.29                        | 4.00                     | 1.64                              | 2.93                    |
| Lichen spp.            | 0.10               | 0.32                        | 1.00                     | 0.41                              | 0.73                    |
| Litter                 | 68.60              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.50               |                             | 5.00                     |                                   |                         |

**Table 81. Points Analysis of the Ungrazed Shallow Range Site on the Native Range, Pasture 5, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Andropogon scoparius   | 1.60               | 5.13                        | 7.00                     | 3.20                              | 8.33                    |
| Aristida longiseta     | 0.10               | 0.32                        | 1.00                     | 0.46                              | 0.78                    |
| Bouteloua gracilis     | 13.80              | 44.23                       | 73.00                    | 33.33                             | 77.56                   |
| Koeleria pyramidata    | 1.50               | 4.81                        | 14.00                    | 6.39                              | 11.20                   |
| Muhlenbergia cuspidata | 0.30               | 0.96                        | 3.00                     | 1.37                              | 2.33                    |
| Stipa comata           | 2.60               | 8.33                        | 21.00                    | 9.59                              | 17.92                   |
| Stipa viridula         | 0.30               | 0.96                        | 3.00                     | 1.37                              | 2.33                    |
| Carex filifolia        | 2.10               | 6.73                        | 20.00                    | 9.13                              | 15.86                   |
| Carex heliophila       | 4.80               | 15.38                       | 37.00                    | 16.89                             | 32.27                   |
| Antennaria parvifolia  | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Artemisia frigida      | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Artemisia ludoviciana  | 0.10               | 0.32                        | 1.00                     | 0.46                              | 0.78                    |
| Aster ericoides        | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Echinacea angustifolia | 0.40               | 1.28                        | 4.00                     | 1.83                              | 3.11                    |
| Oxytropis lambertii    | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Phlox hoodii           | 0.80               | 2.56                        | 7.00                     | 3.20                              | 5.76                    |
| Polygala alba          | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Psoralea argophylla    | 0.10               | 0.32                        | 1.00                     | 0.46                              | 0.78                    |
| Ratibida columnifera   | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Solidago rigida        | 0.20               | 0.64                        | 2.00                     | 0.91                              | 1.55                    |
| Vicia americana        | 0.10               | 0.32                        | 1.00                     | 0.46                              | 0.78                    |
| Rosa arkansana         | 0.80               | 2.56                        | 8.00                     | 3.65                              | 6.21                    |
| Lichen spp.            | 0.40               | 1.28                        | 4.00                     | 1.83                              | 3.11                    |
| Litter                 | 67.10              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 1.70               |                             | 12.00                    |                                   |                         |

**Table 82. Points Analysis of the Grazed Shallow Range Site on the Native Range, Pasture 5, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Andropogon scoparius   | 1.60               | 5.32                        | 7.00                     | 2.95                              | 8.27                    |
| Bouteloua gracilis     | 11.00              | 36.54                       | 73.00                    | 30.80                             | 67.34                   |
| Koeleria pyramidata    | 3.00               | 9.97                        | 28.00                    | 11.81                             | 21.78                   |
| Stipa comata           | 4.00               | 13.29                       | 34.00                    | 14.35                             | 27.64                   |
| Carex filifolia        | 3.60               | 11.96                       | 30.00                    | 12.66                             | 24.62                   |
| Carex heliophila       | 2.90               | 9.63                        | 26.00                    | 10.97                             | 20.60                   |
| Antennaria parvifolia  | 0.30               | 1.00                        | 2.00                     | 0.84                              | 1.84                    |
| Artemisia frigida      | 0.40               | 1.33                        | 4.00                     | 1.69                              | 3.02                    |
| Artemisia ludoviciana  | 0.10               | 0.33                        | 1.00                     | 0.42                              | 0.75                    |
| Asclepias verticillata | 0.10               | 0.33                        | 1.00                     | 0.42                              | 0.75                    |
| Aster ericoides        | 0.50               | 1.66                        | 5.00                     | 2.11                              | 3.77                    |
| Echinacea angustifolia | 0.60               | 1.99                        | 6.00                     | 2.53                              | 4.52                    |
| Phlox hoodii           | 0.90               | 2.99                        | 9.00                     | 3.80                              | 6.79                    |
| Ratibida columnifera   | 0.20               | 0.66                        | 2.00                     | 0.84                              | 1.50                    |
| Solidago rigida        | 0.20               | 0.66                        | 2.00                     | 0.84                              | 1.50                    |
| Rosa arkansana         | 0.50               | 1.66                        | 5.00                     | 2.11                              | 3.77                    |
| Lichen spp.            | 0.20               | 0.66                        | 2.00                     | 0.84                              | 1.50                    |
| Litter                 | 67.80              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 2.10               |                             | 5.00                     |                                   |                         |

**Table 83. Points Analysis of the Ungrazed Silty Range Site on the Native Range, Pasture 5, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                | Basal<br>Cover | Relative<br>Basal<br>Cover | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|------------------------|----------------|----------------------------|----------------------|----------------------------------|---------------------|
| Agropyron smithii      | 2.90           | 7.63                       | 28.00                | 11.52                            | 19.15               |
| Aristida longiseta     | 0.20           | 0.53                       | 2.00                 | 0.82                             | 1.35                |
| Bouteloua gracilis     | 18.10          | 47.63                      | 80.00                | 32.92                            | 80.55               |
| Koeleria pyramidata    | 5.00           | 13.16                      | 37.00                | 15.23                            | 28.39               |
| Panicum oligosanthos   | 1.50           | 3.95                       | 12.00                | 4.94                             | 8.89                |
| Stipa comate           | 2.60           | 6.84                       | 23.00                | 9.47                             | 16.31               |
| Stipa viridula         | 1.00           | 2.63                       | 8.00                 | 3.29                             | 5.92                |
| Carex filifolia        | 3.40           | 8.95                       | 23.00                | 9.47                             | 18.42               |
| Carex heliophila       | 1.00           | 2.63                       | 8.00                 | 3.29                             | 5.92                |
| Antennaria parvifolia  | 0.10           | 0.26                       | 1.00                 | 0.41                             | 0.67                |
| Artemisia dracunculus  | 0.40           | 1.05                       | 4.00                 | 1.65                             | 2.70                |
| Artemisia frigida      | 0.40           | 1.05                       | 4.00                 | 1.65                             | 2.70                |
| Conyza Canadensis      | 0.20           | 0.53                       | 2.00                 | 0.82                             | 1.35                |
| Echinacea angustifolia | 0.10           | 0.26                       | 1.00                 | 0.41                             | 0.67                |
| Erigeron glabellus     | 0.50           | 1.32                       | 5.00                 | 2.06                             | 3.38                |
| Grindelia squarrosa    | 0.10           | 0.26                       | 1.00                 | 0.41                             | 0.67                |
| Hedeoma hispida        | 0.10           | 0.26                       | 1.00                 | 0.41                             | 0.67                |
| Solidago rigida        | 0.30           | 0.79                       | 2.00                 | 0.82                             | 1.61                |
| Sphaeralcea coccinea   | 0.10           | 0.26                       | 1.00                 | 0.41                             | 0.67                |
| Litter                 | 62.00          |                            | 100.00               |                                  |                     |
| Rock                   | 0.00           |                            | 0.00                 |                                  |                     |
| Soil                   | 0.00           |                            | 0.00                 |                                  |                     |

**Table 84. Points Analysis of the Grazed Silty Range Site on the Native Range, Pasture 5,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                 | Basal<br>Cover | Relative<br>Basal<br>Cover | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------|----------------|----------------------------|----------------------|----------------------------------|---------------------|
| Agropyron smithii       | 1.60           | 4.80                       | 15.00                | 5.95                             | 10.75               |
| Aristida longiseta      | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Bouteloua gracilis      | 7.90           | 23.72                      | 49.00                | 19.44                            | 43.16               |
| Koeleria pyramidata     | 4.00           | 12.01                      | 34.00                | 13.49                            | 25.50               |
| Panicum oligosanthos    | 0.50           | 1.50                       | 5.00                 | 1.98                             | 3.48                |
| Stipa comata            | 5.60           | 16.82                      | 42.00                | 16.67                            | 33.49               |
| Stipa viridula          | 1.10           | 3.30                       | 10.00                | 3.97                             | 7.27                |
| Carex filifolia         | 1.40           | 4.20                       | 10.00                | 3.97                             | 8.17                |
| Carex heliophila        | 3.90           | 11.71                      | 28.00                | 11.11                            | 22.82               |
| Agoseris glauca         | 0.30           | 0.90                       | 3.00                 | 1.19                             | 2.09                |
| Antennaria parvifolia   | 1.50           | 4.50                       | 7.00                 | 2.78                             | 7.28                |
| Arabis holboellii       | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Artemisia dracunculus   | 0.60           | 1.80                       | 6.00                 | 2.38                             | 4.18                |
| Artemisia frigida       | 0.80           | 2.40                       | 8.00                 | 3.17                             | 5.57                |
| Aster ericoides         | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Chrysopsis villosa      | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Conyza canadensis       | 0.30           | 0.90                       | 3.00                 | 1.19                             | 2.09                |
| Erigeron glabellus      | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Hedeoma hispida         | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Lactuca oblongifolia    | 0.20           | 0.60                       | 1.00                 | 0.40                             | 1.00                |
| Lotus americanus        | 0.10           | 0.30                       | 1.00                 | 0.40                             | 0.70                |
| Opuntia fragilis        | 1.20           | 3.60                       | 7.00                 | 2.78                             | 6.38                |
| Orthocarpus luteus      | 0.20           | 0.60                       | 2.00                 | 0.79                             | 1.39                |
| Potentilla pensylvanica | 0.30           | 0.90                       | 3.00                 | 1.19                             | 2.09                |
| Ratibida columnifera    | 0.90           | 2.70                       | 9.00                 | 3.57                             | 6.27                |
| Sphaeralcea coccinea    | 0.30           | 0.90                       | 3.00                 | 1.19                             | 2.09                |
| Litter                  | 66.70          |                            | 100.00               |                                  |                     |
| Rock                    | 0.00           |                            | 0.00                 |                                  |                     |
| Soil                    | 0.00           |                            | 0.00                 |                                  |                     |

**Table 85. Points Analysis of the Ungrazed Sandy Range Site on the Native Range, Pasture 6, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.50               | 1.39                        | 5.00                     | 2.08                              | 3.47                    |
| Bouteloua gracilis     | 3.60               | 9.97                        | 29.00                    | 12.08                             | 22.05                   |
| Calamovilfa longifolia | 3.10               | 8.59                        | 29.00                    | 12.08                             | 20.67                   |
| Koeleria pyramidata    | 0.50               | 1.39                        | 5.00                     | 2.08                              | 3.47                    |
| Stipa comata           | 3.10               | 8.59                        | 25.00                    | 10.42                             | 19.01                   |
| Stipa viridula         | 0.80               | 2.22                        | 6.00                     | 2.50                              | 4.72                    |
|                        |                    |                             |                          |                                   |                         |
| Carex filifolia        | 15.80              | 43.77                       | 79.00                    | 32.92                             | 76.69                   |
| Carex heliophila       | 6.50               | 18.01                       | 45.00                    | 18.75                             | 36.76                   |
|                        |                    |                             |                          |                                   |                         |
| Artemisia dracunculus  | 0.50               | 1.39                        | 3.00                     | 1.25                              | 2.64                    |
| Artemisia ludoviciana  | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Asclepias verticillata | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Echinacea angustifolia | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Erysimum asperum       | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Liatris punctata       | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Lygodesmia juncea      | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Opuntia fragilis       | 0.80               | 2.22                        | 5.00                     | 2.08                              | 4.30                    |
| Oxytropis lambertii    | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
| Penstemon albidus      | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
|                        |                    |                             |                          |                                   |                         |
| Lichen spp.            | 0.10               | 0.28                        | 1.00                     | 0.42                              | 0.70                    |
|                        |                    |                             |                          |                                   |                         |
| Furrow                 | 0.40               |                             | 3.00                     |                                   |                         |
| Litter                 | 60.60              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 2.80               |                             | 8.00                     |                                   |                         |
| Soil                   | 0.10               |                             | 1.00                     |                                   |                         |

**Table 86. Points Analysis of the Grazed Sandy Range Site on the Native Range, Pasture 6, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Agropyron smithii      | 0.10                   | 0.29                                | 1.00                         | 0.47                                      | 0.76                        |
| Bouteloua gracilis     | 2.00                   | 5.87                                | 19.00                        | 8.84                                      | 14.71                       |
| Calamovilfa longifolia | 2.90                   | 8.50                                | 25.00                        | 11.63                                     | 20.13                       |
| Koeleria pyramidata    | 0.50                   | 1.47                                | 5.00                         | 2.33                                      | 3.80                        |
| Stipa comata           | 1.90                   | 5.57                                | 15.00                        | 6.98                                      | 12.55                       |
| Stipa viridula         | 0.40                   | 1.17                                | 4.00                         | 1.86                                      | 3.03                        |
| Carex filifolia        | 19.00                  | 55.72                               | 87.00                        | 40.47                                     | 96.19                       |
| Carex heliophila       | 5.50                   | 16.13                               | 41.00                        | 19.07                                     | 35.20                       |
| Artemisia dracunculus  | 0.10                   | 0.29                                | 1.00                         | 0.47                                      | 0.76                        |
| Artemisia ludoviciana  | 1.00                   | 2.93                                | 10.00                        | 4.65                                      | 7.58                        |
| Asclepias verticillata | 0.10                   | 0.29                                | 1.00                         | 0.47                                      | 0.76                        |
| Echinacea angustifolia | 0.20                   | 0.59                                | 2.00                         | 0.93                                      | 1.52                        |
| Rosa arkansana         | 0.40                   | 1.17                                | 4.00                         | 1.86                                      | 3.03                        |
| Furrow                 | 0.70                   |                                     | 2.00                         |                                           |                             |
| Litter                 | 59.40                  |                                     | 98.00                        |                                           |                             |
| Rock                   | 0.00                   |                                     | 0.00                         |                                           |                             |
| Sod                    | 5.80                   |                                     | 12.00                        |                                           |                             |
| Soil                   | 0.00                   |                                     | 0.00                         |                                           |                             |

**Table 87. Points Analysis of the Ungrazed Shallow Range Site on the Native Range, Pasture 6, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii      | 0.30        | 0.86                 | 3.00              | 1.17                       | 2.03             |
| Bouteloua gracilis     | 12.20       | 34.96                | 73.00             | 28.52                      | 63.48            |
| Koeleria pyramidata    | 5.30        | 15.19                | 39.00             | 15.23                      | 30.42            |
| Muhlenbergia cuspidata | 0.30        | 0.86                 | 3.00              | 1.17                       | 2.03             |
| Stipa comata           | 2.90        | 8.31                 | 25.00             | 9.77                       | 18.08            |
| Stipa viridula         | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Carex filifolia        | 5.80        | 16.62                | 44.00             | 17.19                      | 33.81            |
| Carex heliophila       | 0.20        | 0.57                 | 2.00              | 0.78                       | 1.35             |
| Antennaria parvifolia  | 0.20        | 0.57                 | 2.00              | 0.78                       | 1.35             |
| Arabis holboellii      | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Artemisia dracunculus  | 0.50        | 1.43                 | 5.00              | 1.95                       | 3.38             |
| Artemisia frigida      | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Erysimum asperum       | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Haplopappus spinulosus | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Liatris punctata       | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Linum rigidum          | 0.40        | 1.15                 | 2.00              | 0.78                       | 1.93             |
| Orthocarpus luteus     | 0.20        | 0.57                 | 2.00              | 0.78                       | 1.35             |
| Oxytropis lambertii    | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Penstemon albidus      | 0.10        | 0.29                 | 1.00              | 0.39                       | 0.68             |
| Phlox hoodii           | 2.50        | 7.16                 | 21.00             | 8.20                       | 15.36            |
| Vicia americana        | 0.20        | 0.57                 | 2.00              | 0.78                       | 1.35             |
| Selaginella densa      | 0.30        | 0.86                 | 3.00              | 1.17                       | 2.03             |
| Lichen spp.            | 2.80        | 8.02                 | 22.00             | 8.59                       | 16.61            |
| Furrow                 | 1.10        |                      | 7.00              |                            |                  |
| Litter                 | 57.60       |                      | 100.00            |                            |                  |
| Rock                   | 0.00        |                      | 0.00              |                            |                  |
| Sod                    | 5.90        |                      | 16.00             |                            |                  |
| Soil                   | 0.50        |                      | 5.00              |                            |                  |

**Table 88. Points Analysis of the Grazed Shallow Range Site on the Native Range, Pasture 6, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.30               | 0.82                        | 3.00                     | 1.21                              | 2.03                    |
| Bouteloua gracilis     | 14.80              | 40.66                       | 75.00                    | 30.24                             | 70.90                   |
| Koeleria pyramidata    | 4.80               | 13.19                       | 36.00                    | 14.52                             | 27.71                   |
| Stipa comata           | 3.10               | 8.52                        | 24.00                    | 9.68                              | 18.20                   |
| Stipa viridula         | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Carex filifolia        | 7.10               | 19.51                       | 52.00                    | 20.97                             | 40.48                   |
| Carex heliophila       | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Allionia albida        | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Artemisia dracunculus  | 0.50               | 1.37                        | 5.00                     | 2.02                              | 3.39                    |
| Aster ericoides        | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Grindelia squarrosa    | 0.20               | 0.55                        | 2.00                     | 0.81                              | 1.36                    |
| Liatris punctata       | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Petalostemon purpureum | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Phlox hoodii           | 2.50               | 6.87                        | 21.00                    | 8.47                              | 15.34                   |
| Sphaeralcea coccinea   | 0.10               | 0.27                        | 1.00                     | 0.40                              | 0.67                    |
| Selaginella densa      | 0.70               | 1.92                        | 6.00                     | 2.42                              | 4.34                    |
| Lichen spp.            | 1.70               | 4.67                        | 17.00                    | 6.85                              | 11.52                   |
| Furrow                 | 1.60               |                             | 15.00                    |                                   |                         |
| Litter                 | 57.60              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.10               |                             | 1.00                     |                                   |                         |
| Sod                    | 3.60               |                             | 8.00                     |                                   |                         |
| Soil                   | 0.70               |                             | 5.00                     |                                   |                         |

**Table 89. Points Analysis of the Ungrazed Silty Range Site on the Native Range, Pasture 6, For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 2.00               | 4.88                        | 18.00                    | 6.77                              | 11.65                   |
| Bouteloua gracilis      | 12.80              | 31.22                       | 58.00                    | 21.80                             | 53.02                   |
| Koeleria pyramidata     | 3.20               | 7.80                        | 23.00                    | 8.65                              | 16.45                   |
| Stipa comata            | 3.60               | 8.78                        | 29.00                    | 10.90                             | 19.68                   |
| Stipa viridula          | 3.90               | 9.51                        | 26.00                    | 9.77                              | 19.28                   |
| Carex filifolia         | 3.60               | 8.78                        | 19.00                    | 7.14                              | 15.92                   |
| Carex heliophila        | 0.80               | 1.95                        | 6.00                     | 2.26                              | 4.21                    |
| Agoseris glauca         | 0.50               | 1.22                        | 5.00                     | 1.88                              | 3.10                    |
| Antennaria parvifolia   | 1.80               | 4.39                        | 8.00                     | 3.01                              | 7.40                    |
| Artemisia dracunculus   | 0.30               | 0.73                        | 3.00                     | 1.13                              | 1.86                    |
| Artemisia frigida       | 0.50               | 1.22                        | 5.00                     | 1.88                              | 3.10                    |
| Aster ericoides         | 0.50               | 1.22                        | 5.00                     | 1.88                              | 3.10                    |
| Conyza canadensis       | 1.60               | 3.90                        | 14.00                    | 5.26                              | 9.16                    |
| Hedeoma hispida         | 0.30               | 0.73                        | 3.00                     | 1.13                              | 1.86                    |
| Medicago spp.           | 0.20               | 0.49                        | 2.00                     | 0.75                              | 1.24                    |
| Opuntia fragilis        | 0.10               | 0.24                        | 1.00                     | 0.38                              | 0.62                    |
| Potentilla pensylvanica | 4.10               | 10.00                       | 29.00                    | 10.90                             | 20.90                   |
| Psoralea argophylla     | 0.20               | 0.49                        | 2.00                     | 0.75                              | 1.24                    |
| Psoralea esculenta      | 0.10               | 0.24                        | 1.00                     | 0.38                              | 0.62                    |
| Ratibida columnifera    | 0.20               | 0.49                        | 2.00                     | 0.75                              | 1.24                    |
| Sphaeralcea coccinea    | 0.70               | 1.71                        | 7.00                     | 2.63                              | 4.34                    |
| Furrow                  | 3.00               |                             | 6.00                     |                                   |                         |
| Litter                  | 48.10              |                             | 98.00                    |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                     | 7.90               |                             | 16.00                    |                                   |                         |
| Soil                    | 0.00               |                             | 0.00                     |                                   |                         |

**Table 90. Points Analysis of the Grazed Silty Range Site on the Native Range, Pasture 6,  
For the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                 | Basal<br>Cover | Relative<br>Basal<br>Cover | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------|----------------|----------------------------|----------------------|----------------------------------|---------------------|
| Agropyron smithii       | 2.20           | 5.51                       | 20.00                | 6.83                             | 12.34               |
| Bouteloua gracilis      | 11.90          | 29.82                      | 67.00                | 22.87                            | 52.69               |
| Koeleria pyramidata     | 1.50           | 3.76                       | 14.00                | 4.78                             | 8.54                |
| Stipa comata            | 2.20           | 5.51                       | 18.00                | 6.14                             | 11.65               |
| Stipa viridula          | 5.20           | 13.03                      | 36.00                | 12.29                            | 25.32               |
| Carex filifolia         | 4.50           | 11.28                      | 33.00                | 11.26                            | 22.54               |
| Carex heliophila        | 1.20           | 3.01                       | 9.00                 | 3.07                             | 6.08                |
| Achillea millefolium    | 0.20           | 0.50                       | 2.00                 | 0.68                             | 1.18                |
| Agoseris glauca         | 1.00           | 2.51                       | 10.00                | 3.41                             | 5.92                |
| Antennaria parvifolia   | 0.40           | 1.00                       | 2.00                 | 0.68                             | 1.68                |
| Arabis holboellii       | 0.10           | 0.25                       | 1.00                 | 0.34                             | 0.59                |
| Artemisia dracunculus   | 0.20           | 0.50                       | 2.00                 | 0.68                             | 1.18                |
| Artemisia frigida       | 0.50           | 1.25                       | 4.00                 | 1.37                             | 2.62                |
| Aster ericoides         | 1.00           | 2.51                       | 10.00                | 3.41                             | 5.92                |
| Conyza canadensis       | 0.40           | 1.00                       | 4.00                 | 1.37                             | 2.37                |
| Grindelia squarrosa     | 0.20           | 0.50                       | 2.00                 | 0.68                             | 1.18                |
| Lactuca oblongifolia    | 0.20           | 0.50                       | 2.00                 | 0.68                             | 1.18                |
| Lotus americanus        | 0.50           | 1.25                       | 5.00                 | 1.71                             | 2.96                |
| Medicago spp.           | 0.90           | 2.26                       | 5.00                 | 1.71                             | 3.97                |
| Opuntia fragilis        | 0.90           | 2.26                       | 3.00                 | 1.02                             | 3.28                |
| Oxytropis lambertii     | 0.30           | 0.75                       | 3.00                 | 1.02                             | 1.77                |
| Phlox hoodii            | 0.60           | 1.50                       | 4.00                 | 1.37                             | 2.87                |
| Potentilla pensylvanica | 3.20           | 8.02                       | 31.00                | 10.58                            | 18.60               |
| Psoralea argophylla     | 0.40           | 1.00                       | 4.00                 | 1.37                             | 2.37                |
| Ratibida columnifera    | 0.20           | 0.50                       | 2.00                 | 0.68                             | 1.18                |
| Furrow                  | 2.40           |                            | 7.00                 |                                  |                     |
| Litter                  | 54.00          |                            | 97.00                |                                  |                     |
| Rock                    | 0.00           |                            | 0.00                 |                                  |                     |
| Sod                     | 3.70           |                            | 9.00                 |                                  |                     |
| Soil                    | 0.00           |                            | 0.00                 |                                  |                     |

**Table 91. Percentage of Basal Cover for the Native Range Pastures on the Complementary Grazing System  
At the Dickinson Experiment Station, 1984**

| System – WEST    | Past.<br># | Grass | Sedge | Forbs | Shrubs | Club<br>Moss | Lichen | Litter | Rock | Soil |
|------------------|------------|-------|-------|-------|--------|--------------|--------|--------|------|------|
| <b>Ungrazed:</b> |            |       |       |       |        |              |        |        |      |      |
| Clayey           | 1          | 29.90 | 0.40  | 2.90  | 0.00   | 0.00         | 0.10   | 66.40  | 0.00 | 0.30 |
|                  | 3          | 38.10 | 3.50  | 7.60  | 0.00   | 0.00         | 0.80   | 50.00  | 0.00 | 0.00 |
|                  | 5          |       |       |       |        |              |        |        |      |      |
| Sandy            | 1          | 11.80 | 25.30 | 1.60  | 0.20   | 0.00         | 0.00   | 61.10  | 0.00 | 0.00 |
|                  | 3          | 8.90  | 14.50 | 1.20  | 0.00   | 0.00         | 0.00   | 75.20  | 0.00 | 0.20 |
|                  | 5          | 16.70 | 11.40 | 2.80  | 0.10   | 0.00         | 0.00   | 69.00  | 0.00 | 0.00 |
| Shallow          | 1          | 24.10 | 5.70  | 3.20  | 0.00   | 0.00         | 0.80   | 65.90  | 0.00 | 0.30 |
|                  | 3          | 40.40 | 2.20  | 2.10  | 0.10   | 0.00         | 0.00   | 55.00  | 0.00 | 0.20 |
|                  | 5          | 20.20 | 6.90  | 2.90  | 0.80   | 0.00         | 0.40   | 67.10  | 0.00 | 1.70 |
| Silty            | 1          | 33.30 | 2.30  | 4.70  | 0.00   | 0.00         | 0.00   | 59.70  | 0.00 | 0.00 |
|                  | 3          | 26.60 | 0.00  | 3.40  | 0.00   | 0.00         | 0.00   | 70.00  | 0.00 | 0.00 |
|                  | 5          | 31.30 | 4.40  | 2.30  | 0.00   | 0.00         | 0.00   | 62.00  | 0.00 | 0.00 |
| <b>Grazed:</b>   |            |       |       |       |        |              |        |        |      |      |
| Clayey           | 1          | 29.10 | 0.70  | 1.90  | 0.00   | 0.00         | 0.00   | 67.70  | 0.00 | 0.60 |
|                  | 3          | 35.30 | 3.70  | 3.60  | 0.20   | 0.00         | 2.70   | 54.40  | 0.00 | 0.10 |
|                  | 5          |       |       |       |        |              |        |        |      |      |
| Sandy            | 1          | 14.30 | 25.70 | 0.80  | 0.40   | 0.00         | 0.00   | 58.80  | 0.00 | 0.00 |
|                  | 3          | 9.20  | 15.50 | 0.80  | 0.10   | 0.00         | 0.20   | 74.20  | 0.00 | 0.00 |
|                  | 5          | 16.80 | 9.90  | 3.70  | 0.40   | 0.00         | 0.10   | 68.60  | 0.00 | 0.50 |
| Shallow          | 1          | 26.90 | 7.10  | 2.60  | 0.00   | 0.00         | 0.00   | 61.40  | 0.00 | 2.00 |
|                  | 3          | 41.10 | 2.00  | 1.70  | 0.10   | 0.00         | 0.40   | 54.70  | 0.00 | 0.00 |
|                  | 5          | 19.60 | 6.50  | 3.30  | 0.50   | 0.00         | 0.20   | 67.80  | 0.00 | 2.10 |
| Silty            | 1          | 34.70 | 1.30  | 2.10  | 0.00   | 0.00         | 0.10   | 61.80  | 0.00 | 0.00 |
|                  | 3          | 29.00 | 0.70  | 3.00  | 0.00   | 0.00         | 0.00   | 67.30  | 0.00 | 0.00 |
|                  | 5          | 20.80 | 5.30  | 7.20  | 0.00   | 0.00         | 0.00   | 66.70  | 0.00 | 0.00 |

**Table 92. Percentage of Basal Cover for the Native Range Pastures on the Complementary Grazing System  
At the Dickinson Experiment Station, 1984**

| System – EAST    | Past.<br># | Grass | Sedge | Forbs | Shrubs | Club<br>Moss | Lichen | Furrow | Litter | Rock | Sod   | Soil |
|------------------|------------|-------|-------|-------|--------|--------------|--------|--------|--------|------|-------|------|
| <b>Ungrazed:</b> |            |       |       |       |        |              |        |        |        |      |       |      |
| Clayey           | 2          | 24.60 | 2.30  | 6.60  | 0.00   | 0.00         | 0.50   | 5.10   | 54.40  | 0.00 | 6.50  | 0.00 |
|                  | 4          | 24.90 | 3.30  | 5.40  | 0.00   | 0.00         | 1.70   | 10.00  | 41.90  | 0.00 | 12.80 | 0.00 |
|                  | 6          |       |       |       |        |              |        |        |        |      |       |      |
| Sandy            | 2          | 10.80 | 8.30  | 0.60  | 0.00   | 0.00         | 0.50   | 4.80   | 67.80  | 0.00 | 6.80  | 0.40 |
|                  | 4          | 19.00 | 12.80 | 2.70  | 0.30   | 0.00         | 0.10   | 3.80   | 55.80  | 0.00 | 5.20  | 0.30 |
|                  | 6          | 11.60 | 22.30 | 2.10  | 0.00   | 0.00         | 0.10   | 0.40   | 60.60  | 0.00 | 2.80  | 0.10 |
| Shallow          | 2          | 20.50 | 9.60  | 3.20  | 0.00   | 0.00         | 0.20   | 4.10   | 54.10  | 0.00 | 7.00  | 1.30 |
|                  | 4          | 21.30 | 7.40  | 2.80  | 0.00   | 0.00         | 0.90   | 4.20   | 55.80  | 0.00 | 5.40  | 2.20 |
|                  | 6          | 21.10 | 6.00  | 4.70  | 0.00   | 0.30         | 2.80   | 1.10   | 57.60  | 0.00 | 5.90  | 0.50 |
| Silty            | 2          | 40.30 | 6.10  | 3.70  | 0.00   | 0.10         | 0.20   | 5.80   | 39.00  | 0.00 | 0.00  | 4.80 |
|                  | 4          | 28.20 | 4.40  | 2.60  | 0.00   | 0.00         | 0.00   | 2.20   | 60.40  | 0.00 | 1.80  | 0.40 |
|                  | 6          | 25.50 | 4.40  | 11.10 | 0.00   | 0.00         | 0.00   | 3.00   | 48.10  | 0.00 | 7.90  | 0.00 |
| <b>Grazed:</b>   |            |       |       |       |        |              |        |        |        |      |       |      |
| Clayey           | 2          | 31.30 | 0.50  | 8.00  | 0.00   | 0.00         | 0.00   | 3.50   | 52.20  | 0.00 | 4.50  | 0.00 |
|                  | 4          | 16.00 | 0.40  | 2.50  | 0.00   | 0.00         | 2.50   | 9.90   | 51.50  | 0.00 | 16.10 | 1.10 |
|                  | 6          |       |       |       |        |              |        |        |        |      |       |      |
| Sandy            | 2          | 10.80 | 8.90  | 0.70  | 0.00   | 0.00         | 0.10   | 3.80   | 69.30  | 0.00 | 4.30  | 2.10 |
|                  | 4          | 17.90 | 10.70 | 1.80  | 0.00   | 0.00         | 0.00   | 5.60   | 53.20  | 0.00 | 10.80 | 0.00 |
|                  | 6          | 7.80  | 24.50 | 1.40  | 0.40   | 0.00         | 0.00   | 0.70   | 59.40  | 0.00 | 5.80  | 0.00 |
| Shallow          | 2          | 18.20 | 10.10 | 2.80  | 0.00   | 0.00         | 0.70   | 3.10   | 57.50  | 0.00 | 6.50  | 1.10 |
|                  | 4          | 19.30 | 7.50  | 2.00  | 0.00   | 0.00         | 0.40   | 4.80   | 59.50  | 0.10 | 2.70  | 3.70 |
|                  | 6          | 23.10 | 7.20  | 3.70  | 0.00   | 0.70         | 1.70   | 1.60   | 57.60  | 0.10 | 3.60  | 0.70 |
| Silty            | 2          | 43.50 | 5.30  | 3.70  | 0.00   | 0.00         | 0.10   | 4.30   | 38.50  | 0.00 | 4.50  | 0.10 |
|                  | 4          | 27.90 | 6.20  | 2.80  | 0.00   | 0.00         | 0.10   | 3.80   | 55.20  | 0.00 | 3.10  | 0.90 |
|                  | 6          | 23.00 | 5.70  | 11.20 | 0.00   | 0.00         | 0.00   | 2.40   | 54.00  | 0.00 | 3.70  | 0.00 |

**Table 93. Mean Percentage of Basal Cover for the Native Range Pastures on the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>System – WEST</b> | <b>Grass</b> | <b>Sedge</b> | <b>Forbs</b> | <b>Shrubs</b> | <b>Club Moss</b> | <b>Lichen</b> | <b>Furrow</b> | <b>Litter</b> | <b>Rock</b> | <b>Sod</b> | <b>Soil</b> |
|----------------------|--------------|--------------|--------------|---------------|------------------|---------------|---------------|---------------|-------------|------------|-------------|
| <b>Ungrazed:</b>     |              |              |              |               |                  |               |               |               |             |            |             |
| Clayey               | 34.00        | 1.95         | 5.25         | 0.00          | 0.00             | 0.45          | 0.00          | 58.20         | 0.00        | 0.00       | 0.15        |
| Sandy                | 12.47        | 17.07        | 1.87         | 0.10          | 0.00             | 0.00          | 0.00          | 67.43         | 0.00        | 0.00       | 0.07        |
| Shallow              | 28.23        | 4.93         | 2.73         | 0.30          | 0.00             | 0.40          | 0.00          | 62.67         | 0.00        | 0.00       | 0.73        |
| Silty                | 30.40        | 2.23         | 3.47         | 0.00          | 0.00             | 0.00          | 0.00          | 63.90         | 0.00        | 0.00       | 0.00        |
| <b>Grazed:</b>       |              |              |              |               |                  |               |               |               |             |            |             |
| Clayey               | 32.20        | 2.20         | 2.75         | 0.10          | 0.00             | 1.35          | 0.00          | 61.05         | 0.00        | 0.00       | 0.35        |
| Sandy                | 13.43        | 17.03        | 1.77         | 0.30          | 0.00             | 0.10          | 0.00          | 67.20         | 0.00        | 0.00       | 0.17        |
| Shallow              | 29.20        | 5.20         | 2.53         | 0.20          | 0.00             | 0.20          | 0.00          | 61.30         | 0.00        | 0.00       | 1.37        |
| Silty                | 28.17        | 2.43         | 4.10         | 0.00          | 0.00             | 0.03          | 0.00          | 65.27         | 0.00        | 0.00       | 0.00        |
|                      |              |              |              |               |                  |               |               |               |             |            |             |
| <b>System – EAST</b> |              |              |              |               |                  |               |               |               |             |            |             |
| <b>Ungrazed:</b>     |              |              |              |               |                  |               |               |               |             |            |             |
| Clayey               | 24.75        | 2.80         | 6.00         | 0.00          | 0.00             | 1.10          | 7.55          | 48.15         | 0.00        | 9.65       | 0.00        |
| Sandy                | 13.80        | 14.47        | 1.80         | 0.10          | 0.00             | 0.23          | 3.00          | 61.40         | 0.00        | 4.93       | 0.27        |
| Shallow              | 20.97        | 7.67         | 3.57         | 0.00          | 0.10             | 1.30          | 3.13          | 55.83         | 0.00        | 6.10       | 1.33        |
| Silty                | 31.33        | 4.97         | 5.80         | 0.00          | 0.03             | 0.07          | 3.67          | 49.17         | 0.00        | 4.83       | 0.13        |
| <b>Grazed:</b>       |              |              |              |               |                  |               |               |               |             |            |             |
| Clayey               | 23.65        | 0.45         | 5.25         | 0.00          | 0.00             | 1.25          | 6.70          | 51.85         | 0.00        | 10.30      | 0.55        |
| Sandy                | 12.17        | 14.70        | 1.30         | 0.13          | 0.00             | 0.03          | 3.37          | 60.63         | 0.00        | 6.97       | 0.70        |
| Shallow              | 20.20        | 8.27         | 2.83         | 0.00          | 0.23             | 0.93          | 3.17          | 58.20         | 0.07        | 4.27       | 1.83        |
| Silty                | 31.47        | 5.73         | 5.90         | 0.00          | 0.00             | 0.07          | 3.50          | 49.23         | 0.00        | 3.77       | 0.33        |

**Table 94. Points Analysis of the Ungrazed West Pasture, on the Altai Wildrye, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal<br/>Cover</b> | <b>Relative<br/>Basal<br/>Cover</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|------------------------|-------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Avena sativa           | 0.40                   | 1.17                                | 3.50                         | 2.10                                      | 3.27                        |
| Elymus angustus        | 15.00                  | 43.80                               | 64.00                        | 38.44                                     | 82.24                       |
| Poa pratensis          | 0.20                   | 0.58                                | 1.00                         | 0.60                                      | 1.18                        |
| Setaria glauca         | 1.30                   | 3.80                                | 6.50                         | 3.90                                      | 7.70                        |
| Setaria viridis        | 3.60                   | 10.51                               | 19.00                        | 11.41                                     | 21.92                       |
| Stipa viridula         | 1.00                   | 2.92                                | 6.00                         | 3.60                                      | 6.52                        |
| Amaranthus retroflexus | 0.10                   | 0.29                                | 1.00                         | 0.60                                      | 0.89                        |
| Chenopodium album      | 0.35                   | 1.02                                | 3.00                         | 1.80                                      | 2.82                        |
| Convolvulus arvensis   | 0.25                   | 0.73                                | 2.50                         | 1.50                                      | 2.23                        |
| Conyza canadensis      | 0.35                   | 1.02                                | 3.00                         | 1.80                                      | 2.82                        |
| Helianthus rigidus     | 0.05                   | 0.15                                | 0.50                         | 0.30                                      | 0.45                        |
| Kochia scoparia        | 9.75                   | 28.47                               | 41.00                        | 24.62                                     | 53.09                       |
| Lactuca oblongifolia   | 0.10                   | 0.29                                | 1.00                         | 0.60                                      | 0.89                        |
| Polygonum convolvulus  | 0.85                   | 2.48                                | 7.00                         | 4.20                                      | 6.68                        |
| Xanthium strumarium    | 0.75                   | 2.19                                | 6.00                         | 3.60                                      | 5.79                        |
| Rosa arkansana         | 0.20                   | 0.58                                | 1.50                         | 0.90                                      | 1.48                        |
| Litter                 | 62.95                  |                                     | 99.00                        |                                           |                             |
| Rock                   | 0.10                   |                                     | 1.00                         |                                           |                             |
| Soil                   | 2.70                   |                                     | 8.50                         |                                           |                             |

**Table 95. Points Analysis of the Ungrazed East Pasture, on the Altai Wildrye, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-----------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Avena sativa          | 0.15               | 0.47                        | 1.50                     | 0.93                              | 1.40                    |
| Elymus angustus       | 17.20              | 54.26                       | 73.50                    | 45.37                             | 99.63                   |
| Setaria viridis       | 2.20               | 6.94                        | 16.50                    | 10.19                             | 17.13                   |
| Chenopodium album     | 0.05               | 0.16                        | 0.50                     | 0.31                              | 0.47                    |
| Convolvulus arvensis  | 0.15               | 0.47                        | 1.50                     | 0.93                              | 1.40                    |
| Conyza canadensis     | 0.40               | 1.26                        | 3.00                     | 1.85                              | 3.11                    |
| Kochia scoparia       | 9.15               | 28.86                       | 46.00                    | 28.40                             | 57.26                   |
| Lactuca oblongifolia  | 0.45               | 1.42                        | 4.00                     | 2.47                              | 3.89                    |
| Polygonum convolvulus | 1.25               | 3.94                        | 9.50                     | 5.86                              | 9.80                    |
| Salsola kali          | 0.05               | 0.16                        | 0.50                     | 0.31                              | 0.47                    |
| Xanthium strumarium   | 0.65               | 2.05                        | 5.50                     | 3.40                              | 5.45                    |
| Litter                | 62.90              |                             | 99.50                    |                                   |                         |
| Rock                  | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                  | 5.35               |                             | 26.00                    |                                   |                         |

**Table 96. Density Analysis per 0.1 Sq. Meter of the Ungrazed Clayey Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 0.44           | 4.76                                    | 24.00                        | 6.25                                      | 11.01                       |
| Arabis holboellii       | 0.04           | 0.43                                    | 4.00                         | 1.04                                      | 1.47                        |
| Artemisia dracunculus   | 0.08           | 0.87                                    | 8.00                         | 2.08                                      | 2.95                        |
| Artemisia frigida       | 0.72           | 7.79                                    | 36.00                        | 9.38                                      | 17.17                       |
| Conyza canadensis       | 3.56           | 38.53                                   | 68.00                        | 17.71                                     | 56.24                       |
| Grindelia squarrosa     | 0.36           | 3.90                                    | 28.00                        | 7.29                                      | 11.19                       |
| Hedeoma hispida         | 0.56           | 6.06                                    | 16.00                        | 4.17                                      | 10.23                       |
| Lotus americanus        | 1.16           | 12.55                                   | 60.00                        | 15.63                                     | 28.18                       |
| Phlox hoodii            | 0.08           | 0.87                                    | 4.00                         | 1.04                                      | 1.91                        |
| Potentilla pensylvanica | 0.36           | 3.90                                    | 20.00                        | 5.21                                      | 9.11                        |
| Ratibida columnifera    | 0.60           | 6.49                                    | 48.00                        | 12.50                                     | 18.99                       |
| Sphaeralcea coccinea    | 1.28           | 13.85                                   | 68.00                        | 17.71                                     | 31.56                       |

**Table 97. Density Analysis per 0.1 Sq. Meter of the Grazed Clayey Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 0.60           | 9.09                                    | 32.00                        | 8.70                                      | 17.79                       |
| Androsace occidentalis  | 0.04           | 0.61                                    | 4.00                         | 1.09                                      | 1.70                        |
| Antennaria parvifolia   | 0.12           | 1.82                                    | 8.00                         | 2.17                                      | 3.99                        |
| Artemisia dracunculus   | 0.04           | 0.61                                    | 4.00                         | 1.09                                      | 1.70                        |
| Artemisia frigida       | 0.92           | 13.94                                   | 60.00                        | 16.30                                     | 30.24                       |
| Astragalus crassicaupus | 0.04           | 0.61                                    | 4.00                         | 1.09                                      | 1.70                        |
| Conyza canadensis       | 1.20           | 18.18                                   | 64.00                        | 17.39                                     | 35.57                       |
| Grindelia squarrosa     | 0.36           | 5.45                                    | 24.00                        | 6.52                                      | 11.97                       |
| Hedeoma hispida         | 1.44           | 21.82                                   | 48.00                        | 13.04                                     | 34.86                       |
| Lotus americanus        | 0.04           | 0.61                                    | 4.00                         | 1.09                                      | 1.70                        |
| Potentilla pensylvanica | 0.16           | 2.42                                    | 12.00                        | 3.26                                      | 5.68                        |
| Ratibida columnifera    | 1.20           | 18.18                                   | 68.00                        | 18.48                                     | 36.66                       |
| Sphaeralcea coccinea    | 0.44           | 6.67                                    | 36.00                        | 9.78                                      | 16.45                       |

**Table 98. Density Analysis per 0.1 Sq. Meter of the Ungrazed Sandy Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Artemisia ludoviciana</i>  | 0.84           | 19.44                                   | 32.00                        | 12.12                                     | 31.56                       |
| <i>Asclepias verticillata</i> | 0.72           | 16.67                                   | 52.00                        | 19.70                                     | 36.37                       |
| <i>Aster ericoides</i>        | 0.28           | 6.48                                    | 28.00                        | 10.61                                     | 17.09                       |
| <i>Chrysopsis villosa</i>     | 0.08           | 1.85                                    | 8.00                         | 3.03                                      | 4.88                        |
| <i>Echinacea angustifolia</i> | 0.08           | 1.85                                    | 4.00                         | 1.52                                      | 3.37                        |
| <i>Gaura coccinea</i>         | 0.04           | 0.93                                    | 4.00                         | 1.52                                      | 2.45                        |
| <i>Hedeoma hispida</i>        | 0.04           | 0.93                                    | 4.00                         | 1.52                                      | 2.45                        |
| <i>Helianthus rigidus</i>     | 0.16           | 3.70                                    | 12.00                        | 4.55                                      | 8.25                        |
| <i>Lepidium densiflorum</i>   | 0.04           | 0.93                                    | 4.00                         | 1.52                                      | 2.45                        |
| <i>Liatis punctata</i>        | 0.08           | 1.85                                    | 8.00                         | 3.03                                      | 4.88                        |
| <i>Lithospermum incisum</i>   | 0.04           | 0.93                                    | 4.00                         | 1.52                                      | 2.45                        |
| <i>Lygodesmia juncea</i>      | 0.64           | 14.81                                   | 44.00                        | 16.67                                     | 31.48                       |
| <i>Psoralea argophylla</i>    | 0.08           | 1.85                                    | 8.00                         | 3.03                                      | 4.88                        |
| <i>Senecio plattensis</i>     | 0.12           | 2.78                                    | 12.00                        | 4.55                                      | 7.33                        |
| <i>Rosa arkansana</i>         | 1.08           | 25.00                                   | 40.00                        | 15.15                                     | 40.15                       |

**Table 99. Density Analysis per 0.1 Sq. Meter of the Grazed Sandy Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.12           | 3.13                                    | 8.00                         | 3.28                                      | 6.41                        |
| Artemisia ludoviciana  | 0.44           | 11.46                                   | 32.00                        | 13.11                                     | 24.57                       |
| Asclepias verticillata | 1.24           | 32.29                                   | 68.00                        | 27.87                                     | 60.16                       |
| Aster ericoides        | 0.04           | 1.04                                    | 4.00                         | 1.64                                      | 2.68                        |
| Echinacea angustifolia | 0.08           | 2.08                                    | 4.00                         | 1.64                                      | 3.72                        |
| Gaura coccinea         | 0.32           | 8.33                                    | 20.00                        | 8.20                                      | 16.53                       |
| Grindelia squarrosa    | 0.04           | 1.04                                    | 4.00                         | 1.64                                      | 2.68                        |
| Hedeoma hispida        | 0.04           | 1.04                                    | 4.00                         | 1.64                                      | 2.68                        |
| Liatris punctata       | 0.24           | 6.25                                    | 20.00                        | 8.20                                      | 14.45                       |
| Lithospermum incisum   | 0.12           | 3.13                                    | 8.00                         | 3.28                                      | 6.41                        |
| Lygodesmia juncea      | 0.32           | 8.33                                    | 20.00                        | 8.20                                      | 16.53                       |
| Opuntia fragilis       | 0.08           | 2.08                                    | 8.00                         | 3.28                                      | 5.36                        |
| Oxytropis lambertii    | 0.04           | 1.04                                    | 4.00                         | 1.64                                      | 2.68                        |
| Ratibida columnifera   | 0.04           | 1.04                                    | 4.00                         | 1.64                                      | 2.68                        |
| Senecio plattensis     | 0.04           | 1.04                                    | 4.00                         | 1.64                                      | 2.68                        |
| Rosa arkansana         | 0.64           | 16.67                                   | 32.00                        | 13.11                                     | 29.78                       |

**Table 100. Density Analysis per 0.1 Sq. Meter of the Ungrazed Shallow Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                       | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Antennaria parvifolia</i>  | 0.28    | 4.67                           | 8.00                 | 2.27                             | 6.94                |
| <i>Artemisia dracunculus</i>  | 0.24    | 4.00                           | 12.00                | 3.41                             | 7.41                |
| <i>Artemisia frigida</i>      | 0.16    | 2.67                           | 16.00                | 4.55                             | 7.22                |
| <i>Aster ericoides</i>        | 1.20    | 20.00                          | 48.00                | 13.64                            | 33.64               |
| <i>Cerastium arvense</i>      | 0.04    | 0.67                           | 4.00                 | 1.14                             | 1.81                |
| <i>Chrysopsis villosa</i>     | 0.04    | 0.67                           | 4.00                 | 1.14                             | 1.81                |
| <i>Cirsium undulatum</i>      | 0.08    | 1.33                           | 8.00                 | 2.27                             | 3.60                |
| <i>Echinacea angustifolia</i> | 0.64    | 10.67                          | 40.00                | 11.36                            | 22.03               |
| <i>Erysimum asperum</i>       | 0.16    | 2.67                           | 16.00                | 4.55                             | 7.22                |
| <i>Gaura coccinea</i>         | 0.16    | 2.67                           | 12.00                | 3.41                             | 6.08                |
| <i>Grindelia squarrosa</i>    | 0.04    | 0.67                           | 4.00                 | 1.14                             | 1.81                |
| <i>Haplopappus spinulosus</i> | 0.08    | 1.33                           | 8.00                 | 2.27                             | 3.60                |
| <i>Liatris punctata</i>       | 0.04    | 0.67                           | 4.00                 | 1.14                             | 1.81                |
| <i>Linum rigidum</i>          | 0.12    | 2.00                           | 12.00                | 3.41                             | 5.41                |
| <i>Lotus americanus</i>       | 0.20    | 3.33                           | 8.00                 | 2.27                             | 5.60                |
| <i>Neslia paniculata</i>      | 0.08    | 1.33                           | 4.00                 | 1.14                             | 2.47                |
| <i>Penstemon albidus</i>      | 0.08    | 1.33                           | 8.00                 | 2.27                             | 3.60                |
| <i>Petalostemon purpureum</i> | 0.44    | 7.33                           | 32.00                | 9.09                             | 16.42               |
| <i>Phlox hoodii</i>           | 1.36    | 22.67                          | 52.00                | 14.77                            | 37.44               |
| <i>Polygala alba</i>          | 0.08    | 1.33                           | 8.00                 | 2.27                             | 3.60                |
| <i>Psoralea argophylla</i>    | 0.12    | 2.00                           | 12.00                | 3.41                             | 5.41                |
| <i>Ratibida columnifera</i>   | 0.08    | 1.33                           | 8.00                 | 2.27                             | 3.60                |
| <i>Sphaeralcea coccinea</i>   | 0.12    | 2.00                           | 12.00                | 3.41                             | 5.41                |
| <i>Rosa arkansana</i>         | 0.16    | 2.67                           | 12.00                | 3.41                             | 6.08                |

**Table 101. Density Analysis per 0.1 Sq. Meter of the Grazed Shallow Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Arabis holboellii       | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Artemisia dracunculus   | 0.20           | 2.98                                    | 20.00                        | 6.85                                      | 9.83                        |
| Artemisia frigida       | 0.08           | 1.19                                    | 8.00                         | 2.74                                      | 3.93                        |
| Aster ericoides         | 3.00           | 44.64                                   | 56.00                        | 19.18                                     | 63.82                       |
| Chrysopsis villosa      | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Echinacea angustifolia  | 0.24           | 3.57                                    | 16.00                        | 5.48                                      | 9.05                        |
| Erysimum asperum        | 0.24           | 3.57                                    | 24.00                        | 8.22                                      | 11.79                       |
| Grindelia squarrosa     | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Haplopappus spinulosus  | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Hedeoma hispida         | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Lactuca oblongifolia    | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Liatris punctata        | 0.32           | 4.76                                    | 16.00                        | 5.48                                      | 10.24                       |
| Linum rigidum           | 0.12           | 1.79                                    | 12.00                        | 4.11                                      | 5.90                        |
| Lotus americanus        | 0.24           | 3.57                                    | 24.00                        | 8.22                                      | 11.79                       |
| Opuntia fragilis        | 0.12           | 1.79                                    | 8.00                         | 2.74                                      | 4.53                        |
| Penstemon albidus       | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Petalostemon purpureum  | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Phlox hoodii            | 1.52           | 22.62                                   | 44.00                        | 15.07                                     | 37.69                       |
| Polygala alba           | 0.12           | 1.79                                    | 12.00                        | 4.11                                      | 5.90                        |
| Potentilla pensylvanica | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Psoralea argophylla     | 0.04           | 0.60                                    | 4.00                         | 1.37                                      | 1.97                        |
| Ratibida columnifera    | 0.12           | 1.79                                    | 12.00                        | 4.11                                      | 5.90                        |

**Table 102. Density Analysis per 0.1 Sq. Meter of the Ungrazed Silty Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>    | 0.20           | 3.82                                    | 20.00                        | 6.10                                      | 9.92                        |
| <i>Arabis holboellii</i>       | 0.16           | 3.05                                    | 16.00                        | 4.88                                      | 7.93                        |
| <i>Artemisia frigida</i>       | 1.28           | 24.43                                   | 76.00                        | 23.17                                     | 47.60                       |
| <i>Conyza canadensis</i>       | 0.80           | 15.27                                   | 44.00                        | 13.41                                     | 28.68                       |
| <i>Descurainia sophia</i>      | 0.04           | 0.76                                    | 4.00                         | 1.22                                      | 1.98                        |
| <i>Grindelia squarrosa</i>     | 0.12           | 2.29                                    | 12.00                        | 3.66                                      | 5.95                        |
| <i>Gutierrezia sarothrae</i>   | 0.08           | 1.53                                    | 8.00                         | 2.44                                      | 3.97                        |
| <i>Hedeoma hispida</i>         | 0.64           | 12.21                                   | 24.00                        | 7.32                                      | 19.53                       |
| <i>Lactuca oblongifolia</i>    | 0.04           | 0.76                                    | 4.00                         | 1.22                                      | 1.98                        |
| <i>Opuntia fragilis</i>        | 0.04           | 0.76                                    | 4.00                         | 1.22                                      | 1.98                        |
| <i>Potentilla pensylvanica</i> | 0.08           | 1.53                                    | 8.00                         | 2.44                                      | 3.97                        |
| <i>Ratibida columnifera</i>    | 0.68           | 12.98                                   | 36.00                        | 10.98                                     | 23.96                       |
| <i>Sphaeralcea coccinea</i>    | 1.08           | 20.61                                   | 72.00                        | 21.95                                     | 42.56                       |

**Table 103. Density Analysis per 0.1 Sq. Meter of the Grazed Silty Range Site on the Native Range, Pasture 1, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 1.00           | 28.74                                   | 32.00                        | 14.29                                     | 43.03                       |
| Arabis holboellii       | 0.04           | 1.15                                    | 4.00                         | 1.79                                      | 2.94                        |
| Artemisia dracunculus   | 0.08           | 2.30                                    | 8.00                         | 3.57                                      | 5.87                        |
| Artemisia frigida       | 0.60           | 17.24                                   | 48.00                        | 21.43                                     | 38.67                       |
| Conyza canadensis       | 0.28           | 8.05                                    | 20.00                        | 8.93                                      | 16.98                       |
| Grindelia squarrosa     | 0.04           | 1.15                                    | 4.00                         | 1.79                                      | 2.94                        |
| Hedeoma hispida         | 0.32           | 9.20                                    | 24.00                        | 10.71                                     | 19.91                       |
| Lactuca oblongifolia    | 0.04           | 1.15                                    | 4.00                         | 1.79                                      | 2.94                        |
| Opuntia fragilis        | 0.08           | 2.30                                    | 8.00                         | 3.57                                      | 5.87                        |
| Plantago purshii        | 0.04           | 1.15                                    | 4.00                         | 1.79                                      | 2.94                        |
| Potentilla pensylvanica | 0.04           | 1.15                                    | 4.00                         | 1.79                                      | 2.94                        |
| Ratibida columnifera    | 0.72           | 20.69                                   | 52.00                        | 23.21                                     | 43.90                       |
| Senecio plattensis      | 0.08           | 2.30                                    | 4.00                         | 1.79                                      | 4.09                        |
| Sphaeralcea coccinea    | 0.08           | 2.30                                    | 4.00                         | 1.79                                      | 4.09                        |
| Tragopogon dubius       | 0.04           | 1.15                                    | 4.00                         | 1.79                                      | 2.94                        |

**Table 104. Density Analysis per 0.1 Sq. Meter of the Ungrazed Clayey Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 2.52           | 24.51                                   | 72.00                        | 15.25                                     | 39.76                       |
| Antennaria parvifolia   | 0.12           | 1.17                                    | 4.00                         | 0.85                                      | 2.02                        |
| Arabis holboellii       | 0.04           | 0.39                                    | 4.00                         | 0.85                                      | 1.24                        |
| Artemisia dracunculus   | 0.56           | 5.45                                    | 32.00                        | 6.78                                      | 12.23                       |
| Artemisia frigida       | 2.04           | 19.84                                   | 84.00                        | 17.80                                     | 37.64                       |
| Aster ericoides         | 0.36           | 3.50                                    | 24.00                        | 5.08                                      | 8.58                        |
| Conyza canadensis       | 1.68           | 16.34                                   | 68.00                        | 14.41                                     | 30.75                       |
| Grindelia squarrosa     | 0.28           | 2.72                                    | 20.00                        | 4.24                                      | 6.96                        |
| Lotus americanus        | 0.32           | 3.11                                    | 28.00                        | 5.93                                      | 9.04                        |
| Potentilla pensylvanica | 0.24           | 2.33                                    | 24.00                        | 5.08                                      | 7.41                        |
| Psoralea argophylla     | 0.12           | 1.17                                    | 8.00                         | 1.69                                      | 2.86                        |
| Ratibida columnifera    | 1.24           | 12.06                                   | 60.00                        | 12.71                                     | 24.77                       |
| Senecio plattensis      | 0.12           | 1.17                                    | 8.00                         | 1.69                                      | 2.86                        |
| Sphaeralcea coccinea    | 0.08           | 0.78                                    | 8.00                         | 1.69                                      | 2.47                        |
| Vicia americana         | 0.56           | 5.45                                    | 28.00                        | 5.93                                      | 11.38                       |

**Table 105. Density Analysis per 0.1 Sq. Meter of the Grazed Clayey Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>    | 1.28           | 15.38                                   | 48.00                        | 13.19                                     | 28.57                       |
| <i>Arabis holboellii</i>       | 0.08           | 0.96                                    | 8.00                         | 2.20                                      | 3.16                        |
| <i>Artemisia dracunculus</i>   | 0.32           | 3.85                                    | 24.00                        | 6.59                                      | 10.44                       |
| <i>Artemisia frigida</i>       | 1.68           | 20.19                                   | 72.00                        | 19.78                                     | 39.97                       |
| <i>Cirsium undulatum</i>       | 0.16           | 1.92                                    | 4.00                         | 1.10                                      | 3.02                        |
| <i>Conyza canadensis</i>       | 2.76           | 33.17                                   | 72.00                        | 19.78                                     | 52.95                       |
| <i>Descurainia sophia</i>      | 0.04           | 0.48                                    | 4.00                         | 1.10                                      | 1.58                        |
| <i>Echinacea angustifolia</i>  | 0.12           | 1.44                                    | 4.00                         | 1.10                                      | 2.54                        |
| <i>Grindelia squarrosa</i>     | 0.28           | 3.37                                    | 20.00                        | 5.49                                      | 8.86                        |
| <i>Gutierrezia sarothrae</i>   | 0.04           | 0.48                                    | 4.00                         | 1.10                                      | 1.58                        |
| <i>Hedeoma hispida</i>         | 0.08           | 0.96                                    | 4.00                         | 1.10                                      | 2.06                        |
| <i>Opuntia fragilis</i>        | 0.08           | 0.96                                    | 4.00                         | 1.10                                      | 2.06                        |
| <i>Potentilla pensylvanica</i> | 0.12           | 1.44                                    | 12.00                        | 3.30                                      | 4.74                        |
| <i>Psoralea argophylla</i>     | 0.12           | 1.44                                    | 8.00                         | 2.20                                      | 3.64                        |
| <i>Ratibida columnifera</i>    | 0.52           | 6.25                                    | 36.00                        | 9.89                                      | 16.14                       |
| <i>Senecio plattensis</i>      | 0.16           | 1.92                                    | 16.00                        | 4.40                                      | 6.32                        |
| <i>Sphaeralcea coccinea</i>    | 0.48           | 5.77                                    | 24.00                        | 6.59                                      | 12.36                       |

**Table 106. Density Analysis per 0.1 Sq. Meter of the Ungrazed Sandy Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia caudata       | 0.40           | 13.89                                   | 12.00                        | 6.98                                      | 20.87                       |
| Artemisia dracunculus   | 0.32           | 11.11                                   | 20.00                        | 11.63                                     | 22.74                       |
| Artemisia frigida       | 0.12           | 4.17                                    | 8.00                         | 4.65                                      | 8.82                        |
| Artemisia ludoviciana   | 0.76           | 26.39                                   | 28.00                        | 16.28                                     | 42.67                       |
| Asclepias verticillata  | 0.08           | 2.78                                    | 4.00                         | 2.33                                      | 5.11                        |
| Erysimum asperum        | 0.32           | 11.11                                   | 24.00                        | 13.95                                     | 25.06                       |
| Gaura coccinea          | 0.12           | 4.17                                    | 12.00                        | 6.98                                      | 11.15                       |
| Grindelia squarrosa     | 0.08           | 2.78                                    | 4.00                         | 2.33                                      | 5.11                        |
| Haplopappus spinulosus  | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Hedeoma hispida         | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Helianthus rigidus      | 0.12           | 4.17                                    | 4.00                         | 2.33                                      | 6.50                        |
| Lotus americanus        | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Lygodesmia juncea       | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Musineon divaricatum    | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Phlox hoodii            | 0.16           | 5.56                                    | 16.00                        | 9.30                                      | 14.86                       |
| Potentilla pensylvanica | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Psoralea argophylla     | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Ratibida columnifera    | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Sphaeralcea coccinea    | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |
| Rosa arkansana          | 0.04           | 1.39                                    | 4.00                         | 2.33                                      | 3.72                        |

**Table 107. Density Analysis per 0.1 Sq. Meter of the Grazed Sandy Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.28           | 10.14                                   | 24.00                        | 12.24                                     | 22.38                       |
| Artemisia frigida      | 0.08           | 2.90                                    | 8.00                         | 4.08                                      | 6.98                        |
| Artemisia ludoviciana  | 0.76           | 27.54                                   | 16.00                        | 8.16                                      | 35.70                       |
| Chrysopsis villosa     | 0.08           | 2.90                                    | 8.00                         | 4.08                                      | 6.98                        |
| Echinacea angustifolia | 0.08           | 2.90                                    | 8.00                         | 4.08                                      | 6.98                        |
| Erysimum asperum       | 0.08           | 2.90                                    | 8.00                         | 4.08                                      | 6.98                        |
| Gaura coccinea         | 0.20           | 7.25                                    | 16.00                        | 8.16                                      | 15.41                       |
| Grindelia squarrosa    | 0.04           | 1.45                                    | 4.00                         | 2.04                                      | 3.49                        |
| Haplopappus spinulosus | 0.08           | 2.90                                    | 8.00                         | 4.08                                      | 6.98                        |
| Liatris punctata       | 0.04           | 1.45                                    | 4.00                         | 2.04                                      | 3.49                        |
| Lygodesmia juncea      | 0.28           | 10.14                                   | 24.00                        | 12.24                                     | 22.38                       |
| Musineon divaricatum   | 0.04           | 1.45                                    | 4.00                         | 2.04                                      | 3.49                        |
| Opuntia fragilis       | 0.04           | 1.45                                    | 4.00                         | 2.04                                      | 3.49                        |
| Oxytropis lambertii    | 0.20           | 7.25                                    | 20.00                        | 10.20                                     | 17.45                       |
| Petalostemon purpureum | 0.24           | 8.70                                    | 16.00                        | 8.16                                      | 16.86                       |
| Ratibida columnifera   | 0.12           | 4.35                                    | 12.00                        | 6.12                                      | 10.47                       |
| Sphaeralcea coccinea   | 0.12           | 4.35                                    | 12.00                        | 6.12                                      | 10.47                       |

**Table 108. Density Analysis per 0.1 Sq. Meter of the Ungrazed Shallow Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Arabis holboellii</i>       | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Artemisia caudata</i>       | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Artemisia dracunculus</i>   | 0.44           | 13.92                                   | 24.00                        | 8.96                                      | 22.88                       |
| <i>Artemisia frigida</i>       | 0.12           | 3.80                                    | 12.00                        | 4.48                                      | 8.28                        |
| <i>Asclepias verticillata</i>  | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Aster ericoides</i>         | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Erysimum asperum</i>        | 0.24           | 7.59                                    | 24.00                        | 8.96                                      | 16.55                       |
| <i>Gaura coccinea</i>          | 0.48           | 15.19                                   | 48.00                        | 17.91                                     | 33.10                       |
| <i>Grindelia squarrosa</i>     | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Haplopappus spinulosus</i>  | 0.08           | 2.53                                    | 8.00                         | 2.99                                      | 5.52                        |
| <i>Hedeoma hispida</i>         | 0.08           | 2.53                                    | 8.00                         | 2.99                                      | 5.52                        |
| <i>Lepidium densiflorum</i>    | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Liatris punctata</i>        | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Linum rigidum</i>           | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Lithospermum incisum</i>    | 0.08           | 2.53                                    | 8.00                         | 2.99                                      | 5.52                        |
| <i>Lotus americanus</i>        | 0.20           | 6.33                                    | 20.00                        | 7.46                                      | 13.79                       |
| <i>Oxytropis lambertii</i>     | 0.28           | 8.86                                    | 20.00                        | 7.46                                      | 16.32                       |
| <i>Penstemon albidus</i>       | 0.04           | 1.27                                    | 4.00                         | 1.49                                      | 2.76                        |
| <i>Petalostemon purpureum</i>  | 0.32           | 10.13                                   | 24.00                        | 8.96                                      | 19.09                       |
| <i>Phlox hoodia</i>            | 0.20           | 6.33                                    | 16.00                        | 5.97                                      | 12.30                       |
| <i>Potentilla pensylvanica</i> | 0.08           | 2.53                                    | 4.00                         | 1.49                                      | 4.02                        |
| <i>Psoralea argophylla</i>     | 0.12           | 3.80                                    | 12.00                        | 4.48                                      | 8.28                        |
| <i>Sphaeralcea coccinea</i>    | 0.08           | 2.53                                    | 4.00                         | 1.49                                      | 4.02                        |

**Table 109. Density Analysis per 0.1 Sq. Meter of the Grazed Shallow Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.24           | 9.38                                    | 24.00                        | 12.24                                     | 21.62                       |
| Artemisia frigida      | 0.16           | 6.25                                    | 16.00                        | 8.16                                      | 14.41                       |
| Aster ericoides        | 0.28           | 10.94                                   | 12.00                        | 6.12                                      | 17.06                       |
| Chrysopsis villosa     | 0.04           | 1.56                                    | 4.00                         | 2.04                                      | 3.60                        |
| Erysimum asperum       | 0.20           | 7.81                                    | 16.00                        | 8.16                                      | 15.97                       |
| Haplopappus spinulosus | 0.40           | 15.63                                   | 24.00                        | 12.24                                     | 27.87                       |
| Hedeoma hispida        | 0.08           | 3.13                                    | 8.00                         | 4.08                                      | 7.21                        |
| Liatris punctata       | 0.16           | 6.25                                    | 12.00                        | 6.12                                      | 12.37                       |
| Linum rigidum          | 0.08           | 3.13                                    | 8.00                         | 4.08                                      | 7.21                        |
| Oxytropis lambertii    | 0.40           | 15.63                                   | 28.00                        | 14.29                                     | 29.92                       |
| Petalostemon purpureum | 0.08           | 3.13                                    | 8.00                         | 4.08                                      | 7.21                        |
| Phlox hoodii           | 0.36           | 14.06                                   | 28.00                        | 14.29                                     | 28.35                       |
| Psoralea argophylla    | 0.08           | 3.13                                    | 8.00                         | 4.08                                      | 7.21                        |

**Table 110. Density Analysis per 0.1 Sq. Meter of the Ungrazed Silty Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 0.20           | 2.46                                    | 20.00                        | 5.32                                      | 7.78                        |
| Arabis holboellii       | 0.16           | 1.97                                    | 8.00                         | 2.13                                      | 4.10                        |
| Artemisia dracunculus   | 0.32           | 3.94                                    | 20.00                        | 5.32                                      | 9.26                        |
| Artemisia frigida       | 1.28           | 15.76                                   | 60.00                        | 15.96                                     | 31.72                       |
| Conyza Canadensis       | 3.32           | 40.89                                   | 76.00                        | 20.21                                     | 61.10                       |
| Grindelia squarrosa     | 0.16           | 1.97                                    | 8.00                         | 2.13                                      | 4.10                        |
| Hedeoma hispida         | 1.08           | 13.30                                   | 56.00                        | 14.89                                     | 28.19                       |
| Lotus americanus        | 0.32           | 3.94                                    | 28.00                        | 7.45                                      | 11.39                       |
| Plantago purshii        | 0.20           | 2.46                                    | 16.00                        | 4.26                                      | 6.72                        |
| Potentilla pensylvanica | 0.04           | 0.49                                    | 4.00                         | 1.06                                      | 1.55                        |
| Psoralea esculenta      | 0.04           | 0.49                                    | 4.00                         | 1.06                                      | 1.55                        |
| Ratibida columnifera    | 0.16           | 1.97                                    | 16.00                        | 4.26                                      | 6.23                        |
| Senecio plattensis      | 0.12           | 1.48                                    | 8.00                         | 2.13                                      | 3.61                        |
| Sphaeralcea coccinea    | 0.72           | 8.87                                    | 52.00                        | 13.83                                     | 22.70                       |

**Table 111. Density Analysis per 0.1 Sq. Meter of the Grazed Silty Range Site on the Native Range, Pasture 2, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium  | 0.08           | 1.30                                    | 8.00                         | 2.25                                      | 3.55                        |
| Agoseris glauca       | 0.24           | 3.90                                    | 8.00                         | 2.25                                      | 6.15                        |
| Arabis holboellii     | 0.20           | 3.25                                    | 12.00                        | 3.37                                      | 6.62                        |
| Artemisia dracunculus | 0.12           | 1.95                                    | 12.00                        | 3.37                                      | 5.32                        |
| Artemisia frigida     | 1.20           | 19.48                                   | 68.00                        | 19.10                                     | 38.58                       |
| Aster ericoides       | 0.08           | 1.30                                    | 8.00                         | 2.25                                      | 3.55                        |
| Conyza Canadensis     | 1.08           | 17.53                                   | 44.00                        | 12.36                                     | 29.89                       |
| Grindelia squarrosa   | 0.08           | 1.30                                    | 8.00                         | 2.25                                      | 3.55                        |
| Hedeoma hispida       | 0.96           | 15.58                                   | 44.00                        | 12.36                                     | 27.94                       |
| Linum rigidum         | 0.04           | 0.65                                    | 4.00                         | 1.12                                      | 1.77                        |
| Lotus americanus      | 0.28           | 4.55                                    | 16.00                        | 4.49                                      | 9.04                        |
| Plantago purshii      | 0.04           | 0.65                                    | 4.00                         | 1.12                                      | 1.77                        |
| Psoralea argophylla   | 0.04           | 0.65                                    | 4.00                         | 1.12                                      | 1.77                        |
| Ratibida columnifera  | 0.36           | 5.84                                    | 32.00                        | 8.99                                      | 14.83                       |
| Senecio plattensis    | 0.12           | 1.95                                    | 8.00                         | 2.25                                      | 4.20                        |
| Sphaeralcea coccinea  | 1.16           | 18.83                                   | 72.00                        | 20.22                                     | 39.05                       |
| Taraxacum officinale  | 0.08           | 1.30                                    | 4.00                         | 1.12                                      | 2.42                        |

**Table 112. Density Analysis per 0.1 Sq. Meter of the Ungrazed Clayey Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium   | 0.88           | 11.00                                   | 28.00                        | 8.64                                      | 19.64                       |
| Antennaria parvifolia  | 0.16           | 2.00                                    | 4.00                         | 1.23                                      | 3.23                        |
| Arabis holboellii      | 0.04           | 0.50                                    | 4.00                         | 1.23                                      | 1.73                        |
| Artemisia dracunculus  | 0.28           | 3.50                                    | 24.00                        | 7.41                                      | 10.91                       |
| Artemisia frigida      | 0.16           | 2.00                                    | 8.00                         | 2.47                                      | 4.47                        |
| Artemisia ludoviciana  | 1.92           | 24.00                                   | 48.00                        | 14.81                                     | 38.81                       |
| Aster ericoides        | 1.24           | 15.50                                   | 12.00                        | 3.70                                      | 19.20                       |
| Conyza Canadensis      | 0.04           | 0.50                                    | 4.00                         | 1.23                                      | 1.73                        |
| Echinacea angustifolia | 0.04           | 0.50                                    | 4.00                         | 1.23                                      | 1.73                        |
| Grindelia squarrosa    | 0.20           | 2.50                                    | 12.00                        | 3.70                                      | 6.20                        |
| Hedeoma hispida        | 1.04           | 13.00                                   | 56.00                        | 17.28                                     | 30.28                       |
| Liatris punctata       | 0.04           | 0.50                                    | 4.00                         | 1.23                                      | 1.73                        |
| Linum rigidum          | 0.16           | 2.00                                    | 12.00                        | 3.70                                      | 5.70                        |
| Lotus americanus       | 0.08           | 1.00                                    | 4.00                         | 1.23                                      | 2.23                        |
| Oxytropis lambertii    | 0.04           | 0.50                                    | 4.00                         | 1.23                                      | 1.73                        |
| Phlox hoodia           | 0.20           | 2.50                                    | 4.00                         | 1.23                                      | 3.73                        |
| Plantago purshii       | 0.48           | 6.00                                    | 24.00                        | 7.41                                      | 13.41                       |
| Polygala alba          | 0.04           | 0.50                                    | 4.00                         | 1.23                                      | 1.73                        |
| Psoralea argophylla    | 0.60           | 7.50                                    | 40.00                        | 12.35                                     | 19.85                       |
| Ratibida columnifera   | 0.36           | 4.50                                    | 24.00                        | 7.41                                      | 11.91                       |

**Table 113. Density Analysis per 0.1 Sq. Meter of the Grazed Clayey Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium  | 0.68           | 7.91                                    | 24.00                        | 7.23                                      | 15.14                       |
| Antennaria parvifolia | 0.60           | 6.98                                    | 4.00                         | 1.20                                      | 8.18                        |
| Artemisia dracunculus | 0.20           | 2.33                                    | 16.00                        | 4.82                                      | 7.15                        |
| Artemisia frigida     | 0.08           | 0.93                                    | 8.00                         | 2.41                                      | 3.34                        |
| Artemisia ludoviciana | 0.04           | 0.47                                    | 4.00                         | 1.20                                      | 1.67                        |
| Aster ericoides       | 2.44           | 28.37                                   | 32.00                        | 9.64                                      | 38.01                       |
| Grindelia squarrosa   | 0.56           | 6.51                                    | 48.00                        | 14.46                                     | 20.97                       |
| Hedeoma hispida       | 0.52           | 6.05                                    | 32.00                        | 9.64                                      | 15.69                       |
| Lepidium densiflorum  | 0.04           | 0.47                                    | 4.00                         | 1.20                                      | 1.67                        |
| Liatris punctata      | 0.96           | 11.16                                   | 20.00                        | 6.02                                      | 17.18                       |
| Linum rigidum         | 0.40           | 4.65                                    | 32.00                        | 9.64                                      | 14.29                       |
| Lotus americanus      | 0.12           | 1.40                                    | 4.00                         | 1.20                                      | 2.60                        |
| Phlox hoodia          | 0.20           | 2.33                                    | 12.00                        | 3.61                                      | 5.94                        |
| Plantago purshii      | 1.04           | 12.09                                   | 36.00                        | 10.84                                     | 22.93                       |
| Psoralea argophylla   | 0.44           | 5.12                                    | 28.00                        | 8.43                                      | 13.55                       |
| Ratibida columnifera  | 0.12           | 1.40                                    | 12.00                        | 3.61                                      | 5.01                        |
| Senecio plattensis    | 0.04           | 0.47                                    | 4.00                         | 1.20                                      | 1.67                        |
| Taraxacum officinale  | 0.04           | 0.47                                    | 4.00                         | 1.20                                      | 1.67                        |
| Rosa arkansana        | 0.08           | 0.93                                    | 8.00                         | 2.41                                      | 3.34                        |

**Table 114. Density Analysis per 0.1 Sq. Meter of the Ungrazed Sandy Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species               | Density | Relative Percent Density | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------|---------|--------------------------|-------------------|----------------------------|------------------|
| Antennaria parvifolia | 0.04    | 1.64                     | 4.00              | 2.38                       | 4.02             |
| Artemisia dracunculus | 0.92    | 37.70                    | 60.00             | 35.71                      | 73.41            |
| Artemisia ludoviciana | 0.76    | 31.15                    | 44.00             | 26.19                      | 57.34            |
| Chrysopsis villosa    | 0.04    | 1.64                     | 4.00              | 2.38                       | 4.02             |
| Erysimum asperum      | 0.04    | 1.64                     | 4.00              | 2.38                       | 4.02             |
| Hedeoma hispida       | 0.04    | 1.64                     | 4.00              | 2.38                       | 4.02             |
| Linum rigidum         | 0.12    | 4.92                     | 12.00             | 7.14                       | 12.06            |
| Musineon divaricatum  | 0.04    | 1.64                     | 4.00              | 2.38                       | 4.02             |
| Psoralea argophylla   | 0.08    | 3.28                     | 8.00              | 4.76                       | 8.04             |
| Solidago rigida       | 0.32    | 13.11                    | 20.00             | 11.90                      | 25.01            |
| Sphaeralcea coccinea  | 0.04    | 1.64                     | 4.00              | 2.38                       | 4.02             |

**Table 115. Density Analysis per 0.1 Sq. Meter of the Grazed Sandy Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species               | Density | Relative Percent Density | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------|---------|--------------------------|-------------------|----------------------------|------------------|
| Artemisia dracunculus | 0.40    | 21.28                    | 36.00             | 24.32                      | 45.60            |
| Artemisia frigida     | 0.04    | 2.13                     | 4.00              | 2.70                       | 4.83             |
| Artemisia ludoviciana | 0.60    | 31.91                    | 32.00             | 21.62                      | 53.53            |
| Erysimum asperum      | 0.08    | 4.26                     | 8.00              | 5.41                       | 9.67             |
| Hedeoma hispida       | 0.12    | 6.38                     | 8.00              | 5.41                       | 11.79            |
| Opuntia fragilis      | 0.04    | 2.13                     | 4.00              | 2.70                       | 4.83             |
| Phlox hoodia          | 0.04    | 2.13                     | 4.00              | 2.70                       | 4.83             |
| Psoralea argophylla   | 0.16    | 8.51                     | 16.00             | 10.81                      | 19.32            |
| Solidago rigida       | 0.20    | 10.64                    | 16.00             | 10.81                      | 21.45            |
| Sphaeralcea coccinea  | 0.20    | 10.64                    | 20.00             | 13.51                      | 24.15            |

**Table 116. Density Analysis per 0.1 Sq. Meter of the Ungrazed Shallow Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus | 0.20           | 6.67                                    | 20.00                        | 9.62                                      | 16.29                       |
| Aster ericoides       | 1.16           | 38.67                                   | 52.00                        | 25.00                                     | 63.67                       |
| Erysimum asperum      | 0.12           | 4.00                                    | 12.00                        | 5.77                                      | 9.77                        |
| Gaura coccinea        | 0.24           | 8.00                                    | 16.00                        | 7.69                                      | 15.69                       |
| Grindelia squarrosa   | 0.08           | 2.67                                    | 4.00                         | 1.92                                      | 4.59                        |
| Lactuca oblongifolia  | 0.04           | 1.33                                    | 4.00                         | 1.92                                      | 3.25                        |
| Linum rigidum         | 0.28           | 9.33                                    | 24.00                        | 11.54                                     | 20.87                       |
| Lotus americanus      | 0.20           | 6.67                                    | 20.00                        | 9.62                                      | 16.29                       |
| Lygodesmia juncea     | 0.16           | 5.33                                    | 12.00                        | 5.77                                      | 11.10                       |
| Oxytropis lambertii   | 0.08           | 2.67                                    | 8.00                         | 3.85                                      | 6.52                        |
| Psoralea argophylla   | 0.20           | 6.67                                    | 20.00                        | 9.62                                      | 16.29                       |
| Sphaeralcea coccinea  | 0.04           | 1.33                                    | 4.00                         | 1.92                                      | 3.25                        |
|                       |                |                                         |                              |                                           |                             |
| Rosa arkansana        | 0.20           | 6.67                                    | 12.00                        | 5.77                                      | 12.44                       |

**Table 117. Density Analysis per 0.1 Sq. Meter of the Grazed Shallow Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.28           | 10.45                                   | 20.00                        | 11.90                                     | 22.35                       |
| Artemisia frigida      | 0.12           | 4.48                                    | 12.00                        | 7.14                                      | 11.62                       |
| Erysimum asperum       | 0.24           | 8.96                                    | 24.00                        | 14.29                                     | 23.25                       |
| Gaura coccinea         | 0.40           | 14.93                                   | 20.00                        | 11.90                                     | 26.83                       |
| Hedeoma hispida        | 0.08           | 2.99                                    | 8.00                         | 4.76                                      | 7.75                        |
| Linum rigidum          | 0.16           | 5.97                                    | 16.00                        | 9.52                                      | 15.49                       |
| Lotus americanus       | 0.12           | 4.48                                    | 12.00                        | 7.14                                      | 11.62                       |
| Lygodesmia juncea      | 0.20           | 7.46                                    | 12.00                        | 7.14                                      | 14.60                       |
| Opuntia fragilis       | 0.04           | 1.49                                    | 4.00                         | 2.38                                      | 3.87                        |
| Oxytropis lambertii    | 0.08           | 2.99                                    | 8.00                         | 4.76                                      | 7.75                        |
| Petalostemon purpureum | 0.04           | 1.49                                    | 4.00                         | 2.38                                      | 3.87                        |
| Psoralea argophylla    | 0.20           | 7.46                                    | 12.00                        | 7.14                                      | 14.60                       |
| Solidago missouriensis | 0.72           | 26.87                                   | 16.00                        | 9.52                                      | 36.39                       |

**Table 118. Density Analysis per 0.1 Sq. Meter of the Ungrazed Silty Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                        | Density | Relative Percent Density | Percent Frequency | Relative Percent Frequency | Importance Value |
|--------------------------------|---------|--------------------------|-------------------|----------------------------|------------------|
| <i>Achillea millefolium</i>    | 0.08    | 2.17                     | 4.00              | 2.78                       | 4.95             |
| <i>Artemisia frigida</i>       | 0.56    | 15.22                    | 44.00             | 30.56                      | 45.78            |
| <i>Grindelia squarrosa</i>     | 0.04    | 1.09                     | 4.00              | 2.78                       | 3.87             |
| <i>Hedeoma hispida</i>         | 2.48    | 67.39                    | 56.00             | 38.89                      | 106.28           |
| <i>Linum rigidum</i>           | 0.04    | 1.09                     | 4.00              | 2.78                       | 3.87             |
| <i>Potentilla pensylvanica</i> | 0.04    | 1.09                     | 4.00              | 2.78                       | 3.87             |
| <i>Sphaeralcea coccinea</i>    | 0.44    | 11.96                    | 28.00             | 19.44                      | 31.40            |

**Table 119. Density Analysis per 0.1 Sq. Meter of the Grazed Silty Range Site on the Native Range, Pasture 3, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                      | Density | Relative Percent Density | Percent Frequency | Relative Percent Frequency | Importance Value |
|------------------------------|---------|--------------------------|-------------------|----------------------------|------------------|
| <i>Achillea millefolium</i>  | 0.24    | 6.59                     | 8.00              | 4.44                       | 11.03            |
| <i>Antennaria parvifolia</i> | 0.04    | 1.10                     | 4.00              | 2.22                       | 3.32             |
| <i>Arabis holboellii</i>     | 0.04    | 1.10                     | 4.00              | 2.22                       | 3.32             |
| <i>Artemisia frigida</i>     | 0.60    | 16.48                    | 48.00             | 26.67                      | 43.15            |
| <i>Erysimum asperum</i>      | 0.08    | 2.20                     | 8.00              | 4.44                       | 6.64             |
| <i>Gutierrezia sarothrae</i> | 0.04    | 1.10                     | 4.00              | 2.22                       | 3.32             |
| <i>Hedeoma hispida</i>       | 2.16    | 59.34                    | 64.00             | 35.56                      | 94.90            |
| <i>Lepidium densiflorum</i>  | 0.04    | 1.10                     | 4.00              | 2.22                       | 3.32             |
| <i>Psoralea argophylla</i>   | 0.28    | 7.69                     | 24.00             | 13.33                      | 21.02            |
| <i>Ratibida columnifera</i>  | 0.04    | 1.10                     | 4.00              | 2.22                       | 3.32             |
| <i>Sphaeralcea coccinea</i>  | 0.08    | 2.20                     | 8.00              | 4.44                       | 6.64             |

**Table 120. Density Analysis per 0.1 Sq. Meter of the Ungrazed Clayey Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium  | 0.40           | 10.75                                   | 24.00                        | 11.32                                     | 22.07                       |
| Antennaria parvifolia | 0.88           | 23.66                                   | 8.00                         | 3.77                                      | 27.43                       |
| Artemisia frigida     | 0.16           | 4.30                                    | 12.00                        | 5.66                                      | 9.96                        |
| Aster ericoides       | 0.20           | 5.38                                    | 8.00                         | 3.77                                      | 9.15                        |
| Gaura coccinea        | 0.16           | 4.30                                    | 16.00                        | 7.55                                      | 11.85                       |
| Grindelia squarrosa   | 0.48           | 12.90                                   | 32.00                        | 15.09                                     | 27.99                       |
| Hedeoma hispida       | 0.20           | 5.38                                    | 16.00                        | 7.55                                      | 12.93                       |
| Lepidium densiflorum  | 0.12           | 3.23                                    | 8.00                         | 3.77                                      | 7.00                        |
| Linum rigidum         | 0.04           | 1.08                                    | 4.00                         | 1.89                                      | 2.97                        |
| Lotus americanus      | 0.08           | 2.15                                    | 8.00                         | 3.77                                      | 5.92                        |
| Opuntia fragilis      | 0.16           | 4.30                                    | 8.00                         | 3.77                                      | 8.07                        |
| Phlox hoodii          | 0.04           | 1.08                                    | 4.00                         | 1.89                                      | 2.97                        |
| Plantago purshii      | 0.04           | 1.08                                    | 4.00                         | 1.89                                      | 2.97                        |
| Psoralea argophylla   | 0.08           | 2.15                                    | 4.00                         | 1.89                                      | 4.04                        |
| Ratibida columnifera  | 0.64           | 17.20                                   | 52.00                        | 24.53                                     | 41.73                       |
| Vicia americana       | 0.04           | 1.08                                    | 4.00                         | 1.89                                      | 2.97                        |

**Table 121. Density Analysis per 0.1 Sq. Meter of the Grazed Clayey Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium  | 0.24           | 7.23                                    | 12.00                        | 6.12                                      | 13.35                       |
| Artemisia frigida     | 0.08           | 2.41                                    | 8.00                         | 4.08                                      | 6.49                        |
| Artemisia ludoviciana | 0.08           | 2.41                                    | 8.00                         | 4.08                                      | 6.49                        |
| Aster ericoides       | 0.84           | 25.30                                   | 12.00                        | 6.12                                      | 31.42                       |
| Gaura coccinea        | 0.36           | 10.84                                   | 28.00                        | 14.29                                     | 25.13                       |
| Grindelia squarrosa   | 0.48           | 14.46                                   | 28.00                        | 14.29                                     | 28.75                       |
| Gutierrezia sarothrae | 0.04           | 1.20                                    | 4.00                         | 2.04                                      | 3.24                        |
| Hedeoma hispida       | 0.16           | 4.82                                    | 12.00                        | 6.12                                      | 10.94                       |
| Linum rigidum         | 0.32           | 9.64                                    | 20.00                        | 10.20                                     | 19.84                       |
| Lithospermum incisum  | 0.04           | 1.20                                    | 4.00                         | 2.04                                      | 3.24                        |
| Oxytropis lambertii   | 0.08           | 2.41                                    | 8.00                         | 4.08                                      | 6.49                        |
| Phlox hoodia          | 0.04           | 1.20                                    | 4.00                         | 2.04                                      | 3.24                        |
| Plantago purshii      | 0.16           | 4.82                                    | 8.00                         | 4.08                                      | 8.90                        |
| Psoralea argophylla   | 0.08           | 2.41                                    | 8.00                         | 4.08                                      | 6.49                        |
| Ratibida columnifera  | 0.16           | 4.82                                    | 16.00                        | 8.16                                      | 12.98                       |
| Senecio plattensis    | 0.16           | 4.82                                    | 16.00                        | 8.16                                      | 12.98                       |

**Table 122. Density Analysis per 0.1 Sq. Meter of the Ungrazed Sandy Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Antennaria parvifolia  | 0.08           | 2.35                                    | 8.00                         | 3.64                                      | 5.99                        |
| Artemisia frigida      | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |
| Artemisia ludoviciana  | 1.20           | 35.29                                   | 48.00                        | 21.82                                     | 57.11                       |
| Asclepias verticillata | 0.16           | 4.71                                    | 16.00                        | 7.27                                      | 11.98                       |
| Chrysopsis villosa     | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |
| Echinacea angustifolia | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |
| Gaura coccinea         | 0.56           | 16.47                                   | 32.00                        | 14.55                                     | 31.02                       |
| Lactuca oblongifolia   | 0.20           | 5.88                                    | 16.00                        | 7.27                                      | 13.15                       |
| Liatris punctata       | 0.36           | 10.59                                   | 28.00                        | 12.73                                     | 23.32                       |
| Lygodesmia juncea      | 0.24           | 7.06                                    | 20.00                        | 9.09                                      | 16.15                       |
| Opuntia fragilis       | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |
| Oxytropis lambertii    | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |
| Petalostemon purpureum | 0.12           | 3.53                                    | 8.00                         | 3.64                                      | 7.17                        |
| Psoralea esculenta     | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |
| Ratibida columnifera   | 0.08           | 2.35                                    | 8.00                         | 3.64                                      | 5.99                        |
| Salsola kali           | 0.12           | 3.53                                    | 8.00                         | 3.64                                      | 7.17                        |
| Rosa arkansana         | 0.04           | 1.18                                    | 4.00                         | 1.82                                      | 3.00                        |

**Table 123. Density Analysis per 0.1 Sq. Meter of the Grazed Sandy Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Arabis holboellii</i>      | 0.04           | 1.00                                    | 4.00                         | 1.56                                      | 2.56                        |
| <i>Artemisia dracunculus</i>  | 0.24           | 6.00                                    | 20.00                        | 7.81                                      | 13.81                       |
| <i>Artemisia ludoviciana</i>  | 1.44           | 36.00                                   | 60.00                        | 23.44                                     | 59.44                       |
| <i>Aster ericoides</i>        | 0.08           | 2.00                                    | 8.00                         | 3.13                                      | 5.13                        |
| <i>Chrysopsis villosa</i>     | 0.04           | 1.00                                    | 4.00                         | 1.56                                      | 2.56                        |
| <i>Echinacea angustifolia</i> | 0.04           | 1.00                                    | 4.00                         | 1.56                                      | 2.56                        |
| <i>Gaura coccinea</i>         | 0.16           | 4.00                                    | 16.00                        | 6.25                                      | 10.25                       |
| <i>Lactuca oblongifolia</i>   | 0.84           | 21.00                                   | 44.00                        | 17.19                                     | 38.19                       |
| <i>Liatris punctata</i>       | 0.12           | 3.00                                    | 12.00                        | 4.69                                      | 7.69                        |
| <i>Lygodesmia juncea</i>      | 0.36           | 9.00                                    | 24.00                        | 9.38                                      | 18.38                       |
| <i>Oxytropis lambertii</i>    | 0.24           | 6.00                                    | 20.00                        | 7.81                                      | 13.81                       |
| <i>Petalostemon purpureum</i> | 0.08           | 2.00                                    | 8.00                         | 3.13                                      | 5.13                        |
| <i>Psoralea argophylla</i>    | 0.04           | 1.00                                    | 4.00                         | 1.56                                      | 2.56                        |
| <i>Psoralea esculenta</i>     | 0.04           | 1.00                                    | 4.00                         | 1.56                                      | 2.56                        |
| <i>Ratibida columnifera</i>   | 0.08           | 2.00                                    | 8.00                         | 3.13                                      | 5.13                        |
| <i>Salsola kali</i>           | 0.08           | 2.00                                    | 8.00                         | 3.13                                      | 5.13                        |
| <i>Sphaeralcea coccinea</i>   | 0.08           | 2.00                                    | 8.00                         | 3.13                                      | 5.13                        |

**Table 124. Density Analysis per 0.1 Sq. Meter of the Ungrazed Shallow Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Arabis holboellii</i>       | 0.04           | 0.82                                    | 4.00                         | 1.19                                      | 2.01                        |
| <i>Artemisia dracunculus</i>   | 0.16           | 3.28                                    | 12.00                        | 3.57                                      | 6.85                        |
| <i>Artemisia frigida</i>       | 0.08           | 1.64                                    | 8.00                         | 2.38                                      | 4.02                        |
| <i>Aster ericoides</i>         | 1.20           | 24.59                                   | 44.00                        | 13.10                                     | 37.69                       |
| <i>Chrysopsis villosa</i>      | 0.20           | 4.10                                    | 16.00                        | 4.76                                      | 8.86                        |
| <i>Gaura coccinea</i>          | 0.12           | 2.46                                    | 12.00                        | 3.57                                      | 6.03                        |
| <i>Grindelia squarrosa</i>     | 0.32           | 6.56                                    | 24.00                        | 7.14                                      | 13.70                       |
| <i>Haplopappus spinulosus</i>  | 0.12           | 2.46                                    | 12.00                        | 3.57                                      | 6.03                        |
| <i>Hedeoma hispida</i>         | 0.12           | 2.46                                    | 8.00                         | 2.38                                      | 4.84                        |
| <i>Lactuca oblongifolia</i>    | 0.12           | 2.46                                    | 12.00                        | 3.57                                      | 6.03                        |
| <i>Liatris punctata</i>        | 0.40           | 8.20                                    | 32.00                        | 9.52                                      | 17.72                       |
| <i>Linum rigidum</i>           | 0.04           | 0.82                                    | 4.00                         | 1.19                                      | 2.01                        |
| <i>Lygodesmia juncea</i>       | 0.16           | 3.28                                    | 12.00                        | 3.57                                      | 6.85                        |
| <i>Petalostemon purpureum</i>  | 0.60           | 12.30                                   | 44.00                        | 13.10                                     | 25.40                       |
| <i>Phlox hoodia</i>            | 0.16           | 3.28                                    | 12.00                        | 3.57                                      | 6.85                        |
| <i>Potentilla pensylvanica</i> | 0.04           | 0.82                                    | 4.00                         | 1.19                                      | 2.01                        |
| <i>Psoralea argophylla</i>     | 0.04           | 0.82                                    | 4.00                         | 1.19                                      | 2.01                        |
| <i>Ratibida columnifera</i>    | 0.28           | 5.74                                    | 28.00                        | 8.33                                      | 14.07                       |
| <i>Senecio plattensis</i>      | 0.04           | 0.82                                    | 4.00                         | 1.19                                      | 2.01                        |
| <i>Sphaeralcea coccinea</i>    | 0.64           | 13.11                                   | 40.00                        | 11.90                                     | 25.01                       |

**Table 125. Density Analysis per 0.1 Sq. Meter of the Grazed Shallow Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Androsace occidentalis</i>  | 0.04           | 0.76                                    | 4.00                         | 1.37                                      | 2.13                        |
| <i>Antennaria parvifolia</i>   | 0.16           | 3.05                                    | 4.00                         | 1.37                                      | 4.42                        |
| <i>Artemisia dracunculus</i>   | 0.12           | 2.29                                    | 8.00                         | 2.74                                      | 5.03                        |
| <i>Artemisia frigida</i>       | 0.04           | 0.76                                    | 4.00                         | 1.37                                      | 2.13                        |
| <i>Artemisia ludoviciana</i>   | 0.56           | 10.69                                   | 36.00                        | 12.33                                     | 23.02                       |
| <i>Aster ericoides</i>         | 2.16           | 41.22                                   | 60.00                        | 20.55                                     | 61.77                       |
| <i>Grindelia squarrosa</i>     | 0.08           | 1.53                                    | 8.00                         | 2.74                                      | 4.27                        |
| <i>Haplopappus spinulosus</i>  | 0.16           | 3.05                                    | 12.00                        | 4.11                                      | 7.16                        |
| <i>Hedeoma hispida</i>         | 0.32           | 6.11                                    | 16.00                        | 5.48                                      | 11.59                       |
| <i>Lactuca oblongifolia</i>    | 0.20           | 3.82                                    | 16.00                        | 5.48                                      | 9.30                        |
| <i>Liatris punctata</i>        | 0.12           | 2.29                                    | 12.00                        | 4.11                                      | 6.40                        |
| <i>Linum rigidum</i>           | 0.12           | 2.29                                    | 12.00                        | 4.11                                      | 6.40                        |
| <i>Lithospermum incisum</i>    | 0.08           | 1.53                                    | 4.00                         | 1.37                                      | 2.90                        |
| <i>Opuntia fragilis</i>        | 0.04           | 0.76                                    | 4.00                         | 1.37                                      | 2.13                        |
| <i>Oxytropis lambertii</i>     | 0.04           | 0.76                                    | 4.00                         | 1.37                                      | 2.13                        |
| <i>Petalostemon purpureum</i>  | 0.16           | 3.05                                    | 16.00                        | 5.48                                      | 8.53                        |
| <i>Phlox hoodia</i>            | 0.16           | 3.05                                    | 8.00                         | 2.74                                      | 5.79                        |
| <i>Potentilla pensylvanica</i> | 0.04           | 0.76                                    | 4.00                         | 1.37                                      | 2.13                        |
| <i>Psoralea argophylla</i>     | 0.12           | 2.29                                    | 12.00                        | 4.11                                      | 6.40                        |
| <i>Ratibida columnifera</i>    | 0.24           | 4.58                                    | 20.00                        | 6.85                                      | 11.43                       |
| <i>Senecio plattensis</i>      | 0.24           | 4.58                                    | 24.00                        | 8.22                                      | 12.80                       |
| <i>Sphaeralcea coccinea</i>    | 0.04           | 0.76                                    | 4.00                         | 1.37                                      | 2.13                        |

**Table 126. Density Analysis per 0.1 Sq. Meter of the Ungrazed Silty Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>    | 0.24           | 4.72                                    | 16.00                        | 4.71                                      | 9.43                        |
| <i>Antennaria parvifolia</i>   | 0.04           | 0.79                                    | 4.00                         | 1.18                                      | 1.97                        |
| <i>Arabis holboellii</i>       | 0.08           | 1.57                                    | 8.00                         | 2.35                                      | 3.92                        |
| <i>Artemisia dracunculus</i>   | 0.44           | 8.66                                    | 44.00                        | 12.94                                     | 21.60                       |
| <i>Artemisia frigida</i>       | 0.16           | 3.15                                    | 12.00                        | 3.53                                      | 6.68                        |
| <i>Conyza Canadensis</i>       | 1.04           | 20.47                                   | 48.00                        | 14.12                                     | 34.59                       |
| <i>Coryphantha vivipara</i>    | 0.04           | 0.79                                    | 4.00                         | 1.18                                      | 1.97                        |
| <i>Erigeron glabellus</i>      | 0.04           | 0.79                                    | 4.00                         | 1.18                                      | 1.97                        |
| <i>Grindelia squarrosa</i>     | 0.28           | 5.51                                    | 20.00                        | 5.88                                      | 11.39                       |
| <i>Gutierrezia sarothrae</i>   | 0.12           | 2.36                                    | 4.00                         | 1.18                                      | 3.54                        |
| <i>Hedeoma hispida</i>         | 0.68           | 13.39                                   | 44.00                        | 12.94                                     | 26.33                       |
| <i>Lepidium densiflorum</i>    | 0.12           | 2.36                                    | 8.00                         | 2.35                                      | 4.71                        |
| <i>Opuntia fragilis</i>        | 0.20           | 3.94                                    | 16.00                        | 4.71                                      | 8.65                        |
| <i>Petalostemon purpureum</i>  | 0.08           | 1.57                                    | 4.00                         | 1.18                                      | 2.75                        |
| <i>Plantago purshii</i>        | 0.04           | 0.79                                    | 4.00                         | 1.18                                      | 1.97                        |
| <i>Potentilla pensylvanica</i> | 0.12           | 2.36                                    | 8.00                         | 2.35                                      | 4.71                        |
| <i>Psoralea argophylla</i>     | 0.04           | 0.79                                    | 4.00                         | 1.18                                      | 1.97                        |
| <i>Ratibida columnifera</i>    | 0.12           | 2.36                                    | 12.00                        | 3.53                                      | 5.89                        |
| <i>Salsola kali</i>            | 0.08           | 1.57                                    | 8.00                         | 2.35                                      | 3.92                        |
| <i>Sphaeralcea coccinea</i>    | 1.12           | 22.05                                   | 68.00                        | 20.00                                     | 42.05                       |

**Table 127. Density Analysis per 0.1 Sq. Meter of the Grazed Silty Range Site on the Native Range, Pasture 4, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Arabis holboellii       | 0.04           | 1.27                                    | 4.00                         | 1.89                                      | 3.16                        |
| Artemisia dracunculus   | 0.12           | 3.80                                    | 12.00                        | 5.66                                      | 9.46                        |
| Artemisia frigida       | 0.04           | 1.27                                    | 4.00                         | 1.89                                      | 3.16                        |
| Astragalus crassicaupus | 0.12           | 3.80                                    | 4.00                         | 1.89                                      | 5.69                        |
| Erysimum asperum        | 0.08           | 2.53                                    | 8.00                         | 3.77                                      | 6.30                        |
| Grindelia squarrosa     | 0.12           | 3.80                                    | 12.00                        | 5.66                                      | 9.46                        |
| Hedeoma hispida         | 1.00           | 31.65                                   | 40.00                        | 18.87                                     | 50.52                       |
| Lepidium densiflorum    | 0.04           | 1.27                                    | 4.00                         | 1.89                                      | 3.16                        |
| Linum rigidum           | 0.04           | 1.27                                    | 4.00                         | 1.89                                      | 3.16                        |
| Opuntia fragilis        | 0.28           | 8.86                                    | 16.00                        | 7.55                                      | 16.41                       |
| Oxytropis lambertii     | 0.08           | 2.53                                    | 8.00                         | 3.77                                      | 6.30                        |
| Polygala alba           | 0.24           | 7.59                                    | 24.00                        | 11.32                                     | 18.91                       |
| Ratibida columnifera    | 0.16           | 5.06                                    | 16.00                        | 7.55                                      | 12.61                       |
| Sphaeralcea coccinea    | 0.80           | 25.32                                   | 56.00                        | 26.42                                     | 51.74                       |

**Table 128.     Density Analysis per 0.1 Sq. Meter of the Ungrazed Sandy Range Site on the Native Range, Pasture 5, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus | 0.20           | 7.35                                    | 16.00                        | 12.50                                     | 19.85                       |
| Artemisia ludoviciana | 1.76           | 64.71                                   | 68.00                        | 53.13                                     | 117.84                      |
| Aster ericoides       | 0.28           | 10.29                                   | 8.00                         | 6.25                                      | 16.54                       |
| Helianthus rigidus    | 0.16           | 5.88                                    | 12.00                        | 9.38                                      | 15.26                       |
| Liatris punctata      | 0.08           | 2.94                                    | 4.00                         | 3.13                                      | 6.07                        |
| Psoralea esculenta    | 0.12           | 4.41                                    | 12.00                        | 9.38                                      | 13.79                       |
| Salsola kali          | 0.12           | 4.41                                    | 8.00                         | 6.25                                      | 10.66                       |

**Table 129. Density Analysis per 0.1 Sq. Meter of the Grazed Sandy Range Site on the Native Range, Pasture 5, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.04           | 1.16                                    | 4.00                         | 2.33                                      | 3.49                        |
| Artemisia ludoviciana  | 1.92           | 55.81                                   | 72.00                        | 41.86                                     | 97.67                       |
| Aster ericoides        | 0.12           | 3.49                                    | 12.00                        | 6.98                                      | 10.47                       |
| Chrysopsis villosa     | 0.28           | 8.14                                    | 16.00                        | 9.30                                      | 17.44                       |
| Cirsium undulatum      | 0.04           | 1.16                                    | 4.00                         | 2.33                                      | 3.49                        |
| Echinacea angustifolia | 0.04           | 1.16                                    | 4.00                         | 2.33                                      | 3.49                        |
| Erysimum asperum       | 0.12           | 3.49                                    | 12.00                        | 6.98                                      | 10.47                       |
| Gaura coccinea         | 0.08           | 2.33                                    | 8.00                         | 4.65                                      | 6.98                        |
| Haplopappus spinulosus | 0.04           | 1.16                                    | 4.00                         | 2.33                                      | 3.49                        |
| Helianthus rigidus     | 0.20           | 5.81                                    | 8.00                         | 4.65                                      | 10.46                       |
| Lepidium densiflorum   | 0.04           | 1.16                                    | 4.00                         | 2.33                                      | 3.49                        |
| Liatris punctata       | 0.36           | 10.47                                   | 12.00                        | 6.98                                      | 17.45                       |
| Opuntia fragilis       | 0.12           | 3.49                                    | 8.00                         | 4.65                                      | 8.14                        |
| Psoralea argophylla    | 0.04           | 1.16                                    | 4.00                         | 2.33                                      | 3.49                        |

**Table 130. Density Analysis per 0.1 Sq. Meter of the Ungrazed Shallow Range Site on the Native Range, Pasture 5, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                       | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Antennaria parvifolia</i>  | 0.08    | 1.32                           | 4.00                 | 1.22                             | 2.54                |
| <i>Artemisia dracunculus</i>  | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Artemisia frigida</i>      | 0.20    | 3.29                           | 16.00                | 4.88                             | 8.17                |
| <i>Artemisia ludoviciana</i>  | 0.48    | 7.89                           | 20.00                | 6.10                             | 13.99               |
| <i>Aster ericoides</i>        | 0.56    | 9.21                           | 36.00                | 10.98                            | 20.19               |
| <i>Chrysopsis villosa</i>     | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Echinacea angustifolia</i> | 0.84    | 13.82                          | 56.00                | 17.07                            | 30.89               |
| <i>Erysimum asperum</i>       | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Gaura coccinea</i>         | 0.24    | 3.95                           | 20.00                | 6.10                             | 10.05               |
| <i>Grindelia squarrosa</i>    | 0.88    | 14.47                          | 8.00                 | 2.44                             | 16.91               |
| <i>Gutierrezia sarothrae</i>  | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Helianthus rigidus</i>     | 0.48    | 7.89                           | 24.00                | 7.32                             | 15.21               |
| <i>Lactuca oblongifolia</i>   | 0.08    | 1.32                           | 8.00                 | 2.44                             | 3.76                |
| <i>Linum rigidum</i>          | 0.08    | 1.32                           | 8.00                 | 2.44                             | 3.76                |
| <i>Lotus americanus</i>       | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Oxytropis lambertii</i>    | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Petalostemon purpureum</i> | 0.16    | 2.63                           | 12.00                | 3.66                             | 6.29                |
| <i>Phlox hoodia</i>           | 0.40    | 6.58                           | 20.00                | 6.10                             | 12.68               |
| <i>Psoralea esculenta</i>     | 0.16    | 2.63                           | 16.00                | 4.88                             | 7.51                |
| <i>Ratibida columnifera</i>   | 0.04    | 0.66                           | 4.00                 | 1.22                             | 1.88                |
| <i>Sphaeralcea coccinea</i>   | 0.32    | 5.26                           | 20.00                | 6.10                             | 11.36               |
| <i>Rosa arkansana</i>         | 0.84    | 13.82                          | 32.00                | 9.76                             | 23.58               |

**Table 131. Density Analysis per 0.1 Sq. Meter of the Grazed Shallow Range Site on the Native Range, Pasture 5, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| Species                       | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Artemisia dracunculus</i>  | 0.36    | 6.38                           | 24.00                | 6.45                             | 12.83               |
| <i>Artemisia frigida</i>      | 0.12    | 2.13                           | 12.00                | 3.23                             | 5.36                |
| <i>Artemisia ludoviciana</i>  | 0.32    | 5.67                           | 12.00                | 3.23                             | 8.90                |
| <i>Aster ericoides</i>        | 0.76    | 13.48                          | 44.00                | 11.83                            | 25.31               |
| <i>Echinacea angustifolia</i> | 0.16    | 2.84                           | 16.00                | 4.30                             | 7.14                |
| <i>Erysimum asperum</i>       | 0.24    | 4.26                           | 20.00                | 5.38                             | 9.64                |
| <i>Gaura coccinea</i>         | 0.12    | 2.13                           | 12.00                | 3.23                             | 5.36                |
| <i>Gutierrezia sarothrae</i>  | 0.04    | 0.71                           | 4.00                 | 1.08                             | 1.79                |
| <i>Haplopappus spinulosus</i> | 0.16    | 2.84                           | 16.00                | 4.30                             | 7.14                |
| <i>Hedeoma hispida</i>        | 0.12    | 2.13                           | 4.00                 | 1.08                             | 3.21                |
| <i>Helianthus rigidus</i>     | 0.96    | 17.02                          | 44.00                | 11.83                            | 28.85               |
| <i>Linum rigidum</i>          | 0.60    | 10.64                          | 36.00                | 9.68                             | 20.32               |
| <i>Oxytropis lambertii</i>    | 0.08    | 1.42                           | 8.00                 | 2.15                             | 3.57                |
| <i>Petalostemon purpureum</i> | 0.12    | 2.13                           | 8.00                 | 2.15                             | 4.28                |
| <i>Phlox hoodia</i>           | 0.68    | 12.06                          | 44.00                | 11.83                            | 23.89               |
| <i>Polygala alba</i>          | 0.04    | 0.71                           | 4.00                 | 1.08                             | 1.79                |
| <i>Ratibida columnifera</i>   | 0.12    | 2.13                           | 8.00                 | 2.15                             | 4.28                |
| <i>Solidago missouriensis</i> | 0.04    | 0.71                           | 4.00                 | 1.08                             | 1.79                |
| <i>Sphaeralcea coccinea</i>   | 0.24    | 4.26                           | 24.00                | 6.45                             | 10.71               |
| <i>Rosa arkansana</i>         | 0.36    | 6.38                           | 28.00                | 7.53                             | 13.91               |

**Table 132. Density Analysis per 0.1 Sq. Meter of the Ungrazed Silty Range Site on the Native Range, Pasture 5, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.04           | 0.99                                    | 4.00                         | 1.56                                      | 2.55                        |
| Artemisia frigida      | 0.16           | 3.96                                    | 12.00                        | 4.69                                      | 8.65                        |
| Aster ericoides        | 0.28           | 6.93                                    | 12.00                        | 4.69                                      | 11.62                       |
| Conyza canadensis      | 0.60           | 14.85                                   | 36.00                        | 14.06                                     | 28.91                       |
| Erigeron glabellus     | 0.44           | 10.89                                   | 36.00                        | 14.06                                     | 24.95                       |
| Erysimum asperum       | 0.04           | 0.99                                    | 4.00                         | 1.56                                      | 2.55                        |
| Gaura coccinea         | 0.04           | 0.99                                    | 4.00                         | 1.56                                      | 2.55                        |
| Hedeoma hispida        | 0.52           | 12.87                                   | 32.00                        | 12.50                                     | 25.37                       |
| Lactuca oblongifolia   | 1.08           | 26.73                                   | 56.00                        | 21.88                                     | 48.61                       |
| Linum rigidum          | 0.04           | 0.99                                    | 4.00                         | 1.56                                      | 2.55                        |
| Lotus americanus       | 0.04           | 0.99                                    | 4.00                         | 1.56                                      | 2.55                        |
| Opuntia fragilis       | 0.12           | 2.97                                    | 8.00                         | 3.13                                      | 6.10                        |
| Petalostemon purpureum | 0.04           | 0.99                                    | 4.00                         | 1.56                                      | 2.55                        |
| Ratibida columnifera   | 0.36           | 8.91                                    | 20.00                        | 7.81                                      | 16.72                       |
| Sphaeralcea coccinea   | 0.24           | 5.94                                    | 20.00                        | 7.81                                      | 13.75                       |

**Table 133. Density Analysis per 0.1 Sq. Meter of the Grazed Silty Range Site on the Native Range, Pasture 5, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Antennaria parvifolia   | 0.20           | 4.50                                    | 8.00                         | 3.03                                      | 7.53                        |
| Artemisia dracunculus   | 0.04           | 0.90                                    | 4.00                         | 1.52                                      | 2.42                        |
| Artemisia frigida       | 0.32           | 7.21                                    | 28.00                        | 10.61                                     | 17.82                       |
| Aster ericoides         | 0.52           | 11.71                                   | 28.00                        | 10.61                                     | 22.32                       |
| Conyza canadensis       | 0.24           | 5.41                                    | 12.00                        | 4.55                                      | 9.96                        |
| Erigeron glabellus      | 0.04           | 0.90                                    | 4.00                         | 1.52                                      | 2.42                        |
| Erysimum asperum        | 0.08           | 1.80                                    | 8.00                         | 3.03                                      | 4.83                        |
| Hedeoma hispida         | 0.56           | 12.61                                   | 36.00                        | 13.64                                     | 26.25                       |
| Lactuca oblongifolia    | 1.32           | 29.73                                   | 64.00                        | 24.24                                     | 53.97                       |
| Linum rigidum           | 0.16           | 3.60                                    | 16.00                        | 6.06                                      | 9.66                        |
| Opuntia fragilis        | 0.08           | 1.80                                    | 8.00                         | 3.03                                      | 4.83                        |
| Potentilla pensylvanica | 0.12           | 2.70                                    | 8.00                         | 3.03                                      | 5.73                        |
| Ratibida columnifera    | 0.72           | 16.22                                   | 36.00                        | 13.64                                     | 29.86                       |
| Sphaeralcea coccinea    | 0.04           | 0.90                                    | 4.00                         | 1.52                                      | 2.42                        |

**Table 134. Density Analysis per 0.1 Sq. Meter of the Ungrazed Sandy Range Site on the Native Range, Pasture 6, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus   | 0.20           | 15.63                                   | 16.00                        | 18.18                                     | 33.81                       |
| Artemisia ludoviciana   | 0.20           | 15.63                                   | 4.00                         | 4.55                                      | 20.18                       |
| Asclepias verticillata  | 0.44           | 34.38                                   | 28.00                        | 31.82                                     | 66.20                       |
| Aster ericoides         | 0.08           | 6.25                                    | 4.00                         | 4.55                                      | 10.80                       |
| Echinacea angustifolia  | 0.04           | 3.13                                    | 4.00                         | 4.55                                      | 7.68                        |
| Lactuca oblongifolia    | 0.08           | 6.25                                    | 8.00                         | 9.09                                      | 15.34                       |
| Lepidium densiflorum    | 0.04           | 3.13                                    | 4.00                         | 4.55                                      | 7.68                        |
| Lygodesmia juncea       | 0.04           | 3.13                                    | 4.00                         | 4.55                                      | 7.68                        |
| Opuntia fragilis        | 0.04           | 3.13                                    | 4.00                         | 4.55                                      | 7.68                        |
| Oxytropis lambertii     | 0.08           | 6.25                                    | 8.00                         | 9.09                                      | 15.34                       |
| Potentilla pensylvanica | 0.04           | 3.13                                    | 4.00                         | 4.55                                      | 7.68                        |

**Table 135. Density Analysis per 0.1 Sq. Meter of the Grazed Sandy Range Site on the Native Range, Pasture 6, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Artemisia dracunculus  | 0.32           | 10.26                                   | 16.00                        | 11.43                                     | 21.69                       |
| Artemisia ludoviciana  | 1.44           | 46.15                                   | 36.00                        | 25.71                                     | 71.86                       |
| Asclepias verticillata | 0.24           | 7.69                                    | 20.00                        | 14.29                                     | 21.98                       |
| Aster ericoides        | 0.12           | 3.85                                    | 12.00                        | 8.57                                      | 12.42                       |
| Echinacea angustifolia | 0.04           | 1.28                                    | 4.00                         | 2.86                                      | 4.14                        |
| Lepidium densiflorum   | 0.08           | 2.56                                    | 8.00                         | 5.71                                      | 8.27                        |
| Liatis punctata        | 0.04           | 1.28                                    | 4.00                         | 2.86                                      | 4.14                        |
| Opuntia fragilis       | 0.04           | 1.28                                    | 4.00                         | 2.86                                      | 4.14                        |
| Psoralea argophylla    | 0.04           | 1.28                                    | 4.00                         | 2.86                                      | 4.14                        |
| Rosa arkansana         | 0.76           | 24.36                                   | 32.00                        | 22.86                                     | 47.22                       |

**Table 136. Density Analysis per 0.1 Sq. Meter of the Ungrazed Shallow Range Site on the Native Range, Pasture 6, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Antennaria parvifolia  | 0.12           | 3.06                                    | 4.00                         | 1.61                                      | 4.67                        |
| Artemisia dracunculus  | 0.56           | 14.29                                   | 44.00                        | 17.74                                     | 32.03                       |
| Artemisia frigida      | 0.16           | 4.08                                    | 16.00                        | 6.45                                      | 10.53                       |
| Aster ericoides        | 1.40           | 35.71                                   | 56.00                        | 22.58                                     | 58.29                       |
| Erysimum asperum       | 0.08           | 2.04                                    | 8.00                         | 3.23                                      | 5.27                        |
| Gaura coccinea         | 0.08           | 2.04                                    | 4.00                         | 1.61                                      | 3.65                        |
| Grindelia squarrosa    | 0.16           | 4.08                                    | 16.00                        | 6.45                                      | 10.53                       |
| Hedeoma hispida        | 0.08           | 2.04                                    | 4.00                         | 1.61                                      | 3.65                        |
| Lactuca oblongifolia   | 0.04           | 1.02                                    | 4.00                         | 1.61                                      | 2.63                        |
| Liatris punctata       | 0.60           | 15.31                                   | 36.00                        | 14.52                                     | 29.83                       |
| Lygodesmia juncea      | 0.04           | 1.02                                    | 4.00                         | 1.61                                      | 2.63                        |
| Oxytropis lambertii    | 0.16           | 4.08                                    | 16.00                        | 6.45                                      | 10.53                       |
| Petalostemon purpureum | 0.16           | 4.08                                    | 8.00                         | 3.23                                      | 7.31                        |
| Phlox hoodia           | 0.20           | 5.10                                    | 20.00                        | 8.06                                      | 13.16                       |
| Polygala alba          | 0.08           | 2.04                                    | 8.00                         | 3.23                                      | 5.27                        |

**Table 137. Density Analysis per 0.1 Sq. Meter of the Grazed Shallow Range Site on the Native Range, Pasture 6, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Androsace occidentalis  | 0.12           | 3.70                                    | 12.00                        | 4.62                                      | 8.32                        |
| Artemisia dracunculus   | 0.40           | 12.35                                   | 32.00                        | 12.31                                     | 24.66                       |
| Artemisia frigida       | 0.04           | 1.23                                    | 4.00                         | 1.54                                      | 2.77                        |
| Aster ericoides         | 0.60           | 18.52                                   | 40.00                        | 15.38                                     | 33.90                       |
| Astragalus crassicaupus | 0.28           | 8.64                                    | 16.00                        | 6.15                                      | 14.79                       |
| Echinacea angustifolia  | 0.08           | 2.47                                    | 8.00                         | 3.08                                      | 5.55                        |
| Gaura coccinea          | 0.28           | 8.64                                    | 20.00                        | 7.69                                      | 16.33                       |
| Grindelia squarrosa     | 0.20           | 6.17                                    | 20.00                        | 7.69                                      | 13.86                       |
| Haplopappus spinulosus  | 0.08           | 2.47                                    | 8.00                         | 3.08                                      | 5.55                        |
| Hedeoma hispida         | 0.04           | 1.23                                    | 4.00                         | 1.54                                      | 2.77                        |
| Lactuca oblongifolia    | 0.08           | 2.47                                    | 4.00                         | 1.54                                      | 4.01                        |
| Liatris punctata        | 0.36           | 11.11                                   | 24.00                        | 9.23                                      | 20.34                       |
| Linum rigidum           | 0.08           | 2.47                                    | 8.00                         | 3.08                                      | 5.55                        |
| Oxytropis lambertii     | 0.20           | 6.17                                    | 20.00                        | 7.69                                      | 13.86                       |
| Petalostemon purpureum  | 0.12           | 3.70                                    | 12.00                        | 4.62                                      | 8.32                        |
| Phlox hoodia            | 0.20           | 6.17                                    | 20.00                        | 7.69                                      | 13.86                       |
| Polygala alba           | 0.08           | 2.47                                    | 8.00                         | 3.08                                      | 5.55                        |

**Table 138. Density Analysis per 0.1 Sq. Meter of the Ungrazed Silty Range Site on the Native Range, Pasture 6, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Antennaria parvifolia   | 0.12           | 1.38                                    | 8.00                         | 2.08                                      | 3.46                        |
| Artemisia dracunculus   | 0.08           | 0.92                                    | 8.00                         | 2.08                                      | 3.00                        |
| Artemisia frigida       | 0.44           | 5.07                                    | 36.00                        | 9.38                                      | 14.45                       |
| Conyza canadensis       | 3.24           | 37.33                                   | 72.00                        | 18.75                                     | 56.08                       |
| Erysimum asperum        | 0.12           | 1.38                                    | 12.00                        | 3.13                                      | 4.51                        |
| Hedeoma hispida         | 0.32           | 3.69                                    | 28.00                        | 7.29                                      | 10.98                       |
| Lactuca oblongifolia    | 0.80           | 9.22                                    | 52.00                        | 13.54                                     | 22.76                       |
| Lotus americanus        | 0.56           | 6.45                                    | 36.00                        | 9.38                                      | 15.83                       |
| Opuntia fragilis        | 0.04           | 0.46                                    | 4.00                         | 1.04                                      | 1.50                        |
| Potentilla pensylvanica | 2.16           | 24.88                                   | 84.00                        | 21.88                                     | 46.76                       |
| Psoralea esculenta      | 0.04           | 0.46                                    | 4.00                         | 1.04                                      | 1.50                        |
| Ratibida columnifera    | 0.16           | 1.84                                    | 8.00                         | 2.08                                      | 3.92                        |
| Sphaeralcea coccinea    | 0.60           | 6.91                                    | 32.00                        | 8.33                                      | 15.24                       |

**Table 139. Density Analysis per 0.1 Sq. Meter of the Grazed Silty Range Site on the Native Range, Pasture 6, for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 0.16           | 3.01                                    | 16.00                        | 4.65                                      | 7.66                        |
| Androsace occidentalis  | 0.12           | 2.26                                    | 12.00                        | 3.49                                      | 5.75                        |
| Arabis holboellii       | 0.04           | 0.75                                    | 4.00                         | 1.16                                      | 1.91                        |
| Artemisia dracunculus   | 0.08           | 1.50                                    | 8.00                         | 2.33                                      | 3.83                        |
| Artemisia frigida       | 0.52           | 9.77                                    | 36.00                        | 10.47                                     | 20.24                       |
| Conyza Canadensis       | 0.48           | 9.02                                    | 28.00                        | 8.14                                      | 17.16                       |
| Erysimum asperum        | 0.68           | 12.78                                   | 40.00                        | 11.63                                     | 24.41                       |
| Grindelia squarrosa     | 0.12           | 2.26                                    | 12.00                        | 3.49                                      | 5.75                        |
| Hedeoma hispida         | 0.08           | 1.50                                    | 8.00                         | 2.33                                      | 3.83                        |
| Lactuca oblongifolia    | 0.32           | 6.02                                    | 24.00                        | 6.98                                      | 13.00                       |
| Lygodesmia juncea       | 0.08           | 1.50                                    | 8.00                         | 2.33                                      | 3.83                        |
| Opuntia fragilis        | 0.08           | 1.50                                    | 8.00                         | 2.33                                      | 3.83                        |
| Oxytropis lambertii     | 0.12           | 2.26                                    | 8.00                         | 2.33                                      | 4.59                        |
| Phlox hoodia            | 0.04           | 0.75                                    | 4.00                         | 1.16                                      | 1.91                        |
| Potentilla pensylvanica | 1.76           | 33.08                                   | 80.00                        | 23.26                                     | 56.34                       |
| Psoralea argophylla     | 0.20           | 3.76                                    | 16.00                        | 4.65                                      | 8.41                        |
| Ratibida columnifera    | 0.44           | 8.27                                    | 32.00                        | 9.30                                      | 17.57                       |

**Table 140. Mean Forb and Shrub Density per 0.1 Sq. Meter for the Native Range Pastures on the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| System: | WEST | Pasture # | Forbs    |        | Shrubs   |        |
|---------|------|-----------|----------|--------|----------|--------|
|         |      |           | Ungrazed | Grazed | Ungrazed | Grazed |
| Clayey  |      | 1         | 9.24     | 6.60   | 0.00     | 0.00   |
|         |      | 3         | 8.00     | 8.52   | 0.00     | 0.08   |
|         |      | 5         |          |        |          |        |
|         |      | Mean      | 8.62     | 7.56   | 0.00     | 0.04   |
| Sandy   |      | 1         | 3.24     | 3.20   | 1.08     | 0.64   |
|         |      | 3         | 2.44     | 1.88   | 0.00     | 0.00   |
|         |      | 5         | 2.72     | 3.44   | 0.00     | 0.00   |
|         |      | Mean      | 2.80     | 2.84   | 0.36     | 0.21   |
| Shallow |      | 1         | 5.84     | 6.72   | 0.16     | 0.00   |
|         |      | 3         | 2.80     | 2.68   | 0.20     | 0.00   |
|         |      | 5         | 5.24     | 5.28   | 0.84     | 0.36   |
|         |      | Mean      | 4.63     | 4.89   | 0.40     | 0.12   |
| Silty   |      | 1         | 5.24     | 3.48   | 0.00     | 0.00   |
|         |      | 3         | 3.68     | 3.64   | 0.00     | 0.00   |
|         |      | 5         | 4.04     | 4.44   | 0.00     | 0.00   |
|         |      | Mean      | 4.32     | 3.85   | 0.00     | 0.00   |

**Table 140 (Continued):**

| <b>System: EAST</b> |      |       |      |      |      |
|---------------------|------|-------|------|------|------|
| Clayey              | 2    | 10.28 | 8.32 | 0.00 | 0.00 |
|                     | 4    | 3.72  | 3.32 | 0.00 | 0.00 |
|                     | 6    |       |      |      |      |
|                     | Mean | 7.00  | 5.82 | 0.00 | 0.00 |
|                     |      |       |      |      |      |
| Sandy               | 2    | 2.84  | 2.76 | 0.04 | 0.00 |
|                     | 4    | 3.36  | 4.00 | 0.04 | 0.00 |
|                     | 6    | 1.28  | 2.36 | 0.00 | 0.76 |
|                     | Mean | 2.49  | 3.04 | 0.03 | 0.25 |
|                     |      |       |      |      |      |
| Shallow             | 2    | 3.16  | 2.56 | 0.00 | 0.00 |
|                     | 4    | 4.88  | 5.24 | 0.00 | 0.00 |
|                     | 6    | 3.92  | 3.24 | 0.00 | 0.00 |
|                     | Mean | 3.99  | 3.68 | 0.00 | 0.00 |
|                     |      |       |      |      |      |
| Silty               | 2    | 8.12  | 6.16 | 0.00 | 0.00 |
|                     | 4    | 5.08  | 3.16 | 0.00 | 0.00 |
|                     | 6    | 8.68  | 5.32 | 0.00 | 0.00 |
|                     | Mean | 7.29  | 4.88 | 0.00 | 0.00 |

**Table 141. Mean Alfalfa Seedling Counts per Meter of Row of the Alfalfa Interseeded Pastures for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>System – EAST</b> |          | <b>13 Jul</b> | <b>22 Aug</b> |
|----------------------|----------|---------------|---------------|
| <b>Pasture – 2</b>   |          |               |               |
| Site – Clayey        | Ungrazed | 30.75         | 0.75          |
|                      | Grazed   | 29.43         | 0.14          |
| Site – Sandy         | Ungrazed | 20.29         | 0.00          |
|                      | Grazed   | 32.80         | 0.33          |
| Site – Shallow       | Ungrazed | 36.50         | 0.17          |
|                      | Grazed   | 42.67         | 0.00          |
| Site – Silty         | Ungrazed | 42.00         | 12.67         |
|                      | Grazed   | 36.87         | 18.50         |
| <b>Pasture – 4</b>   |          |               |               |
| Site – Clayey        | Ungrazed | 34.13         | 1.25          |
|                      | Grazed   | 9.50          | 0.50          |
| Site – Sandy         | Ungrazed | 3.67          | 0.00          |
|                      | Grazed   | 7.63          | 0.00          |
| Site – Shallow       | Ungrazed | 8.00          | 0.00          |
|                      | Grazed   | 30.25         | 0.00          |
| Site – Silty         | Ungrazed | 60.25         | 11.00         |
|                      | Grazed   | 50.25         | 18.25         |

**Table 141 (Continued):**

| <b>Pasture – 6</b> |          |       |      |
|--------------------|----------|-------|------|
| Site - Sandy       | Ungrazed | 38.75 | 0.00 |
|                    | Grazed   | 75.00 | 0.25 |
| Site - Shallow     | Ungrazed | 33.25 | 2.75 |
|                    | Grazed   | 17.00 | 0.25 |
| Site – Silty       | Ungrazed | 34.75 | 5.63 |
|                    | Grazed   | 27.13 | 1.63 |

**Table 142. Mean Alfalfa Seedling Counts per Foot of Row of the Alfalfa Interseeded Pastures for the Complementary Grazing System at the Dickinson Experiment Station, 1984**

| <b>System – EAST</b> |          | <b>13 Jul</b> | <b>22 Aug</b> |
|----------------------|----------|---------------|---------------|
| <b>Pasture – 2</b>   |          |               |               |
| Site – Clayey        | Ungrazed | 9.38          | 0.23          |
|                      | Grazed   | 8.97          | 0.04          |
| Site – Sandy         | Ungrazed | 6.19          | 0.00          |
|                      | Grazed   | 10.00         | 0.10          |
| Site – Shallow       | Ungrazed | 11.13         | 0.05          |
|                      | Grazed   | 13.01         | 0.00          |
| Site – Silty         | Ungrazed | 12.80         | 3.86          |
|                      | Grazed   | 11.24         | 5.64          |
| <b>Pasture – 4</b>   |          |               |               |
| Site – Clayey        | Ungrazed | 10.41         | 0.38          |

|                |          |       |      |
|----------------|----------|-------|------|
|                | Grazed   | 2.90  | 0.15 |
| Site – Sandy   | Ungrazed | 1.12  | 0.00 |
|                | Grazed   | 2.33  | 0.00 |
| Site – Shallow | Ungrazed | 2.44  | 0.00 |
|                | Grazed   | 9.22  | 0.00 |
| Site – Silty   | Ungrazed | 18.37 | 3.35 |
|                | Grazed   | 15.32 | 5.56 |

**Table 142 (Continued):**

| <b>Pasture – 6</b> |          |       |      |
|--------------------|----------|-------|------|
| Site – Sandy       | Ungrazed | 11.81 | 0.00 |
|                    | Grazed   | 22.87 | 0.08 |
| Site – Shallow     | Ungrazed | 10.14 | 0.84 |
|                    | Grazed   | 5.18  | 0.08 |
| Site – Silty       | Ungrazed | 10.59 | 1.72 |
|                    | Grazed   | 8.27  | 0.50 |

**PLANT SPECIES LIST OF THE COMPLEMENTARY GRAZING SYSTEM,  
DICKINSON EXPERIMENT STATION, 1984**

**Graminoids:**

|       |                           |                      |
|-------|---------------------------|----------------------|
| Ag de | Agropyron desertorum      | Crested wheatgrass   |
| Ag sm | Agropyron smithii         | Western wheatgrass   |
| Ag tr | Agropyron trachycaulum    | Slender wheatgrass   |
| An sc | Andropogon scoparius      | Little bluestem      |
| Ar lo | Aristida longiseta        | Red threeawn         |
| Av sa | Avena sativa              | Oats                 |
| Bo cu | Bouteloua curtipendula    | Side-oats grama      |
| Bo gr | Bouteloua gracilis        | Blue grama           |
| Bu da | Buchloe dactyloides       | Buffalo grass        |
| Ca mo | Calamagrostis montanensis | Plains reedgrass     |
| Ca lo | Calamovilfa longifolia    | Prairie sandreed     |
| El an | Elymus angustus           | Altai wildrye        |
| Ko py | Koeleria pyramidata       | Prairie junegrass    |
| Mu cu | Muhlenbergia cuspidata    | Plains muhly         |
| Mu sq | Munroa squarrosa          | False buffalo grass  |
| Pa ol | Panicum oligosanthos      | Scribner panic grass |
| Po co | Poa compressa             | Canada bluegrass     |
| Po pr | Poa pratensis             | Kentucky bluegrass   |
| Sc pa | Schedonnardus paniculatus | Tumble grass         |
| Se gl | Setaria glauca            | Yellow pigeongrass   |
| Se ve | Setaria verticillata      | Bur pigeongrass      |
| Se vi | Setaria viridis           | Green pigeongrass    |
| St co | Stipa comata              | Needleandthread      |
| St vi | Stipa viridula            | Green needlegrass    |

**Graminoids (Continued)**

|         |                  |                    |
|---------|------------------|--------------------|
| Ca el   | Carex eleocharis | Needleleaf sedge   |
| Ca fi   | Carex filifolia  | Threadleaved sedge |
| Ca he   | Carex heliophila | Yellow sedge       |
| El spp. | Eleocharis spp.  | Spikerush          |

**Forbs:**

|       |                         |                     |
|-------|-------------------------|---------------------|
| Ac mi | Achillea millefolium    | Yarrow              |
| Ag gl | Agoseris glauca         | Prairie dandelion   |
| Al ai | Allionia ainearis       | Four O'clock        |
| Al te | Allium textile          | White wild onion    |
| Am re | Amaranthus retroflexus  | Rough pigweed       |
| An oc | Androsace occidentalis  | Fairy candelabra    |
| An cy | Anemone cylindrica      | Cottonweed          |
| An ne | Antennaria neglecta     | Pussytoes           |
| An pa | Antennaria parvifolia   | Pussytoes           |
| Ar ho | Arabis holboellii       | Slim rockcress      |
| Ar ca | Artemisia caudata       | Green sage          |
| Ar dr | Artemisia dracunculus   | Green sage          |
| Ar fr | Artemisia frigida       | Fringed sage        |
| Ar lu | Artemisia ludoviciana   | White sage          |
| As ve | Asclepias verticillata  | Whorled milkweed    |
| As vi | Asclepias viridiflora   | Green milkweed      |
| As er | Aster ericoides         | White prairie aster |
| As ca | Astragalus canadensis   | Little rattlepod    |
| As cr | Astragalus crassicaulus | Ground plum         |
| Ce ar | Cerastium arvense       | Prairie chickweed   |
| Ce la | Ceratoides lanata       | Winter fat          |
| Ch al | Chenopodium album       | Lamb's quarters     |

**Forbs (Continued):**

|         |                               |                       |
|---------|-------------------------------|-----------------------|
| Ch vi   | <i>Chrysopsis villosa</i>     | Golden aster          |
| Ci un   | <i>Cirsium undulatum</i>      | Prairie thistle       |
| Co um   | <i>Commandra umbellata</i>    | Bastard toadflax      |
| Co ar   | <i>Convolvulus arvensis</i>   | Field bindweed        |
| Co ca   | <i>Conyza canadensis</i>      | Horseweed             |
| Co vi   | <i>Coryphantha vivipara</i>   | Ball cactus           |
| De pi   | <i>Descurainia pinnata</i>    | Tansy mustard         |
| De so   | <i>Descurainia sophia</i>     | Flixweed              |
| Ec an   | <i>Echinacea angustifolia</i> | Purple coneflower     |
| Er gl   | <i>Erigeron glabellus</i>     | Rough erigeron        |
| Er spp. | <i>Erigeron</i> spp.          | Daisy fleabane        |
| Er fl   | <i>Eriogonum flavum</i>       | Yellow umbrella plant |
| Er mu   | <i>Eriogonum multiceps</i>    | Eriogonum             |
| Er as   | <i>Erysimum asperum</i>       | Western wallflower    |
| Eu di   | <i>Euphorbia dictyosperma</i> | Spurge                |
| Eu ge   | <i>Euphorbia geyeri</i>       | Geyer's spurge        |
| Eu ma   | <i>Euphorbia maculata</i>     | Nodding spurge        |
| Ga co   | <i>Gaura coccinea</i>         | Gaura                 |
| Gr sq   | <i>Grindelia squarrosa</i>    | Gumweed               |
| Gu sa   | <i>Gutierrezia sarothrae</i>  | Broomweed             |
| Ha sp   | <i>Haplopappus spinulosus</i> | Spiny ironweed        |
| He hi   | <i>Hedeoma hispida</i>        | Rough pennyroyal      |
| He ri   | <i>Helianthus rigidus</i>     | Stiff sunflower       |
| Hi vu   | <i>Hippuris vulgaris</i>      | Marestail             |
| Hy ri   | <i>Hymenoxys richardsonii</i> | Rubber plant          |
| Ko sc   | <i>Kochia scoparia</i>        | Kochia                |
| La ob   | <i>Lactuca oblongifolia</i>   | Blue wild lettuce     |
| Le de   | <i>Lepidium densiflorum</i>   | Peppergrass           |
| Li pu   | <i>Liatris punctata</i>       | Blazing star          |
| Li ri   | <i>Linum rigidum</i>          | Stiffstem flax        |

**Forbs (Continued):**

|       |                                |                                  |
|-------|--------------------------------|----------------------------------|
| Li in | <i>Lithospermum incisum</i>    | Narrow-leaved puccoon            |
| Lo am | <i>Lotus americanus</i>        | Prairie bird's foot trefoil      |
| Ly ju | <i>Lygodesmia juncea</i>       | Skeleton weed                    |
| Ma ro | <i>Malva rotundifolia</i>      | Small mallow                     |
| Me fa | <i>Medicago falcata</i>        | Alfalfa                          |
| Me of | <i>Melilotus officinalis</i>   | Yellow sweetclover               |
| Mu di | <i>Musineon divaricatum</i>    | Wild parsley                     |
| Ne pa | <i>Neslia paniculata</i>       | Ball mustard                     |
| Oe se | <i>Oenothera serrulata</i>     | Tooth-leaved evening<br>primrose |
| Op fr | <i>Opuntia fragilis</i>        | Brittle prickly pear             |
| Or lu | <i>Orthocarpus luteus</i>      | Owl clover                       |
| Ox la | <i>Oxytropis lambertii</i>     | Purple loco                      |
| Pe al | <i>Penstemon albidus</i>       | White beardtongue                |
| Pe pu | <i>Petalostemon purpureum</i>  | Purple prairie clover            |
| Ph ho | <i>Phlox hoodii</i>            | Moss phlox                       |
| Pl pu | <i>Plantago purshii</i>        | Woolly plantain                  |
| Po al | <i>Polygala alba</i>           | White milkwort                   |
| Po ar | <i>Polygonum arenastrum</i>    | Common knotweed                  |
| Po co | <i>Polygonum convolvulus</i>   | Wild buckwheat                   |
| Po pe | <i>Potentilla pensylvanica</i> | Potentilla                       |
| Ps ar | <i>Psoralea argophylla</i>     | Silverleaf scurfpea              |
| Ps es | <i>Psoralea esculenta</i>      | Indian breadroot                 |
| Ra cy | <i>Ranunculus cymbalaria</i>   | Seaside buttercup                |
| Ra co | <i>Ratibida columnifera</i>    | Long headed coneflower           |
| Sa ka | <i>Salsola kali</i>            | Russian thistle                  |
| Se pl | <i>Senecio plattensis</i>      | Prairie ragwort                  |
| So mi | <i>Solidago missouriensis</i>  | Early goldenrod                  |
| So ri | <i>Solidago rigida</i>         | Stiff goldenrod                  |
| Sp co | <i>Sphaeralcea coccinea</i>    | Scarlet globemallow              |

**Forbs (Continued):**

|       |                               |                    |
|-------|-------------------------------|--------------------|
| Ta of | <i>Taraxacum officinale</i>   | Dandelion          |
| Th rh | <i>Thermopsis rhombifolia</i> | False lupine       |
| Tr du | <i>Tragopogon dubius</i>      | Large goat's beard |
| Ve fa | <i>Vernonia fasciculata</i>   | Ironweed           |
| Vi am | <i>Vicia americana</i>        | Wild vetch         |
| Vi nu | <i>Viola nuttallii</i>        | Nuttall's violet   |
| Xa st | <i>Xanthium strumarium</i>    | Cocklebur          |

**Shrubs:**

|       |                                    |                   |
|-------|------------------------------------|-------------------|
| Ju ho | <i>Juniperus horizontalis</i>      | Creeping juniper  |
| Ro ar | <i>Rosa arkansana</i>              | Prairie wild rose |
| Sy oc | <i>Symphoricarpos occidentalis</i> | Wolfberry         |

**Lycopods:**

|       |                          |           |
|-------|--------------------------|-----------|
| Se de | <i>Selaginella densa</i> | Club moss |
|-------|--------------------------|-----------|

**Eumycota:**

|         |                    |         |
|---------|--------------------|---------|
| Li spp. | Species of lichens | Lichens |
|---------|--------------------|---------|

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## Native Range Fertilization with Ammonium Nitrate and Urea – 1984

### Dickinson Experiment Station

H. Goetz and L. Manske

A study that compares fertilization of native range between ammonium nitrate and urea was started at the Dickinson Experiment Station in the spring of 1982. The trial was established on 2.6 acres located on the SW $\frac{1}{4}$  SW $\frac{1}{4}$  NW $\frac{1}{4}$  sec. 16, T. 143 N., R. 96 W. at the ranch headquarters of the Dickinson Experiment Station. The 30 X 60 foot plots were arranged in a randomized block design with three replications. The alleys between the replications were 10 feet wide and the perimeter border was 40 feet wide. A barbed wire fence was constructed to exclude grazing on the plots until after all of the data for that season were collected. The soil was moreau silty clay. The range site was clayey. The fertilization treatments were 40 and 60 pounds of nitrogen per acre for ammonium nitrate and urea applied annually and biennially, and 100 pounds of nitrogen per acre for ammonium nitrate and urea applied biennially. A total of ten fertilizer treatments and two control plots with no treatment were included in each replication. The fertilizer was broadcast applied on 4 May 1982, 1983, and 1984. The data that were collected from these plots were: above ground herbage production separated into seven categories, leaf height measurements and phenological phases of five major graminoid species, quantitative species composition, soil moisture and soil nutrient content at increments to 48 inches in depth.

The above ground herbage production was sampled by clipping to ground level two  $\frac{1}{4}\text{m}^2$  quadrats for each plot. The herbage was separated into seven categories, cool short, warm short, cool mid, western wheatgrass, warm mid, sedge and forbs. The samples were oven dried at 80°C. The dried samples were then weighted in grams. The average weight of each category for the two  $\frac{1}{4}\text{m}^2$  quadrats was determined and the average pounds per acre of herbage production was calculated for each category by multiplying the average weight in grams by 35.68. The total average production for each plot was found by the summation of the average pounds per acre for each category. The reported figures were means of the three replications for each treatment. Five clips were made for the 1984 season. The dates for these were 30 May, 25 June, 18 July, 1 August and 15 August.

The herbage samples were ground in a Wiley mill and analyzed for nutrient content by proximate analysis at the nutrition laboratory in the animal science department at North Dakota State University under direction of Dr. Duane Erickson. The results of these analysis will be made available at a later date.

Leaf height measurements and phenological development of the flower stalks were collected for five dominant graminoid species, Carex filifolia, Bouteloua gracilis, Koeleria pyramidata, Agropyron smithii and Stipa comata. Twelve plants of each species were selected at random on each plot. All of the leaves of each plant were outstretched and measured to the nearest millimeter in sequence from the oldest to the youngest. Along with the length measurements, the degree of dryness for the leaf blades were recorded. The categories of dryness used were: 0, 0.1-2, 2.1-25, 25.1-50, 50.1-75, 75.1-98 and 100 percent dry. The highest figure of the category was used to record the percentage of dryness for each leaf blade.

If the flower stalks were present, the height was measured and the phenological stage of development was recorded. The categories used were: flower stalk developing, head emergence, anthesis, seeds developing and seeds being shed. Leaf height and phenological development data were collected in the 1984 season. The dates for these were 7-8 June, 19-20 July and 23 August.

Quantitative species composition data for each plot was collected during the period of 23-30 July for the 1984 season. The herbacious plants were sampled by the ten pin point-frame method (Levy and Madden 1933, Tinney, Aamodt, and Ahlgren 1937, Heady and Rader 1958, and Smith 1959). The point frame was a metal frame that was constructed to stand at a 60° angle with holes for ten pins spaced at 5 cm intervals. The frame was set down and the pins raised and then allowed to move down through the existing vegetation. If a pin hit the basal portion of a living plant, the species of that plant was recorded. Hits on *Selaginella densa* and the various species of lichens were also recorded as hits. The pins that did not make contact with living vegetation were counted as no hits. These were divided into litter (dead and decaying vegetation), soil (mineral soil not covered by litter or living vegetation) and rock (a hard mass of mineral substance large enough to obstruct plant growth, about the size of a half dollar or larger). Aerial hits were not recorded. Fifteen hundred points were read for each treatment (500 points per plot). A systematic sampling scheme was used for each plot. A permanent major transect was established two feet inside and parallel to the north boundary of each plot. Five minor transects were established perpendicular to the major transect at three foot intervals starting three feet from the east boundary of the plot. One hundred points were read on each minor transect.

Forb and shrub densities were sampled by the use of one tenth meter square quadrats. The forbs and shrubs that were rooted within the frame were counted by species in each of the 10 quadrats per plot, 30 quadrats per treatment.

Soil moisture by the gravimetric method was taken three times during the 1984 season. The dates for these were 26 June, 25 July, and 27 August. The one inch Veihmeyer soil tube was used to collect the samples. Three locations were selected as sample sites for the trial, at the north end, in the center and at the south end. Two replications were taken at each location. The samples were collected at increments of 0-6, 6-12, 12-24, 24-36 and 36-48 inches in depth. Each subsample was placed in a numbered steel can of known weight. These were weighted, then oven dried at 100°C. The dried soil cans were again weighted. The difference in weight was the weight of the soil water. Percent soil moisture was then calculated.

Soil nutrient content was collected monthly during the 1984 season. The dates for these were 26 June, 26 July and 27 August. The samples were collected using the one inch Veihmeyer soil tube. Three replications were taken from each treatment. The samples were collected at increments of 0-6, 6-12, 12-24, 24-36, and 36-48 inches in depth. Each subsample was placed in labeled soil bags and frozen. The samples were analyzed for nutrient content by the soils laboratory at North Dakota State University.

The month of May was very dry. The first precipitation occurred 33 days after the application of the fertilizer. It was suspected that a large amount of the ammonia from the fertilizer volatilized in 1984.

**Figure 1:** Native Range Fertilization with Ammonium Nitrate (A) and Urea (U) Randomized Block Plot Design with Three Replications.

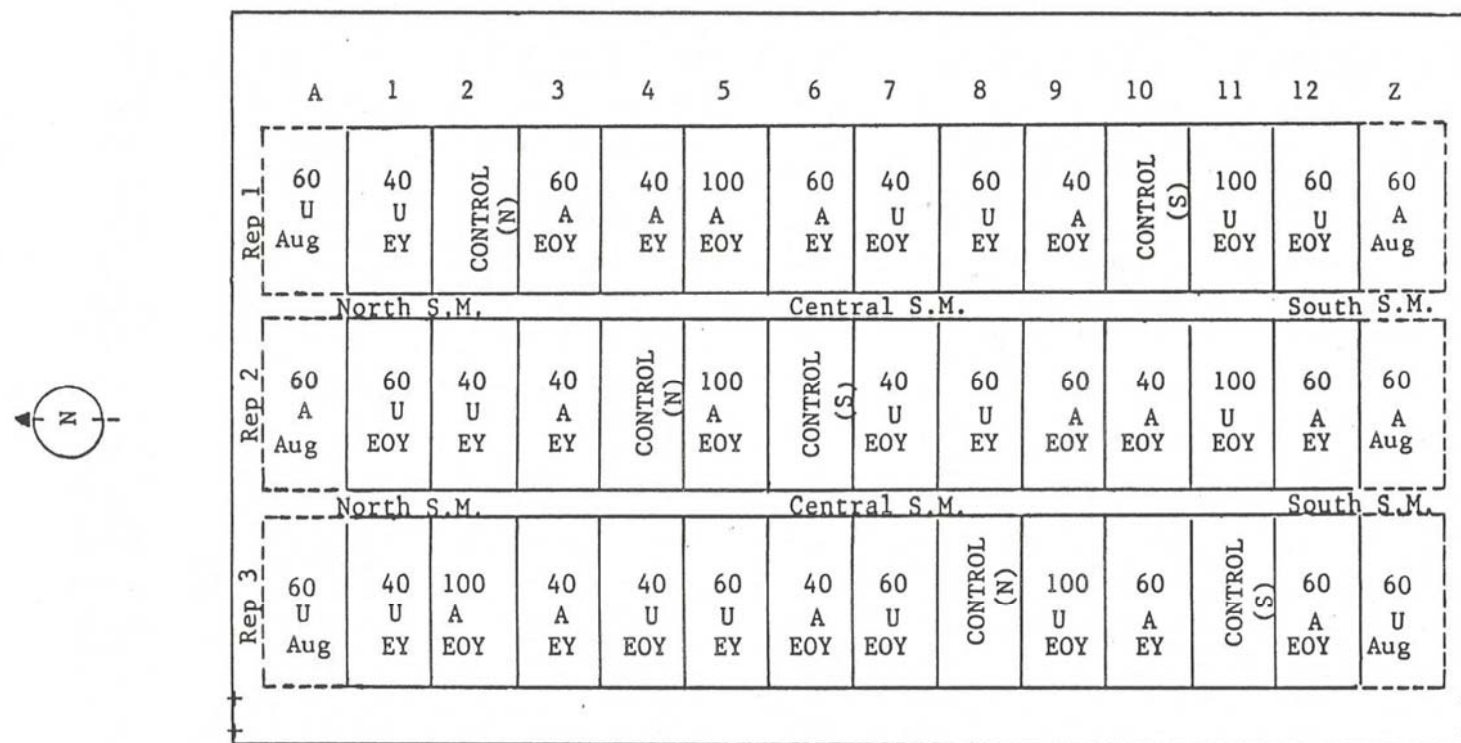


Figure 1. Native range fertilization with ammonium nitrate (A) and urea (U) randomized block plot design with three replications. Rates are 40, 60 and 100 lbs. of nitrogen per acre. Fertilizer is broadcast applied annually (EY) or biennially (EOY). Soil moisture (S.M.) samples collected at north, central and south location in each alley.

**Table 1. Monthly Mean Maximum, Minimum and Average Temperatures in Fahrenheit (°F) and Monthly Precipitation in Inches (in) at the Ranch Headquarters, Dickinson Experiment Station, Jan-Dec, 1984**

| <b>Month</b> | <b>Temperature</b>  |                     |                     | <b>Precipitation<br/>(in)</b> |
|--------------|---------------------|---------------------|---------------------|-------------------------------|
|              | <b>Max<br/>(°F)</b> | <b>Min<br/>(°F)</b> | <b>Avg<br/>(°F)</b> |                               |
| January      | 25.90               | 7.45                | 16.68               | 0.31                          |
| February     | 42.00               | 18.83               | 30.42               | 0.10                          |
| March        | 35.39               | 15.10               | 25.25               | 0.38                          |
| April        | 54.37               | 28.33               | 41.35               | 2.87                          |
| May          | 66.00               | 36.23               | 51.12               | T                             |
| June         | 73.40               | 49.30               | 61.35               | 5.30                          |
| July         | 85.10               | 54.45               | 69.78               | 0.11                          |
| August       | 87.16               | 56.23               | 71.70               | 1.92                          |
| September    | 63.67               | 37.13               | 50.40               | 0.53                          |
| October      | 53.97               | 30.35               | 42.16               | 0.96                          |
| November     | 40.67               | 15.57               | 28.12               | 0.05                          |
| December     | 17.35               | -4.90               | 6.23                | 0.35                          |

**Table 2. Mean Above Ground Herbage Production by Category in Lbs/Acre  
For the Ammonium Nitrate Fertilization Treatment on Native Range  
At the Dickinson Experiment Station, 1984**

| <b>Lbs of N/Acre</b><br>EY = Annually<br>EOY = Biennially | <b>30<br/>May</b> | <b>25<br/>Jun</b> | <b>18<br/>Jul</b> | <b>2<br/>Aug</b> | <b>15<br/>Aug</b> |
|-----------------------------------------------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| <b>Control:</b>                                           |                   |                   |                   |                  |                   |
| Cool Short                                                | 101.1             | 209.1             | 262.6             | 481.4            | 411.5             |
| Warm Short                                                | 143.0             | 291.1             | 317.9             | 740.7            | 630.1             |
| Cool Mid                                                  | 117.5             | 292.6             | 435.0             | 599.8            | 577.9             |
| Western whtg.                                             | 49.4              | 55.6              | 199.5             | 415.1            | 346.4             |
| Warm Mid                                                  | 21.4              | 5.1               | 31.5              | 34.2             | 165.9             |
| Sedge                                                     | 147.8             | 108.2             | 231.3             | 442.8            | 402.3             |
| Grass Total                                               | 580.1             | 947.4             | 1477.7            | 2743.9           | 2533.3            |
| Forbs                                                     | 155.8             | 184.1             | 443.0             | 651.8            | 562.6             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 735.9             | 1131.4            | 1920.8            | 3395.6           | 3095.8            |
| <b>40 EY:</b>                                             |                   |                   |                   |                  |                   |
| Cool Short                                                | 76.1              | 281.9             | 264.0             | 426.4            | 416.9             |
| Warm Short                                                | 70.2              | 182.6             | 475.1             | 652.4            | 592.9             |
| Cool Mid                                                  | 183.2             | 668.4             | 792.7             | 867.6            | 709.4             |
| Western whtg.                                             | 133.8             | 72.0              | 213.5             | 390.1            | 488.8             |
| Warm Mid                                                  | 0.0               | 51.1              | 16.7              | 68.4             | 127.9             |
| Sedge                                                     | 212.3             | 96.9              | 123.7             | 425.4            | 260.5             |
| Grass Total                                               | 675.5             | 1352.9            | 1885.7            | 2830.2           | 2596.3            |
| Forbs                                                     | 168.3             | 302.7             | 656.5             | 980.6            | 664.2             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 843.8             | 1655.6            | 2542.2            | 3719.2           | 3260.6            |
| <b>40EOY:</b>                                             |                   |                   |                   |                  |                   |
| Cool Short                                                | 112.4             | 136.8             | 293.8             | 479.3            | 318.7             |
| Warm Short                                                | 109.4             | 378.2             | 343.7             | 825.4            | 724.3             |
| Cool Mid                                                  | 133.2             | 380.0             | 742.1             | 902.7            | 660.1             |
| Western whtg.                                             | 44.0              | 83.3              | 189.1             | 457.3            | 424.0             |
| Warm Mid                                                  | 6.0               | 3.0               | 73.2              | 447.2            | 73.7              |
| Sedge                                                     | 261.1             | 240.3             | 170.1             | 515.6            | 363.3             |
| Grass Total                                               | 666.0             | 1221.5            | 1811.9            | 3627.5           | 2564.2            |
| Forbs                                                     | 173.1             | 238.5             | 554.8             | 592.9            | 415.3             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 839.1             | 1459.9            | 2366.8            | 4220.8           | 2621.5            |

**Table 2. (Cont.) Mean Above Ground Herbage Production by Category in Lbs/Acre  
For the Ammonium Nitrate Fertilization Treatment on Native Range at the  
Dickinson Experiment Station, 1984**

| <b>Lbs of N/Acre</b><br>EY = Annually<br>EOY = Biennially | <b>30<br/>May</b> | <b>25<br/>Jun</b> | <b>18<br/>Jul</b> | <b>2<br/>Aug</b> | <b>15<br/>Aug</b> |
|-----------------------------------------------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| <b>60 EY:</b>                                             |                   |                   |                   |                  |                   |
| Cool Short                                                | 163.5             | 122.2             | 321.1             | 456.7            | 441.2             |
| Warm Short                                                | 168.3             | 412.1             | 303.3             | 1034.7           | 815.3             |
| Cool Mid                                                  | 198.6             | 648.2             | 899.0             | 1128.1           | 748.7             |
| Western whtg.                                             | 90.4              | 90.4              | 76.7              | 959.2            | 341.3             |
| Warm Mid                                                  | 0.0               | 0.0               | 239.7             | 63.6             | 155.2             |
| Sedge                                                     | 297.3             | 316.4             | 303.3             | 585.8            | 416.9             |
| Grass Total                                               | 918.2             | 1619.3            | 2143.2            | 4228.1           | 2918.6            |
| Forbs                                                     | 162.3             | 187.8             | 453.8             | 667.8            | 595.9             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | <b>1080.4</b>     | <b>1553.6</b>     | <b>2596.9</b>     | <b>4895.9</b>    | <b>3514.5</b>     |
| <b>60 EOY:</b>                                            |                   |                   |                   |                  |                   |
| Cool Short                                                | 100.5             | 240.8             | 276.5             | 521.5            | 418.7             |
| Warm Short                                                | 148.1             | 284.1             | 476.3             | 949.1            | 745.7             |
| Cool Mid                                                  | 247.4             | 654.1             | 812.9             | 1158.4           | 715.4             |
| Western whtg.                                             | 70.2              | 249.1             | 248.0             | 471.0            | 437.7             |
| Warm Mid                                                  | 0.0               | 0.0               | 2.4               | 0.0              | 152.2             |
| Sedge                                                     | 182.6             | 131.4             | 283.1             | 441.2            | 325.3             |
| Grass Total                                               | 748.69            | 1499.6            | 2099.2            | 3541.2           | 2794.9            |
| Forbs                                                     | 160.0             | 198.0             | 418.7             | 768.3            | 490.0             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | <b>908.7</b>      | <b>1697.6</b>     | <b>2517.8</b>     | <b>4309.6</b>    | <b>3284.9</b>     |
| <b>100 EOY:</b>                                           |                   |                   |                   |                  |                   |
| Cool Short                                                | 148.1             | 70.2              | 276.5             | 579.2            | 278.9             |
| Warm Short                                                | 130.2             | 516.8             | 446.0             | 904.5            | 777.6             |
| Cool Mid                                                  | 295.0             | 578.0             | 616.7             | 1002.0           | 777.8             |
| Western whtg.                                             | 94.6              | 178.4             | 308.0             | 568.5            | 447.8             |
| Warm Mid                                                  | 1.2               | 1.2               | 11.9              | 0.0              | 133.8             |
| Sedge                                                     | 305.1             | 245.6             | 358.0             | 479.3            | 346.1             |
| Grass Total                                               | 974.1             | 1591.8            | 2017.1            | 3533.5           | 2852.0            |
| Forbs                                                     | 142.1             | 259.9             | 508.4             | 688.6            | 582.8             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | <b>1116.2</b>     | <b>1596.7</b>     | <b>2525.5</b>     | <b>4222.1</b>    | <b>3434.8</b>     |

**Table 3. Mean Above Ground Herbage Production by Category in Lbs/Acre for the Urea Fertilization Treatment on Native Range at the Dickinson Experiment Station, 1984**

| <b>Lbs of N/Acre</b><br>EY = Annually<br>EOY = Biennially | <b>30<br/>May</b> | <b>25<br/>Jun</b> | <b>18<br/>Jul</b> | <b>2<br/>Aug</b> | <b>15<br/>Aug</b> |
|-----------------------------------------------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| <b>Control:</b>                                           |                   |                   |                   |                  |                   |
| Cool Short                                                | 101.1             | 206.1             | 262.6             | 481.4            | 411.5             |
| Warm Short                                                | 143.0             | 291.1             | 317.9             | 740.7            | 630.1             |
| Cool Mid                                                  | 117.5             | 292.6             | 435.0             | 599.8            | 577.1             |
| Western whtg.                                             | 49.4              | 55.6              | 199.5             | 415.1            | 346.4             |
| Warm Mid                                                  | 21.4              | 5.1               | 31.5              | 34.2             | 165.9             |
| Sedge                                                     | 147.8             | 108.2             | 231.3             | 442.8            | 402.3             |
| Grass Total                                               | 580.1             | 947.4             | 1477.7            | 2743.9           | 2533.3            |
| Forbs                                                     | 155.8             | 184.1             | 443.0             | 651.8            | 562.6             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 735.9             | 1131.4            | 1920.8            | 3395.6           | 3095.8            |
| <b>40 EY:</b>                                             |                   |                   |                   |                  |                   |
| Cool Short                                                | 77.3              | 213.5             | 309.8             | 417.5            | 419.8             |
| Warm Short                                                | 77.9              | 170.1             | 543.5             | 749.9            | 650.0             |
| Cool Mid                                                  | 106.5             | 381.7             | 427.0             | 786.8            | 739.2             |
| Western whtg.                                             | 172.5             | 187.3             | 421.6             | 566.7            | 381.2             |
| Warm Mid                                                  | 3.0               | 0.6               | 73.2              | 134.4            | 0.0               |
| Sedge                                                     | 63.6              | 110.0             | 123.1             | 329.6            | 198.0             |
| Grass Total                                               | 500.7             | 1163.2            | 1864.8            | 2984.6           | 2388.2            |
| Forbs                                                     | 276.5             | 477.5             | 343.1             | 719.6            | 545.9             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 77.2              | 1640.7            | 2207.9            | 3704.2           | 2934.1            |
| <b>40 EOY:</b>                                            |                   |                   |                   |                  |                   |
| Cool Short                                                | 108.1             | 170.1             | 271.2             | 503.1            | 371.7             |
| Warm Short                                                | 224.2             | 247.4             | 391.3             | 625.6            | 730.9             |
| Cool Mid                                                  | 120.1             | 481.7             | 573.3             | 958.6            | 627.4             |
| Western whtg.                                             | 59.5              | 42.8              | 192.7             | 424.4            | 325.9             |
| Warm Mid                                                  | 1.2               | 0.0               | 88.0              | 198.0            | 131.4             |
| Sedge                                                     | 169.5             | 95.7              | 180.2             | 306.9            | 427.0             |
| Grass Total                                               | 682.5             | 1037.7            | 1631.9            | 2956.5           | 2614.2            |
| Forbs                                                     | 131.4             | 152.1             | 420.4             | 700.5            | 615.5             |
| Shrubs                                                    | 44.6              | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 858.5             | 1258.3            | 2052.4            | 3657.0           | 3229.6            |

**Table 3. (Cont.) Mean Above Ground Herbage Production by Category in Lbs/Acre for the Urea Fertilization Treatment on Native Range at the Dickinson Experiment Station, 1984**

| <b>Lbs of N/Acre</b><br>EY = Annually<br>EOY = Biennially | <b>30<br/>May</b> | <b>25<br/>Jun</b> | <b>18<br/>Jul</b> | <b>2<br/>Aug</b> | <b>15<br/>Aug</b> |
|-----------------------------------------------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| <b>60 EY:</b>                                             |                   |                   |                   |                  |                   |
| Cool Short                                                | 160.6             | 190.9             | 251.6             | 529.3            | 453.1             |
| Warm Short                                                | 126.7             | 248.0             | 255.1             | 647.0            | 634.5             |
| Cool Mid                                                  | 218.8             | 532.2             | 689.8             | 907.5            | 729.7             |
| Western whtg.                                             | 124.3             | 127.9             | 421.6             | 441.8            | 361.6             |
| Warm mid                                                  | 0.0               | 2.4               | 1.8               | 276.5            | 152.2             |
| Sedge                                                     | 272.4             | 240.3             | 123.1             | 416.9            | 374.6             |
| Grass Total                                               | 902.7             | 1236.6            | 1864.8            | 3218.9           | 2705.7            |
| Forbs                                                     | 186.7             | 168.9             | 343.1             | 526.3            | 478.7             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 1089.4            | 1405.5            | 2207.9            | 3745.2           | 3184.4            |
| <b>60 EOY:</b>                                            |                   |                   |                   |                  |                   |
| Cool Short                                                | 109.4             | 100.5             | 220.6             | 471.6            | 273.6             |
| Warm Short                                                | 140.3             | 374.6             | 275.3             | 752.3            | 763.6             |
| Cool Mid                                                  | 270.0             | 577.4             | 777.2             | 792.7            | 602.4             |
| Western whtg.                                             | 124.3             | 82.1              | 243.2             | 490.0            | 367.5             |
| Warm mid                                                  | 17.8              | 0.0               | 1.2               | 63.0             | 0.0               |
| Sedge                                                     | 299.1             | 174.2             | 255.7             | 546.5            | 388.3             |
| Grass Total                                               | 961.0             | 1308.9            | 1773.3            | 3116.1           | 2395.3            |
| Forbs                                                     | 176.0             | 182.6             | 394.9             | 581.6            | 583.4             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 1137.0            | 1491.4            | 2168.2            | 3697.6           | 2978.7            |
| <b>100 EOY:</b>                                           |                   |                   |                   |                  |                   |
| Cool short                                                | 111.8             | 166.5             | 166.5             | 449.6            | 440.1             |
| Warm short                                                | 103.5             | 473.4             | 589.3             | 771.9            | 599.4             |
| Cool mid                                                  | 436.5             | 663.7             | 723.7             | 987.2            | 909.3             |
| Western whtg.                                             | 64.8              | 140.9             | 140.3             | 605.4            | 371.1             |
| Warm mid                                                  | 0.0               | 0.0               | 77.3              | 207.5            | 168.3             |
| Sedge                                                     | 312.2             | 335.4             | 308.6             | 578.0            | 468.6             |
| Grass Total                                               | 1028.8            | 1779.8            | 2005.2            | 3599.5           | 2741.2            |
| Forbs                                                     | 214.1             | 240.3             | 389.5             | 614.9            | 763.0             |
| Shrubs                                                    | 0.0               | 0.0               | 0.0               | 0.0              | 0.0               |
| <b>TOTAL</b>                                              | 1242.9            | 1995.1            | 2394.7            | 4214.4           | 3554.7            |

**Table 4. Mean Percentage of Herbage Production Increase for the Fertilization Treatments Compared to the Herbage Production on the Unfertilized Plots for 1982, 1983 and 1984**

| Rate<br>Lbs of N/Acre | Ammonium Nitrate |      |      | Urea  |      |      |
|-----------------------|------------------|------|------|-------|------|------|
|                       | 1982             | 1983 | 1984 | 1982  | 1983 | 1984 |
| 40 EY                 | 67.1             | 51.9 | 16.9 | 72.1  | 52.3 | 9.6  |
| 40 EOY                | 49.3             | 25.4 | 12.0 | 44.1  | 18.2 | 7.6  |
| 60 EY                 | 74.0             | 55.9 | 32.7 | 53.6  | 50.1 | 13.2 |
| 60 EOY                | 69.0             | 51.8 | 23.7 | 86.0  | 41.1 | 11.6 |
| 100 EOY               | 111.3            | 45.2 | 25.5 | 117.9 | 71.3 | 30.4 |

**Table 5. Points Analysis of the Control Treatment (North and South) for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                 | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii       | 1.10        | 2.18                 | 11.00             | 3.40                       | 5.58             |
| Andropogon scoparius    | 0.10        | 0.20                 | 0.33              | 0.10                       | 0.30             |
| Aristida longiseta      | 0.13        | 0.26                 | 1.33              | 0.41                       | 0.67             |
| Bouteloua gracilis      | 14.37       | 28.51                | 75.67             | 23.35                      | 51.86            |
| Buchloe dactyloides     | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Koeleria pyramidata     | 2.67        | 5.29                 | 19.00             | 5.86                       | 11.15            |
| Muhlenbergia cuspidata  | 2.03        | 4.03                 | 12.67             | 3.91                       | 7.94             |
| Munroa squarrosa        | 0.07        | 0.13                 | 0.67              | 0.21                       | 0.34             |
| Stipa comata            | 5.00        | 9.92                 | 38.33             | 11.83                      | 21.75            |
| Stipa viridula          | 1.20        | 2.38                 | 9.33              | 2.88                       | 5.26             |
| Carex filifolia         | 4.47        | 8.86                 | 31.67             | 9.77                       | 18.63            |
| Carex heliophila        | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Achillea millefolium    | 0.33        | 0.66                 | 3.33              | 1.03                       | 1.69             |
| Antennaria parvifolia   | 0.97        | 1.92                 | 6.67              | 2.06                       | 3.98             |
| Artemisia dracunculus   | 0.43        | 0.86                 | 3.67              | 1.13                       | 1.99             |
| Artemisia frigida       | 0.87        | 1.72                 | 8.00              | 2.47                       | 4.19             |
| Aster ericoides         | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Astragalus canadensis   | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Astragalus crassicaupus | 0.10        | 0.20                 | 1.00              | 0.31                       | 0.51             |
| Chrysopsis villosa      | 0.17        | 0.33                 | 0.67              | 0.21                       | 0.54             |
| Cirsium undulatum       | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Erysimum asperum        | 0.07        | 0.13                 | 0.67              | 0.21                       | 0.34             |
| Gaura coccinea          | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Grindelia squarrosa     | 0.13        | 0.26                 | 1.33              | 0.41                       | 0.67             |
| Hedeoma hispida         | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Lactuca oblongifolia    | 0.30        | 0.60                 | 3.00              | 0.93                       | 1.53             |
| Liatris punctata        | 0.10        | 0.20                 | 1.00              | 0.31                       | 0.51             |
| Lotus americanus        | 0.20        | 0.40                 | 1.67              | 0.51                       | 0.91             |
| Orthocarpus luteus      | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Petalostemon purpureum  | 0.03        | 0.07                 | 0.33              | 0.10                       | 0.17             |
| Phlox hoodii            | 0.83        | 1.65                 | 7.67              | 2.37                       | 4.02             |
| Plantago purshii        | 0.07        | 0.13                 | 0.67              | 0.21                       | 0.34             |
| Polygala alba           | 0.27        | 0.53                 | 2.67              | 0.82                       | 1.35             |
| Psoralea argophylla     | 0.07        | 0.13                 | 0.67              | 0.21                       | 0.34             |
| Ratibida columnifera    | 0.63        | 1.26                 | 6.00              | 1.85                       | 3.11             |
| Solidago rigida         | 0.17        | 0.33                 | 1.67              | 0.51                       | 0.84             |
| Sphaeralcea coccinea    | 0.73        | 1.46                 | 7.00              | 2.16                       | 3.62             |
| Selaginella densa       | 7.70        | 15.28                | 35.33             | 10.91                      | 26.19            |
| Lichen spp.             | 4.83        | 9.59                 | 28.33             | 8.74                       | 18.33            |
| Litter                  | 49.43       |                      | 100.00            |                            |                  |
| Rock                    | 0.00        |                      | 0.00              |                            |                  |
| Soil                    | 0.17        |                      | 1.33              |                            |                  |

**Table 6. Points Analysis of the Control Treatment (North) for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 1.13               | 2.19                        | 11.33                    | 3.42                              | 5.61                    |
| Aristida longiseta     | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Bouteloua gracilis     | 13.67              | 26.38                       | 74.67                    | 22.54                             | 48.92                   |
| Koeleria pyramidata    | 2.87               | 5.53                        | 24.67                    | 7.44                              | 12.97                   |
| Muhlenbergia cuspidata | 1.20               | 2.32                        | 6.00                     | 1.81                              | 4.13                    |
| Munroa squarrosa       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Stipa comata           | 4.20               | 8.11                        | 36.67                    | 11.07                             | 19.18                   |
| Stipa viridula         | 1.33               | 2.57                        | 9.33                     | 2.82                              | 5.39                    |
| Carex filifolia        | 3.87               | 7.46                        | 28.00                    | 8.45                              | 15.91                   |
| Carex heliophila       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Achillea millefolium   | 0.33               | 0.64                        | 3.33                     | 1.01                              | 1.65                    |
| Antennaria parvifolia  | 1.40               | 2.70                        | 8.67                     | 2.62                              | 5.32                    |
| Artemisia dracunculus  | 0.47               | 0.90                        | 4.67                     | 1.41                              | 2.31                    |
| Artemisia frigida      | 0.67               | 1.29                        | 6.00                     | 1.81                              | 3.10                    |
| Astragalus canadensis  | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Grindelia squarrosa    | 0.20               | 0.39                        | 2.00                     | 0.60                              | 0.99                    |
| Lactuca oblongifolia   | 0.33               | 0.64                        | 3.33                     | 1.01                              | 1.65                    |
| Liatis punctata        | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Lotus americanus       | 0.33               | 0.64                        | 2.67                     | 0.80                              | 1.44                    |
| Petalostemon purpureum | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Phlox hoodii           | 0.87               | 1.67                        | 8.67                     | 2.62                              | 4.29                    |
| Polygala alba          | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Psoralea argophylla    | 0.13               | 0.26                        | 1.33                     | 0.40                              | 0.66                    |
| Ratibida columnifera   | 0.67               | 1.29                        | 6.00                     | 1.81                              | 3.10                    |
| Sphaeralcea coccinea   | 0.60               | 1.16                        | 6.00                     | 1.81                              | 2.97                    |
| Selaginella densa      | 14.13              | 27.28                       | 62.67                    | 18.91                             | 46.19                   |
| Lichen spp.            | 2.93               | 5.66                        | 20.67                    | 6.24                              | 11.90                   |
| Litter                 | 48.13              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.07               |                             | 0.67                     |                                   |                         |

**Table 7. Points Analysis of the Control Treatment (South) for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                 | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii       | 1.07        | 2.18                 | 10.67             | 3.37                       | 5.55             |
| Andropogon scoparius    | 0.20        | 0.41                 | 0.67              | 0.21                       | 0.62             |
| Aristida longiseta      | 0.20        | 0.41                 | 2.00              | 0.63                       | 1.04             |
| Bouteloua gracilis      | 15.07       | 30.75                | 76.67             | 24.21                      | 54.96            |
| Buchloe dactyloides     | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Koeleria pyramidata     | 2.47        | 5.03                 | 13.33             | 4.21                       | 9.24             |
| Muhlenbergia cuspidata  | 2.87        | 5.85                 | 19.33             | 6.11                       | 11.96            |
| Munroa squarrosa        | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Stipa comata            | 5.80        | 11.84                | 40.00             | 12.63                      | 24.47            |
| Stipa viridula          | 1.07        | 2.18                 | 9.33              | 2.95                       | 5.13             |
| Carex filifolia         | 5.07        | 10.34                | 35.33             | 11.16                      | 21.50            |
| Achillea millefolium    | 0.33        | 0.68                 | 3.33              | 1.05                       | 1.73             |
| Antennaria parvifolia   | 0.53        | 1.09                 | 4.67              | 1.47                       | 2.56             |
| Artemisia dracunculus   | 0.40        | 0.82                 | 2.67              | 0.84                       | 1.66             |
| Artemisia frigida       | 1.07        | 2.18                 | 10.00             | 3.16                       | 5.34             |
| Aster ericoides         | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Astragalus crassicaupus | 0.20        | 0.41                 | 2.00              | 0.63                       | 1.04             |
| Chrysopsis villosa      | 0.33        | 0.68                 | 1.33              | 0.42                       | 1.10             |
| Cirsium undulatum       | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Erysimum asperum        | 0.13        | 0.27                 | 1.33              | 0.42                       | 0.69             |
| Gaura coccinea          | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Grindelia squarrosa     | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Hedeoma hispida         | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Lactuca oblongifolia    | 0.27        | 0.54                 | 2.67              | 0.84                       | 1.38             |
| Liatris punctata        | 0.13        | 0.27                 | 1.33              | 0.42                       | 0.69             |
| Lotus americanus        | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Orthocarpus luteus      | 0.07        | 0.14                 | 0.67              | 0.21                       | 0.35             |
| Phlox hoodii            | 0.80        | 1.63                 | 6.67              | 2.11                       | 3.74             |
| Plantago purshii        | 0.13        | 0.27                 | 1.33              | 0.42                       | 0.69             |
| Polygala alba           | 0.47        | 0.95                 | 4.67              | 1.47                       | 2.42             |
| Ratibida columnifera    | 0.60        | 1.22                 | 6.00              | 1.89                       | 3.11             |
| Solidago rigida         | 0.33        | 0.68                 | 3.33              | 1.05                       | 1.73             |
| Sphaeralcea coccinea    | 0.87        | 1.77                 | 8.00              | 2.53                       | 4.30             |
| Selaginella densa       | 1.27        | 2.59                 | 8.00              | 2.53                       | 5.12             |
| Lichen                  | 6.73        | 13.74                | 36.00             | 11.37                      | 25.11            |
| Litter                  | 50.73       |                      | 100.00            |                            |                  |
| Rock                    | 0.00        |                      | 0.00              |                            |                  |
| Soil                    | 0.27        |                      | 2.00              |                            |                  |

**Table 8. Points Analysis of the Ammonium Nitrate Treatment at the 40 Pounds of Nitrogen Per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 1.53               | 2.88                        | 15.33                    | 4.35                              | 7.23                    |
| Bouteloua gracilis      | 12.53              | 23.56                       | 71.33                    | 20.23                             | 43.79                   |
| Koeleria pyramidata     | 2.80               | 5.26                        | 24.67                    | 6.99                              | 12.25                   |
| Muhlenbergia cuspidata  | 0.60               | 1.13                        | 5.33                     | 1.51                              | 2.64                    |
| Stipa comata            | 5.67               | 10.65                       | 40.67                    | 11.53                             | 22.18                   |
| Stipa viridula          | 1.93               | 3.63                        | 17.33                    | 4.91                              | 8.54                    |
| Carex filifolia         | 3.87               | 7.27                        | 29.33                    | 8.32                              | 15.59                   |
| Achillea millefolium    | 0.73               | 1.38                        | 7.33                     | 2.08                              | 3.46                    |
| Antennaria parvifolia   | 1.07               | 2.01                        | 9.33                     | 2.65                              | 4.66                    |
| Arabis holboellii       | 0.20               | 0.38                        | 2.00                     | 0.57                              | 0.95                    |
| Artemisia dracunculus   | 0.27               | 0.50                        | 2.67                     | 0.76                              | 1.26                    |
| Artemisia frigida       | 0.47               | 0.88                        | 4.67                     | 1.32                              | 2.20                    |
| Commandra umbellata     | 0.07               | 0.13                        | 0.67                     | 0.19                              | 0.32                    |
| Erysimum asperum        | 0.07               | 0.13                        | 0.67                     | 0.19                              | 0.32                    |
| Grindelia squarrosa     | 0.07               | 0.13                        | 0.67                     | 0.19                              | 0.32                    |
| Gutierrezia sarothrae   | 0.13               | 0.25                        | 1.33                     | 0.38                              | 0.63                    |
| Hedeoma hispida         | 0.20               | 0.38                        | 2.00                     | 0.57                              | 0.95                    |
| Liatis punctata         | 0.13               | 0.25                        | 0.67                     | 0.19                              | 0.44                    |
| Opuntia fragilis        | 0.13               | 0.25                        | 1.33                     | 0.38                              | 0.63                    |
| Phlox hoodii            | 1.27               | 2.38                        | 12.00                    | 3.40                              | 5.78                    |
| Plantago purshii        | 0.27               | 0.50                        | 2.67                     | 0.76                              | 1.26                    |
| Polygala alba           | 0.07               | 0.13                        | 0.67                     | 0.19                              | 0.32                    |
| Potentilla pensylvanica | 0.17               | 0.13                        | 0.67                     | 0.19                              | 0.32                    |
| Ratibida columnifera    | 1.40               | 2.63                        | 13.33                    | 3.78                              | 6.41                    |
| Solidago rigida         | 0.13               | 0.25                        | 1.33                     | 0.38                              | 0.63                    |
| Sphaeralcea coccinea    | 0.60               | 1.13                        | 5.33                     | 1.51                              | 2.64                    |
| Rosa arkansana          | 0.07               | 0.13                        | 0.67                     | 0.19                              | 0.32                    |
| Selaginella densa       | 7.87               | 14.79                       | 26.67                    | 7.56                              | 22.35                   |
| Lichen spp.             | 9.00               | 16.92                       | 52.00                    | 14.74                             | 31.66                   |
| Litter                  | 46.73              |                             | 98.67                    |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                    | 0.01               |                             | 0.67                     |                                   |                         |

**Table 9. Points Analysis of the Ammonium Nitrate Treatment at the 40 Pounds of Nitrogen Per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 0.80               | 1.49                        | 7.33                     | 2.23                              | 3.72                    |
| Andropogon scoparius    | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Bouteloua gracilis      | 14.60              | 27.17                       | 70.00                    | 21.26                             | 48.43                   |
| Calamovilfa longifolia  | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Koeleria pyramidata     | 3.13               | 5.83                        | 24.67                    | 7.49                              | 13.32                   |
| Muhlenbergia cuspidata  | 0.93               | 1.74                        | 6.67                     | 2.02                              | 3.76                    |
| Stipa comata            | 6.07               | 11.29                       | 44.67                    | 13.56                             | 24.85                   |
| Stipa viridula          | 1.80               | 3.35                        | 14.00                    | 4.25                              | 7.60                    |
| Carex filifolia         | 4.87               | 9.06                        | 36.67                    | 11.13                             | 20.19                   |
| Achillea millefolium    | 0.53               | 0.99                        | 4.67                     | 1.42                              | 2.41                    |
| Agoseris glauca         | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Antennaria parvifolia   | 1.27               | 2.36                        | 6.67                     | 2.02                              | 4.38                    |
| Artemisia dracunculus   | 0.40               | 0.74                        | 4.00                     | 1.21                              | 1.95                    |
| Artemisia frigida       | 0.33               | 0.62                        | 3.33                     | 1.01                              | 1.63                    |
| Astragalus crassicaupus | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Erigeron strigosus      | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Erysimum asperum        | 0.27               | 0.50                        | 2.67                     | 0.81                              | 1.31                    |
| Gaura coccinea          | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Haplopappus spinulosus  | 0.13               | 0.25                        | 1.33                     | 0.40                              | 0.65                    |
| Hedeoma hispida         | 0.40               | 0.74                        | 4.00                     | 1.21                              | 1.95                    |
| Liatris punctata        | 0.20               | 0.37                        | 2.00                     | 0.61                              | 0.98                    |
| Linum rigidum           | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Lithospermum incisum    | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Orthocarpus luteus      | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Phlox hoodii            | 1.27               | 2.36                        | 10.67                    | 3.24                              | 5.60                    |
| Plantago purshii        | 0.20               | 0.37                        | 2.00                     | 0.61                              | 0.98                    |
| Potentilla pensylvanica | 0.20               | 0.37                        | 2.00                     | 0.61                              | 0.98                    |
| Psoralea esculenta      | 0.20               | 0.37                        | 1.33                     | 0.40                              | 0.77                    |
| Ratibida columnifera    | 0.87               | 1.61                        | 8.00                     | 2.43                              | 4.04                    |
| Sphaeralcea coccinea    | 0.07               | 0.12                        | 0.67                     | 0.20                              | 0.32                    |
| Selaginella densa       | 7.40               | 13.77                       | 27.33                    | 8.30                              | 22.07                   |
| Lichen spp.             | 7.20               | 13.40                       | 38.67                    | 11.74                             | 25.14                   |
| Litter                  | 46.07              |                             | 100.00                   |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                    | 0.20               |                             | 1.33                     |                                   |                         |

**Table 10. Points Analysis of the Ammonium Nitrate Treatment at the 60 Pounds of Nitrogen Per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 1.60               | 3.48                        | 14.67                    | 4.84                              | 8.32                    |
| Bouteloua gracilis     | 13.53              | 29.42                       | 66.67                    | 21.98                             | 51.40                   |
| Koeleria pyramidata    | 2.53               | 5.51                        | 21.33                    | 7.03                              | 12.54                   |
| Muhlenbergia cuspidata | 0.67               | 1.45                        | 4.00                     | 1.32                              | 2.77                    |
| Poa compressa          | 0.07               | 0.14                        | 0.67                     | 0.22                              | 0.36                    |
| Stipa comata           | 6.80               | 14.78                       | 47.33                    | 15.60                             | 30.38                   |
| Stipa viridula         | 0.93               | 2.03                        | 8.67                     | 2.86                              | 4.89                    |
| Carex filifolia        | 7.60               | 16.52                       | 48.67                    | 16.04                             | 32.56                   |
| Carex heliophila       | 0.13               | 0.29                        | 0.67                     | 0.22                              | 0.51                    |
| Achillea millefolium   | 0.67               | 1.45                        | 4.67                     | 1.54                              | 2.99                    |
| Antennaria parvifolia  | 0.60               | 1.30                        | 4.67                     | 1.54                              | 2.84                    |
| Arabis holboellii      | 0.13               | 0.29                        | 1.33                     | 0.44                              | 0.73                    |
| Artemisia dracunculus  | 0.53               | 1.16                        | 4.67                     | 1.54                              | 2.70                    |
| Artemisia frigida      | 1.53               | 3.33                        | 13.33                    | 4.40                              | 7.73                    |
| Commandra umbellata    | 0.13               | 0.29                        | 1.33                     | 0.44                              | 0.73                    |
| Erysimum asperum       | 0.13               | 0.29                        | 1.33                     | 0.44                              | 0.73                    |
| Grindelia squarrosa    | 0.33               | 0.72                        | 2.67                     | 0.88                              | 1.60                    |
| Hedeoma hispida        | 0.07               | 0.14                        | 0.67                     | 0.22                              | 0.36                    |
| Liatris punctata       | 0.20               | 0.43                        | 2.00                     | 0.66                              | 1.09                    |
| Oxytropis lambertii    | 0.07               | 0.14                        | 0.67                     | 0.22                              | 0.36                    |
| Phlox hoodii           | 0.67               | 1.45                        | 4.00                     | 1.32                              | 2.77                    |
| Polygala alba          | 0.07               | 0.14                        | 0.67                     | 0.22                              | 0.36                    |
| Psoralea argophylla    | 0.07               | 0.14                        | 0.67                     | 0.22                              | 0.36                    |
| Ratibida columnifera   | 0.60               | 1.30                        | 5.33                     | 1.76                              | 3.06                    |
| Sphaeralcea coccinea   | 1.27               | 2.75                        | 12.00                    | 3.96                              | 6.71                    |
| Selaginella densa      | 0.40               | 0.87                        | 2.67                     | 0.88                              | 1.75                    |
| Lichen spp.            | 4.67               | 10.14                       | 28.00                    | 9.23                              | 19.37                   |
| Litter                 | 54.00              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.00               |                             | 0.00                     |                                   |                         |

**Table 11. Points Analysis of the Ammonium Nitrate Treatment at the 60 Pounds of Nitrogen Per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii       | 1.20               | 2.31                        | 11.33                    | 3.50                              | 5.81                    |
| Bouteloua gracilis      | 15.20              | 29.27                       | 74.00                    | 22.84                             | 52.11                   |
| Koeleria pyramidata     | 3.20               | 6.16                        | 24.67                    | 7.61                              | 13.77                   |
| Muhlenbergia cuspidata  | 0.13               | 0.26                        | 1.33                     | 0.41                              | 0.67                    |
| Poa compressa           | 0.13               | 0.26                        | 1.33                     | 0.41                              | 0.67                    |
| Stipa comata            | 7.13               | 13.74                       | 51.33                    | 15.84                             | 29.58                   |
| Stipa viridula          | 1.47               | 2.82                        | 11.33                    | 3.50                              | 6.32                    |
| Carex filifolia         | 4.47               | 8.60                        | 28.67                    | 8.85                              | 17.45                   |
| Achillea millefolium    | 0.27               | 0.51                        | 2.67                     | 0.82                              | 1.33                    |
| Antennaria parvifolia   | 0.53               | 1.03                        | 4.00                     | 1.23                              | 2.26                    |
| Artemisia dracunculus   | 0.40               | 0.77                        | 3.33                     | 1.03                              | 1.80                    |
| Artemisia frigida       | 1.07               | 2.05                        | 9.33                     | 2.88                              | 4.93                    |
| Erysimum asperum        | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Grindelia squarrosa     | 0.20               | 0.39                        | 2.00                     | 0.62                              | 1.01                    |
| Gutierrezia sarothrae   | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Haplopappus spinulosus  | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Hedeoma hispida         | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Liatris punctata        | 0.40               | 0.77                        | 4.00                     | 1.23                              | 2.00                    |
| Linum rigidum           | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Lithospermum incisum    | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Phlox hoodii            | 2.67               | 5.13                        | 18.67                    | 5.76                              | 10.89                   |
| Potentilla pensylvanica | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Psoralea esculenta      | 0.27               | 0.51                        | 2.67                     | 0.82                              | 1.33                    |
| Ratibida columnifera    | 0.53               | 1.03                        | 5.33                     | 1.65                              | 2.68                    |
| Sphaeralcea coccinea    | 0.53               | 1.03                        | 4.67                     | 1.44                              | 2.47                    |
| Taraxacum officinale    | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Rosa arkansana          | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Selaginella densa       | 9.87               | 19.00                       | 43.33                    | 13.37                             | 32.37                   |
| Lichen spp.             | 1.67               | 3.21                        | 14.00                    | 4.32                              | 7.53                    |
| Litter                  | 48.07              |                             | 100.00                   |                                   |                         |
| Rock                    | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                    | 0.00               |                             | 0.00                     |                                   |                         |

**Table 12. Points Analysis of the Ammonium Nitrate Treatment at the 100 Pounds of Nitrogen Per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                     | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii           | 1.67        | 3.43                 | 14.00             | 4.15                       | 7.58             |
| Bouteloua gracilis          | 11.00       | 22.63                | 62.67             | 18.58                      | 41.21            |
| Koeleria pyramidata         | 2.33        | 4.80                 | 18.00             | 5.34                       | 10.14            |
| Muhlenbergia cuspidata      | 0.73        | 1.51                 | 4.67              | 1.38                       | 2.89             |
| Panicum oligosanthos        | 0.73        | 1.51                 | 6.00              | 1.78                       | 3.29             |
| Poa compressa               | 0.13        | 0.27                 | 1.33              | 0.40                       | 0.67             |
| Stipa comata                | 7.93        | 16.32                | 53.33             | 15.81                      | 32.13            |
| Stipa viridula              | 2.93        | 6.04                 | 19.33             | 5.73                       | 11.77            |
| Carex filifolia             | 4.67        | 9.60                 | 30.67             | 9.09                       | 18.69            |
| Carex heliophila            | 0.20        | 0.41                 | 2.00              | 0.59                       | 1.00             |
| Achillea millefolium        | 1.20        | 2.47                 | 10.00             | 2.96                       | 5.43             |
| Antennaria parvifolia       | 0.60        | 1.23                 | 4.67              | 1.38                       | 2.61             |
| Arabis holboellii           | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Artemisia dracunculus       | 0.20        | 0.41                 | 2.00              | 0.59                       | 1.00             |
| Artemisia frigida           | 1.40        | 2.88                 | 13.33             | 3.95                       | 6.83             |
| Cirsium undulatum           | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Echinacea angustifolia      | 0.13        | 0.27                 | 1.33              | 0.40                       | 0.67             |
| Erigeron strigosus          | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Erysimum asperum            | 0.47        | 0.96                 | 4.00              | 1.19                       | 2.15             |
| Grindelia squarrosa         | 0.33        | 0.69                 | 2.67              | 0.79                       | 1.48             |
| Hedeoma hispida             | 0.13        | 0.27                 | 1.33              | 0.40                       | 0.67             |
| Lactuca oblongifolia        | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Liatris punctata            | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Linum rigidum               | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Orthocarpus luteus          | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Phlox hoodii                | 0.67        | 1.37                 | 6.00              | 1.78                       | 3.15             |
| Plantago purshii            | 0.13        | 0.27                 | 1.33              | 0.40                       | 0.67             |
| Potentilla pensylvanica     | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Psoralea argophylla         | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Psoralea esculenta          | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Ratibida columnifera        | 1.13        | 2.33                 | 10.67             | 3.16                       | 5.49             |
| Senecio plattensis          | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Sphaeralcea coccinea        | 1.00        | 2.06                 | 10.00             | 2.96                       | 5.02             |
| Symphoricarpos occidentalis | 0.07        | 0.14                 | 0.67              | 0.20                       | 0.34             |
| Selaginella densa           | 1.73        | 3.57                 | 7.33              | 2.17                       | 5.74             |
| Lichen spp.                 | 6.33        | 13.03                | 42.67             | 12.65                      | 25.68            |
| Litter                      | 51.33       |                      | 100.00            |                            |                  |
| Rock                        | 0.00        |                      | 0.00              |                            |                  |
| Soil                        | 0.07        |                      | 0.67              |                            |                  |

**Table 13. Points Analysis of the Urea Treatment at the 40 Pounds of Nitrogen per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                | Basal<br>Cover | Relative<br>Basal<br>Cover | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|------------------------|----------------|----------------------------|----------------------|----------------------------------|---------------------|
| Agropyron smithii      | 2.13           | 4.26                       | 17.33                | 5.58                             | 9.84                |
| Andropogon scoparius   | 0.07           | 0.13                       | 0.67                 | 0.21                             | 0.34                |
| Bouteloua gracilis     | 12.53          | 25.00                      | 68.67                | 22.10                            | 47.10               |
| Buchloe dactyloides    | 0.07           | 0.13                       | 0.67                 | 0.21                             | 0.34                |
| Koeleria pyramidata    | 2.73           | 5.45                       | 24.00                | 7.73                             | 13.18               |
| Muhlenbergia cuspidata | 0.67           | 1.33                       | 4.67                 | 1.50                             | 2.83                |
| Stipa comata           | 5.53           | 11.04                      | 40.67                | 13.09                            | 24.13               |
| Stipa viridula         | 1.27           | 2.53                       | 12.00                | 3.86                             | 6.39                |
| Carex filifolia        | 1.53           | 3.06                       | 14.00                | 4.51                             | 7.57                |
| Carex heliophila       | 0.07           | 0.13                       | 0.67                 | 0.21                             | 0.34                |
| Achillea millefolium   | 0.73           | 1.46                       | 5.33                 | 1.72                             | 3.18                |
| Antennaria parvifolia  | 1.67           | 3.32                       | 12.00                | 3.86                             | 7.18                |
| Artemisia dracunculus  | 0.07           | 0.13                       | 0.67                 | 0.21                             | 0.34                |
| Artemisia frigida      | 0.87           | 1.73                       | 7.33                 | 2.36                             | 4.09                |
| Aster ericoides        | 0.13           | 0.27                       | 1.33                 | 0.43                             | 0.70                |
| Cerastium arvense      | 0.07           | 0.13                       | 0.67                 | 0.21                             | 0.34                |
| Erigeron strigosus     | 0.13           | 0.27                       | 1.33                 | 0.43                             | 0.70                |
| Erysimum asperum       | 0.13           | 0.27                       | 1.33                 | 0.43                             | 0.70                |
| Grindelia squarrosa    | 0.13           | 0.27                       | 0.67                 | 0.21                             | 0.48                |
| Hedeoma hispida        | 0.27           | 0.53                       | 2.67                 | 0.86                             | 1.39                |
| Liatris punctata       | 0.13           | 0.27                       | 1.33                 | 0.43                             | 0.70                |
| Linum rigidum          | 0.20           | 0.40                       | 2.00                 | 0.64                             | 1.04                |
| Phlox hoodii           | 0.87           | 1.73                       | 6.00                 | 1.93                             | 3.66                |
| Psoralea esculenta     | 0.07           | 0.13                       | 0.67                 | 0.21                             | 0.34                |
| Ratibida columnifera   | 1.07           | 2.13                       | 10.67                | 3.43                             | 5.56                |
| Sphaeralcea coccinea   | 0.53           | 1.06                       | 5.33                 | 1.72                             | 2.78                |
| Selaginella densa      | 7.67           | 15.29                      | 28.00                | 9.01                             | 24.30               |
| Lichen spp.            | 8.80           | 17.55                      | 40.00                | 12.88                            | 30.43               |
| Litter                 | 49.87          |                            | 100.00               |                                  |                     |
| Rock                   | 0.00           |                            | 0.00                 |                                  |                     |
| Soil                   | 0.00           |                            | 0.00                 |                                  |                     |

**Table 14. Points Analysis of the Urea Treatment at the 40 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii      | 1.93        | 3.67                 | 16.67             | 4.78                       | 8.45             |
| Bouteloua gracilis     | 16.13       | 30.63                | 78.67             | 22.56                      | 53.19            |
| Koeleria pyramidata    | 2.93        | 5.57                 | 24.00             | 6.88                       | 12.45            |
| Muhlenbergia cuspidata | 0.40        | 0.76                 | 3.33              | 0.96                       | 1.72             |
| Munroa squarrosa       | 0.13        | 0.25                 | 1.33              | 0.38                       | 0.63             |
| Poa compressa          | 0.20        | 0.38                 | 1.33              | 0.38                       | 0.76             |
| Stipa comata           | 6.27        | 11.90                | 43.33             | 12.43                      | 24.33            |
| Stipa viridula         | 1.60        | 3.04                 | 14.67             | 4.21                       | 7.25             |
| Carex filifolia        | 5.00        | 9.49                 | 34.00             | 9.75                       | 19.24            |
| Carex heliophila       | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Achillea millefolium   | 0.53        | 1.01                 | 5.33              | 1.53                       | 2.54             |
| Androsace occidentalis | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Antennaria parvifolia  | 0.87        | 1.65                 | 6.67              | 1.91                       | 3.56             |
| Arabis holboellii      | 0.13        | 0.25                 | 1.33              | 0.38                       | 0.63             |
| Artemisia dracunculus  | 0.27        | 0.51                 | 2.67              | 0.76                       | 1.27             |
| Artemisia frigida      | 1.27        | 2.41                 | 12.00             | 3.44                       | 5.85             |
| Aster ericoides        | 0.13        | 0.25                 | 1.33              | 0.38                       | 0.63             |
| Chrysopsis villosa     | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Erigeron strigosus     | 0.20        | 0.38                 | 2.00              | 0.57                       | 0.95             |
| Grindelia squarrosa    | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Haplopappus spinulosus | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Hedeoma hispida        | 0.13        | 0.25                 | 1.33              | 0.38                       | 0.63             |
| Liatis punctata        | 0.20        | 0.38                 | 2.00              | 0.57                       | 0.95             |
| Linum rigidum          | 0.13        | 0.25                 | 1.33              | 0.38                       | 0.63             |
| Opuntia fragilis       | 0.13        | 0.25                 | 0.67              | 0.19                       | 0.44             |
| Orthocarpus luteus     | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Petalostemon purpureum | 1.73        | 3.29                 | 14.67             | 4.21                       | 7.50             |
| Phlox hoodii           | 0.33        | 0.63                 | 3.33              | 0.96                       | 1.59             |
| Plantago purshii       | 0.13        | 0.25                 | 0.67              | 0.19                       | 0.44             |
| Polygala alba          | 0.07        | 0.13                 | 0.67              | 0.19                       | 0.32             |
| Psoralea esculenta     | 0.93        | 1.77                 | 9.33              | 2.68                       | 4.45             |
| Solidago rigida        | 0.87        | 1.65                 | 8.67              | 2.49                       | 4.14             |
| Selaginella densa      | 2.60        | 4.94                 | 12.67             | 3.63                       | 8.57             |
| Lichen spp.            | 7.00        | 13.29                | 40.67             | 11.66                      |                  |
| Litter                 | 47.27       |                      | 100.00            |                            |                  |
| Rock                   | 0.00        |                      | 0.00              |                            |                  |
| Soil                   | 0.07        |                      | 0.67              |                            |                  |

**Table 15. Points Analysis of the Urea Treatment at the 60 Pounds of Nitrogen per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.93               | 1.83                        | 9.33                     | 2.79                              | 4.62                    |
| Bouteloua gracilis     | 12.40              | 24.28                       | 63.33                    | 18.96                             | 43.24                   |
| Buchloe dactyloides    | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Koeleria pyramidata    | 2.40               | 4.70                        | 21.33                    | 6.39                              | 11.09                   |
| Muhlenbergia cuspidata | 1.13               | 2.22                        | 5.33                     | 1.60                              | 3.82                    |
| Munroa squarrosa       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Poa compressa          | 0.13               | 0.26                        | 1.33                     | 0.40                              | 0.66                    |
| Stipa comata           | 7.40               | 14.49                       | 51.33                    | 15.37                             | 29.86                   |
| Stipa viridula         | 1.80               | 3.52                        | 16.00                    | 4.79                              | 8.31                    |
| Carex filifolia        | 4.80               | 9.40                        | 34.00                    | 10.18                             | 19.58                   |
| Achillea millefolium   | 0.40               | 0.78                        | 4.00                     | 1.20                              | 1.98                    |
| Antennaria parvifolia  | 0.93               | 1.83                        | 6.00                     | 1.80                              | 3.63                    |
| Artemisia dracunculus  | 0.33               | 0.65                        | 3.33                     | 1.00                              | 1.65                    |
| Artemisia frigida      | 1.13               | 2.22                        | 10.67                    | 3.19                              | 5.41                    |
| Aster ericoides        | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Cirsium undulatum      | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Commandra umbellata    | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Erigeron strigosus     | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Grindelia squarrosa    | 0.20               | 0.39                        | 2.00                     | 0.60                              | 0.99                    |
| Gutierrezia sarothrae  | 0.13               | 0.26                        | 1.33                     | 0.40                              | 0.66                    |
| Hedeoma hispida        | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Liatis punctata        | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Opuntia fragilis       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Phlox hoodii           | 1.80               | 3.52                        | 13.33                    | 3.99                              | 7.51                    |
| Psoralea argophylla    | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Ratibida columnifera   | 1.00               | 1.96                        | 10.00                    | 2.99                              | 4.95                    |
| Sphaeralcea coccinea   | 0.67               | 1.31                        | 5.33                     | 1.60                              | 2.91                    |
| Selaginella densa      | 6.47               | 12.66                       | 28.67                    | 8.58                              | 21.24                   |
| Lichen spp.            | 6.33               | 12.40                       | 40.67                    | 12.18                             | 24.58                   |
| Litter                 | 48.60              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.33               |                             | 2.00                     |                                   |                         |

**Table 16. Points Analysis of the Urea Treatment at the 60 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 1.07               | 2.01                        | 8.67                     | 2.59                              | 4.60                    |
| Andropogon scoparius   | 0.27               | 0.50                        | 1.33                     | 0.40                              | 0.90                    |
| Bouteloua gracilis     | 10.73              | 20.25                       | 60.67                    | 18.13                             | 38.38                   |
| Koeleria pyramidata    | 2.33               | 4.40                        | 16.67                    | 4.98                              | 9.38                    |
| Muhlenbergia cuspidata | 1.73               | 3.27                        | 13.33                    | 3.98                              | 7.25                    |
| Stipa comata           | 6.87               | 12.96                       | 52.00                    | 15.54                             | 28.50                   |
| Stipa viridula         | 2.20               | 4.15                        | 16.00                    | 4.78                              | 8.93                    |
| Carex filifolia        | 7.27               | 13.71                       | 34.00                    | 10.16                             | 23.87                   |
| Carex heliophila       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Achillea millefolium   | 0.73               | 1.38                        | 7.33                     | 2.19                              | 3.57                    |
| Antennaria parvifolia  | 2.27               | 4.28                        | 12.67                    | 3.78                              | 8.06                    |
| Arabis holboellii      | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Artemisia dracunculus  | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Artemisia frigida      | 1.13               | 2.14                        | 8.67                     | 2.59                              | 4.73                    |
| Aster ericoides        | 0.13               | 0.25                        | 0.67                     | 0.20                              | 0.45                    |
| Echinacea angustifolia | 0.93               | 1.76                        | 7.33                     | 2.19                              | 3.95                    |
| Erysimum asperum       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Grindelia squarrosa    | 0.27               | 0.50                        | 2.67                     | 0.80                              | 1.30                    |
| Haplopappus spinulosus | 0.13               | 0.25                        | 1.33                     | 0.40                              | 0.65                    |
| Hedeoma hispida        | 0.27               | 0.50                        | 2.67                     | 0.80                              | 1.30                    |
| Lepidium densiflorum   | 0.27               | 0.50                        | 2.00                     | 0.60                              | 1.10                    |
| Liatis punctata        | 0.27               | 0.50                        | 2.67                     | 0.80                              | 1.30                    |
| Linum rigidum          | 0.33               | 0.63                        | 2.67                     | 0.80                              | 1.43                    |
| Lotus americanus       | 0.07               | 0.13                        | 0.67                     | 0.20                              | 0.33                    |
| Orthocarpus luteus     | 0.13               | 0.25                        | 1.33                     | 0.40                              | 0.65                    |
| Phlox hoodii           | 0.93               | 1.76                        | 7.33                     | 2.19                              | 3.95                    |
| Plantago purshii       | 0.40               | 0.75                        | 4.00                     | 1.20                              | 1.95                    |
| Polygala alba          | 0.13               | 0.25                        | 1.33                     | 0.40                              | 0.65                    |
| Ratibida columnifera   | 0.67               | 1.26                        | 6.67                     | 1.99                              | 3.25                    |
| Sphaeralcea coccinea   | 0.60               | 1.13                        | 6.00                     | 1.79                              | 2.92                    |
| Selaginella densa      | 7.60               | 14.34                       | 31.33                    | 9.36                              | 23.70                   |
| Lichen spp.            | 3.00               | 5.66                        | 20.00                    | 5.98                              | 11.64                   |
| Litter                 | 46.47              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.53               |                             | 2.67                     |                                   |                         |

**Table 17. Points Analysis of the Urea Treatment at the 100 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 1.13               | 2.26                        | 11.33                    | 3.64                              | 5.90                    |
| Aristida longiseta     | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Bouteloua gracilis     | 16.80              | 33.51                       | 76.00                    | 24.41                             | 57.92                   |
| Koeleria pyramidata    | 2.40               | 4.79                        | 16.67                    | 5.35                              | 10.14                   |
| Muhlenbergia cuspidata | 0.40               | 0.80                        | 2.67                     | 0.86                              | 1.66                    |
| Poa compressa          | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Stipa comata           | 7.07               | 14.10                       | 50.00                    | 16.06                             | 30.16                   |
| Stipa viridula         | 1.47               | 2.93                        | 12.67                    | 4.07                              | 7.00                    |
| Carex filifolia        | 7.07               | 14.10                       | 42.00                    | 13.49                             | 27.59                   |
| Carex heliophila       | 0.60               | 1.20                        | 5.33                     | 1.71                              | 2.91                    |
| Achillea millefolium   | 0.47               | 0.93                        | 4.00                     | 1.28                              | 2.21                    |
| Antennaria parvifolia  | 0.20               | 0.40                        | 0.67                     | 0.21                              | 0.61                    |
| Artemisia dracunculus  | 0.33               | 0.66                        | 3.33                     | 1.07                              | 1.73                    |
| Artemisia frigida      | 0.53               | 1.06                        | 4.67                     | 1.50                              | 2.56                    |
| Haplopappus spinulosus | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Liatris punctata       | 0.20               | 0.40                        | 2.00                     | 0.64                              | 1.04                    |
| Linum rigidum          | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Lotus americanus       | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Orthocarpus luteus     | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Petalostemon purpureum | 0.13               | 0.27                        | 0.67                     | 0.21                              | 0.48                    |
| Phlox hoodia           | 1.07               | 2.13                        | 8.00                     | 2.57                              | 4.70                    |
| Polygala alba          | 0.13               | 0.27                        | 1.33                     | 0.43                              | 0.70                    |
| Psoralea esculenta     | 0.07               | 0.13                        | 0.67                     | 0.21                              | 0.34                    |
| Ratibida columnifera   | 0.73               | 1.46                        | 7.33                     | 2.36                              | 3.82                    |
| Sphaeralcea coccinea   | 0.80               | 1.60                        | 8.00                     | 2.57                              | 4.17                    |
| Selaginella densa      | 4.60               | 9.18                        | 24.00                    | 7.71                              | 16.89                   |
| Lichen spp.            | 3.53               | 7.05                        | 26.00                    | 8.35                              | 15.40                   |
| Litter                 | 49.73              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Soil                   | 0.13               |                             | 1.33                     |                                   |                         |

**Table 18. Mean Percentage of Basal Cover for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Treatment</b>            | <b>Application<br/>Rate</b> | <b>Grass</b> | <b>Sedge</b> | <b>Forbs</b> | <b>Shrubs</b> | <b>Club<br/>Moss</b> | <b>Lichen</b> | <b>Litter</b> | <b>Rock</b> | <b>Soil</b> |
|-----------------------------|-----------------------------|--------------|--------------|--------------|---------------|----------------------|---------------|---------------|-------------|-------------|
| <b>Control</b>              | 0 lbs                       | 26.70        | 4.50         | 6.65         | 0.00          | 7.70                 | 4.83          | 49.43         | 0.00        | 0.17        |
|                             |                             |              |              |              |               |                      |               |               |             |             |
| <b>Ammonium<br/>Nitrate</b> | 40 lbs EY                   | 25.06        | 3.87         | 7.35         | 0.07          | 7.87                 | 9.00          | 46.73         | 0.00        | 0.01        |
|                             | 40 lbs EOY                  | 27.47        | 4.87         | 6.83         | 0.00          | 7.40                 | 7.20          | 46.07         | 0.00        | 0.20        |
|                             | 60 lbs EY                   | 26.13        | 7.73         | 7.07         | 0.00          | 0.40                 | 4.67          | 54.00         | 0.00        | 0.00        |
|                             | 60 lbs EOY                  | 28.46        | 4.47         | 7.43         | 0.07          | 9.87                 | 1.67          | 48.07         | 0.00        | 0.00        |
|                             | 100 lbs EOY                 | 27.45        | 4.87         | 8.16         | 0.07          | 1.73                 | 6.33          | 51.33         | 0.00        | 0.07        |
|                             |                             |              |              |              |               |                      |               |               |             |             |
| <b>Urea</b>                 | 40 lbs EY                   | 25.00        | 1.60         | 7.07         | 0.00          | 7.67                 | 8.80          | 49.87         | 0.00        | 0.00        |
|                             | 40 lbs EOY                  | 29.59        | 5.07         | 8.40         | 0.00          | 2.60                 | 7.00          | 47.27         | 0.00        | 0.07        |
|                             | 60 lbs EY                   | 26.33        | 4.80         | 7.15         | 0.00          | 6.47                 | 6.33          | 48.60         | 0.00        | 0.33        |
|                             | 60 lbs EOY                  | 25.20        | 7.34         | 9.87         | 0.00          | 7.60                 | 3.00          | 46.47         | 0.00        | 0.53        |
|                             | 100 lbs EOY                 | 29.41        | 7.67         | 4.94         | 0.00          | 4.60                 | 3.53          | 49.73         | 0.00        | 0.13        |

**Table 19. Density Analysis per 0.1 Sq. Meter of the Control Treatment (North and South) for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>          | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium    | 0.27           | 2.57                                    | 15.00                        | 3.21                                      | 5.78                        |
| Androsace occidentalis  | 0.12           | 1.12                                    | 5.00                         | 1.07                                      | 2.19                        |
| Antennaria parvifolia   | 0.55           | 5.30                                    | 11.67                        | 2.50                                      | 7.80                        |
| Arabis hirsuta          | 0.03           | 0.32                                    | 3.33                         | 0.71                                      | 1.03                        |
| Arabis holboellii       | 0.03           | 0.32                                    | 3.33                         | 0.71                                      | 1.03                        |
| Artemisia dracunculus   | 0.27           | 2.57                                    | 21.67                        | 4.64                                      | 7.21                        |
| Artemisia frigida       | 0.67           | 6.42                                    | 45.00                        | 9.64                                      | 16.06                       |
| Astragalus agrestis     | 0.10           | 0.96                                    | 3.33                         | 0.71                                      | 1.67                        |
| Astragalus crassicaulus | 0.02           | 0.16                                    | 1.67                         | 0.36                                      | 0.52                        |
| Collomia linearis       | 0.03           | 0.32                                    | 3.33                         | 0.71                                      | 1.03                        |
| Draba nemorosa          | 0.15           | 1.44                                    | 6.67                         | 1.43                                      | 2.87                        |
| Erigeron glabellus      | 0.08           | 0.80                                    | 8.33                         | 1.79                                      | 2.59                        |
| Gaura coccinea          | 0.12           | 1.12                                    | 3.33                         | 0.71                                      | 1.83                        |
| Grindelia squarrosa     | 0.07           | 0.64                                    | 5.00                         | 1.07                                      | 1.71                        |
| Hedeoma hispida         | 1.37           | 13.16                                   | 45.00                        | 9.64                                      | 22.80                       |
| Lactuca oblongifolia    | 0.12           | 1.12                                    | 10.00                        | 2.14                                      | 3.26                        |
| Liatris punctata        | 0.03           | 0.32                                    | 3.33                         | 0.71                                      | 1.03                        |
| Linum rigidum           | 0.18           | 1.77                                    | 18.33                        | 3.93                                      | 5.70                        |
| Lotus americanus        | 0.58           | 5.62                                    | 23.33                        | 5.00                                      | 10.62                       |
| Melilotus officinalis   | 0.02           | 0.16                                    | 1.67                         | 0.36                                      | 0.52                        |
| Orthocarpus luteus      | 0.07           | 0.64                                    | 5.00                         | 1.07                                      | 1.71                        |
| Petalostemon purpureum  | 0.03           | 0.32                                    | 3.33                         | 0.71                                      | 1.03                        |
| Phlox hoodia            | 0.90           | 8.67                                    | 26.67                        | 5.71                                      | 14.38                       |
| Plantago purshii        | 1.38           | 13.32                                   | 40.00                        | 8.57                                      | 21.89                       |
| Polygala alba           | 0.13           | 1.28                                    | 8.33                         | 1.79                                      | 3.07                        |
| Potentilla argute       | 0.03           | 0.32                                    | 1.67                         | 0.36                                      | 0.68                        |
| Potentilla pensylvanica | 0.02           | 0.16                                    | 1.67                         | 0.36                                      | 0.52                        |
| Psoralea argophylla     | 0.18           | 1.77                                    | 10.00                        | 2.14                                      | 3.91                        |
| Psoralea esculenta      | 0.12           | 1.12                                    | 8.33                         | 1.79                                      | 2.91                        |
| Ratibida columnifera    | 1.17           | 11.24                                   | 50.00                        | 10.71                                     | 21.95                       |
| Solidago rigida         | 0.03           | 0.32                                    | 1.67                         | 0.36                                      | 0.68                        |
| Sphaeralcea coccinea    | 1.23           | 11.88                                   | 51.67                        | 11.07                                     | 22.95                       |
| Taraxacum officinale    | 0.15           | 1.44                                    | 6.67                         | 1.43                                      | 2.87                        |
| Vicia americana         | 0.13           | 1.28                                    | 13.33                        | 2.86                                      | 4.14                        |

**Table 20. Density Analysis per 0.1 Sq. Meter of the Control Treatment (North) for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>    | 0.47           | 4.62                                    | 26.67                        | 6.11                                      | 10.73                       |
| <i>Antennaria parvifolia</i>   | 0.73           | 7.26                                    | 13.33                        | 3.05                                      | 10.31                       |
| <i>Arabis holboellii</i>       | 0.03           | 0.33                                    | 3.33                         | 0.76                                      | 1.09                        |
| <i>Artemisia dracunculus</i>   | 0.30           | 2.97                                    | 26.67                        | 6.11                                      | 9.08                        |
| <i>Artemisia frigida</i>       | 0.43           | 4.29                                    | 30.00                        | 6.87                                      | 11.16                       |
| <i>Astragalus agrestis</i>     | 0.20           | 1.98                                    | 6.67                         | 1.53                                      | 3.51                        |
| <i>Draba nemorosa</i>          | 0.27           | 2.64                                    | 10.00                        | 2.29                                      | 4.93                        |
| <i>Grindelia squarrosa</i>     | 0.13           | 1.32                                    | 10.00                        | 2.29                                      | 3.61                        |
| <i>Hedeoma hispida</i>         | 0.93           | 9.24                                    | 26.67                        | 6.11                                      | 15.35                       |
| <i>Lactuca oblongifolia</i>    | 0.10           | 0.99                                    | 10.00                        | 2.29                                      | 3.28                        |
| <i>Liatriis punctate</i>       | 0.07           | 0.66                                    | 6.67                         | 1.53                                      | 2.19                        |
| <i>Linum rigidum</i>           | 0.10           | 0.99                                    | 10.00                        | 2.29                                      | 3.28                        |
| <i>Lotus americanus</i>        | 1.03           | 10.23                                   | 33.33                        | 7.63                                      | 17.86                       |
| <i>Melilotus officinalis</i>   | 0.03           | 0.33                                    | 3.33                         | 0.76                                      | 1.09                        |
| <i>Orthocarpus luteus</i>      | 0.03           | 0.33                                    | 3.33                         | 0.76                                      | 1.09                        |
| <i>Petalostemon purpureum</i>  | 0.03           | 0.33                                    | 3.33                         | 0.76                                      | 1.09                        |
| <i>Phlox hoodia</i>            | 0.70           | 6.93                                    | 20.00                        | 4.58                                      | 11.51                       |
| <i>Plantago purshii</i>        | 1.03           | 10.23                                   | 30.00                        | 6.87                                      | 17.10                       |
| <i>Polygala alba</i>           | 0.17           | 1.65                                    | 6.67                         | 1.53                                      | 3.18                        |
| <i>Potentilla arguta</i>       | 0.07           | 0.66                                    | 3.33                         | 0.76                                      | 1.42                        |
| <i>Potentilla pensylvanica</i> | 0.03           | 0.33                                    | 3.33                         | 0.76                                      | 1.09                        |
| <i>Psoralea argophylla</i>     | 0.37           | 3.63                                    | 20.00                        | 4.58                                      | 8.21                        |
| <i>Psoralea esculenta</i>      | 0.17           | 1.65                                    | 10.00                        | 2.29                                      | 3.94                        |
| <i>Ratibida columnifera</i>    | 1.23           | 12.21                                   | 50.00                        | 11.45                                     | 23.66                       |
| <i>Sphaeralcea coccinea</i>    | 1.20           | 11.88                                   | 46.67                        | 10.69                                     | 22.57                       |
| <i>Vicia americana</i>         | 0.23           | 2.31                                    | 23.33                        | 5.34                                      | 7.65                        |

**Table 21. Density Analysis per 0.1 Sq. Meter of the Control Treatment (South) for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>    | 0.07           | 0.63                                    | 3.33                         | 0.67                                      | 1.30                        |
| <i>Androsace occidentalis</i>  | 0.23           | 2.19                                    | 10.00                        | 2.01                                      | 4.20                        |
| <i>Antennaria parvifolia</i>   | 0.37           | 3.44                                    | 10.00                        | 2.01                                      | 5.45                        |
| <i>Arabis hirsute</i>          | 0.07           | 0.63                                    | 6.67                         | 1.34                                      | 1.97                        |
| <i>Arabis holboellii</i>       | 0.03           | 0.31                                    | 3.33                         | 0.67                                      | 0.98                        |
| <i>Artemisia dracunculus</i>   | 0.23           | 2.19                                    | 16.67                        | 3.36                                      | 5.55                        |
| <i>Artemisia frigida</i>       | 0.90           | 8.44                                    | 60.00                        | 12.08                                     | 20.52                       |
| <i>Astragalus crassicaupus</i> | 0.03           | 0.31                                    | 3.33                         | 0.67                                      | 0.98                        |
| <i>Collomia linearis</i>       | 0.07           | 0.63                                    | 6.67                         | 1.34                                      | 1.97                        |
| <i>Draba nemorosa</i>          | 0.03           | 0.31                                    | 3.33                         | 0.67                                      | 0.98                        |
| <i>Erigeron glabellus</i>      | 0.17           | 1.56                                    | 16.67                        | 3.36                                      | 4.92                        |
| <i>Gaura coccinea</i>          | 0.23           | 2.19                                    | 6.67                         | 1.34                                      | 3.53                        |
| <i>Hedeoma hispida</i>         | 1.80           | 16.88                                   | 63.33                        | 12.75                                     | 29.63                       |
| <i>Lactuca oblongifolia</i>    | 0.13           | 1.25                                    | 10.00                        | 2.01                                      | 3.26                        |
| <i>Linum rigidum</i>           | 0.27           | 2.50                                    | 26.67                        | 5.37                                      | 7.87                        |
| <i>Lotus americanus</i>        | 0.13           | 1.25                                    | 13.33                        | 2.68                                      | 3.93                        |
| <i>Orthocarpus luteus</i>      | 0.10           | 0.94                                    | 6.67                         | 1.34                                      | 2.28                        |
| <i>Petalostemon purpureum</i>  | 0.03           | 0.31                                    | 3.33                         | 0.67                                      | 0.98                        |
| <i>Phlox hoodii</i>            | 1.10           | 10.31                                   | 33.33                        | 6.71                                      | 17.02                       |
| <i>Plantago purshii</i>        | 1.73           | 16.25                                   | 50.00                        | 10.07                                     | 26.32                       |
| <i>Polygala alba</i>           | 0.10           | 0.94                                    | 10.00                        | 2.01                                      | 2.95                        |
| <i>Psoralea esculenta</i>      | 0.07           | 0.63                                    | 6.67                         | 1.34                                      | 1.97                        |
| <i>Ratibida columnifera</i>    | 1.10           | 10.31                                   | 50.00                        | 10.07                                     | 20.38                       |
| <i>Solidago rigida</i>         | 0.07           | 0.63                                    | 3.33                         | 0.67                                      | 1.30                        |
| <i>Sphaeralcea coccinea</i>    | 1.27           | 11.88                                   | 56.67                        | 11.41                                     | 23.29                       |
| <i>Taraxacum officinale</i>    | 0.30           | 2.81                                    | 13.33                        | 2.68                                      | 5.49                        |
| <i>Vicia americana</i>         | 0.03           | 0.31                                    | 3.33                         | 0.67                                      | 0.98                        |

**Table 22. Density Analysis per 0.1 Sq. Meter of the Ammonium Nitrate Treatment at the 40 Pounds of Nitrogen per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>                | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>   | 1.10           | 11.83                                   | 43.33                        | 9.70                                      | 21.53                       |
| <i>Androsace occidentalis</i> | 0.17           | 1.79                                    | 3.33                         | 0.75                                      | 2.54                        |
| <i>Antennaria parvifolia</i>  | 0.90           | 9.68                                    | 16.67                        | 3.73                                      | 13.41                       |
| <i>Arabis hirsuta</i>         | 0.13           | 1.43                                    | 10.00                        | 2.24                                      | 3.67                        |
| <i>Arabis holboellii</i>      | 0.03           | 0.36                                    | 3.33                         | 0.75                                      | 1.11                        |
| <i>Artemisia dracunculus</i>  | 0.23           | 2.51                                    | 16.67                        | 3.73                                      | 6.24                        |
| <i>Artemisia frigida</i>      | 0.23           | 2.51                                    | 20.00                        | 4.48                                      | 6.99                        |
| <i>Aster ericoides</i>        | 0.27           | 2.87                                    | 10.00                        | 2.24                                      | 5.11                        |
| <i>Cerastium arvense</i>      | 0.13           | 1.43                                    | 10.00                        | 2.24                                      | 3.67                        |
| <i>Collomia linearis</i>      | 0.33           | 3.58                                    | 20.00                        | 4.48                                      | 8.06                        |
| <i>Echinacea angustifolia</i> | 0.10           | 1.08                                    | 6.67                         | 1.49                                      | 2.57                        |
| <i>Erigeron glabellus</i>     | 0.07           | 0.72                                    | 3.33                         | 0.75                                      | 1.47                        |
| <i>Grindelia squarrosa</i>    | 0.07           | 0.72                                    | 6.67                         | 1.49                                      | 2.21                        |
| <i>Gutierrezia sarothrae</i>  | 0.07           | 0.72                                    | 3.33                         | 0.75                                      | 1.47                        |
| <i>Hedeoma hispida</i>        | 0.80           | 8.60                                    | 33.33                        | 7.46                                      | 16.06                       |
| <i>Lepidium densiflorum</i>   | 0.13           | 1.43                                    | 6.67                         | 1.49                                      | 2.92                        |
| <i>Linum rigidum</i>          | 0.13           | 1.43                                    | 13.33                        | 2.99                                      | 4.42                        |
| <i>Lotus americanus</i>       | 0.27           | 2.87                                    | 10.00                        | 2.24                                      | 5.11                        |
| <i>Melilotus officinalis</i>  | 0.03           | 0.36                                    | 3.33                         | 0.75                                      | 1.11                        |
| <i>Opuntia fragilis</i>       | 0.03           | 0.36                                    | 3.33                         | 0.75                                      | 1.11                        |
| <i>Penstemon gracilis</i>     | 0.10           | 1.08                                    | 3.33                         | 0.75                                      | 1.83                        |
| <i>Phlox hoodii</i>           | 0.50           | 5.38                                    | 20.00                        | 4.48                                      | 9.86                        |
| <i>Plantago purshii</i>       | 1.20           | 12.90                                   | 63.33                        | 14.18                                     | 27.08                       |
| <i>Ratibida columnifera</i>   | 1.13           | 12.19                                   | 50.00                        | 11.19                                     | 23.38                       |
| <i>Sphaeralcea coccinea</i>   | 0.90           | 9.68                                    | 46.67                        | 10.45                                     | 20.13                       |
| <i>Taraxacum officinale</i>   | 0.20           | 2.15                                    | 16.67                        | 3.73                                      | 5.88                        |
| <i>Vicia americana</i>        | 0.03           | 0.36                                    | 3.33                         | 0.75                                      | 1.11                        |

**Table 23. Density Analysis per 0.1 Sq. Meter of the Ammonium Nitrate Treatment at the 40 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>           | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium     | 0.70           | 6.44                                    | 20.00                        | 4.65                                      | 11.09                       |
| Androsace occidentalis   | 0.07           | 0.61                                    | 3.33                         | 0.78                                      | 1.39                        |
| Antennaria parvifolia    | 0.43           | 3.99                                    | 13.33                        | 3.10                                      | 7.09                        |
| Arabis holboellii        | 0.10           | 0.92                                    | 6.67                         | 1.55                                      | 2.47                        |
| Artemisia dracunculus    | 0.23           | 2.15                                    | 16.67                        | 3.88                                      | 6.03                        |
| Artemisia frigida        | 0.30           | 2.76                                    | 30.00                        | 6.98                                      | 9.74                        |
| Aster ericoides          | 2.60           | 23.93                                   | 33.33                        | 7.75                                      | 31.68                       |
| Astragalus crassicaupus  | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Astragalus missouriensis | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Bahia oppositifolia      | 0.10           | 0.92                                    | 10.00                        | 2.33                                      | 3.25                        |
| Erigeron glabellus       | 0.23           | 2.15                                    | 6.67                         | 1.55                                      | 3.70                        |
| Erysimum asperum         | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Gaura coccinea           | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Grindelia squarrosa      | 0.20           | 1.84                                    | 13.33                        | 3.10                                      | 4.94                        |
| Haplopappus spinulosus   | 0.07           | 0.61                                    | 6.67                         | 1.55                                      | 2.16                        |
| Hedeoma hispida          | 1.70           | 15.64                                   | 46.67                        | 10.85                                     | 26.49                       |
| Liatis punctata          | 0.23           | 2.15                                    | 13.33                        | 3.10                                      | 5.25                        |
| Linum rigidum            | 0.13           | 1.23                                    | 13.33                        | 3.10                                      | 4.33                        |
| Lithospermum incisum     | 0.07           | 0.61                                    | 3.33                         | 0.78                                      | 1.39                        |
| Lotus americanus         | 0.10           | 0.92                                    | 10.00                        | 2.33                                      | 3.25                        |
| Orthocarpus luteus       | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Oxytropis lambertii      | 0.07           | 0.61                                    | 6.67                         | 1.55                                      | 2.16                        |
| Penstemon gracilis       | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Petalostemon purpureum   | 0.07           | 0.61                                    | 6.67                         | 1.55                                      | 2.16                        |
| Phlox hoodii             | 0.70           | 6.44                                    | 20.00                        | 4.65                                      | 11.09                       |
| Plantago purshii         | 1.27           | 11.66                                   | 43.33                        | 10.08                                     | 21.74                       |
| Polygala alba            | 0.07           | 0.61                                    | 3.33                         | 0.78                                      | 1.39                        |
| Potentilla arguta        | 0.03           | 0.31                                    | 3.33                         | 0.78                                      | 1.09                        |
| Psoralea esculenta       | 0.10           | 0.92                                    | 6.67                         | 1.55                                      | 2.47                        |
| Ratibida columnifera     | 0.77           | 7.06                                    | 50.00                        | 11.63                                     | 18.69                       |
| Sphaeralcea coccinea     | 0.13           | 1.23                                    | 6.67                         | 1.55                                      | 2.78                        |
| Taraxacum officinale     | 0.10           | 0.92                                    | 6.67                         | 1.55                                      | 2.47                        |
| Vicia americana          | 0.10           | 0.92                                    | 10.00                        | 2.33                                      | 3.25                        |

**Table 24. Density Analysis per 0.1 Sq. Meter of the Ammonium Nitrate Treatment at the 60 Pounds of Nitrogen per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium   | 0.43           | 5.28                                    | 20.00                        | 4.92                                      | 10.20                       |
| Antennaria parvifolia  | 0.57           | 6.91                                    | 6.67                         | 1.64                                      | 8.55                        |
| Artemisia dracunculus  | 0.37           | 4.47                                    | 33.33                        | 8.20                                      | 12.67                       |
| Artemisia frigida      | 0.93           | 11.38                                   | 63.33                        | 15.57                                     | 26.95                       |
| Cerastium arvense      | 0.17           | 2.03                                    | 3.33                         | 0.82                                      | 2.85                        |
| Collomia linearis      | 0.03           | 0.41                                    | 3.33                         | 0.82                                      | 1.23                        |
| Erigeron glabellus     | 0.07           | 0.81                                    | 6.67                         | 1.64                                      | 2.45                        |
| Gaura coccinea         | 0.07           | 0.81                                    | 6.67                         | 1.64                                      | 2.45                        |
| Grindelia squarrosa    | 0.23           | 2.85                                    | 16.67                        | 4.10                                      | 6.95                        |
| Hedeoma hispida        | 0.33           | 4.07                                    | 23.33                        | 5.74                                      | 9.81                        |
| Lepidium densiflorum   | 0.03           | 0.41                                    | 3.33                         | 0.82                                      | 1.23                        |
| Lotus americanus       | 0.10           | 1.22                                    | 6.67                         | 1.64                                      | 2.86                        |
| Phlox hoodii           | 1.23           | 15.04                                   | 16.67                        | 4.10                                      | 19.14                       |
| Plantago purshii       | 0.50           | 6.10                                    | 30.00                        | 7.38                                      | 13.48                       |
| Potentilla arguta      | 0.03           | 0.41                                    | 3.33                         | 0.82                                      | 1.23                        |
| Psoralea esculenta     | 0.30           | 3.66                                    | 20.00                        | 4.92                                      | 8.58                        |
| Ratibida columnifera   | 0.90           | 10.98                                   | 43.33                        | 10.66                                     | 21.64                       |
| Solidago missouriensis | 0.03           | 0.41                                    | 3.33                         | 0.82                                      | 1.23                        |
| Sphaeralcea coccinea   | 1.57           | 19.11                                   | 76.67                        | 18.85                                     | 37.96                       |
| Taraxacum officinale   | 0.13           | 1.63                                    | 6.67                         | 1.64                                      | 3.27                        |
| Vicia americana        | 0.17           | 2.03                                    | 13.33                        | 3.28                                      | 5.31                        |

**Table 25. Density Analysis per 0.1 Sq. Meter of the Ammonium Nitrate Treatment at the 60 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>              | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium        | 0.67           | 8.93                                    | 23.33                        | 6.80                                      | 15.73                       |
| Antennaria parvifolia       | 0.63           | 8.48                                    | 10.00                        | 2.91                                      | 11.39                       |
| Artemisia dracunculus       | 0.17           | 2.23                                    | 16.67                        | 4.85                                      | 7.08                        |
| Artemisia frigida           | 0.37           | 4.91                                    | 30.00                        | 8.74                                      | 13.65                       |
| Aster ericoides             | 0.40           | 5.36                                    | 6.67                         | 1.94                                      | 7.30                        |
| Grindelia squarrosa         | 0.17           | 2.23                                    | 16.67                        | 4.85                                      | 7.08                        |
| Gutierrezia sarothrae       | 0.03           | 0.45                                    | 3.33                         | 0.97                                      | 1.42                        |
| Haplopappus spinulosus      | 0.03           | 0.45                                    | 3.33                         | 0.97                                      | 1.42                        |
| Hedeoma hispida             | 0.27           | 3.57                                    | 16.67                        | 4.85                                      | 8.42                        |
| Lepidium densiflorum        | 0.10           | 1.34                                    | 3.33                         | 0.97                                      | 2.31                        |
| Liatis punctata             | 0.33           | 4.46                                    | 20.00                        | 5.83                                      | 10.29                       |
| Linum lewisii               | 0.10           | 1.34                                    | 6.67                         | 1.94                                      | 3.28                        |
| Lotus americanus            | 0.07           | 0.89                                    | 6.67                         | 1.94                                      | 2.83                        |
| Phlox hoodii                | 2.03           | 27.23                                   | 56.67                        | 16.50                                     | 43.73                       |
| Plantago purshii            | 0.50           | 6.70                                    | 23.33                        | 6.80                                      | 13.50                       |
| Psoralea esculenta          | 0.13           | 1.79                                    | 13.33                        | 3.88                                      | 5.67                        |
| Ratibida columnifera        | 0.40           | 5.36                                    | 26.67                        | 7.77                                      | 13.13                       |
| Sphaeralcea coccinea        | 0.67           | 8.93                                    | 36.67                        | 10.68                                     | 19.61                       |
| Taraxacum officinale        | 0.07           | 0.89                                    | 6.67                         | 1.94                                      | 2.83                        |
| Rosa arkansana              | 0.13           | 1.79                                    | 10.00                        | 2.91                                      | 4.70                        |
| Symphoricarpos occidentalis | 0.20           | 2.68                                    | 6.67                         | 1.94                                      | 4.62                        |

**Table 26. Density Analysis per 0.1 Sq. Meter of the Ammonium Nitrate Treatment at the 100 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>                     | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>        | 2.03           | 25.10                                   | 26.67                        | 7.34                                      | 32.44                       |
| <i>Androsace occidentalis</i>      | 0.03           | 0.41                                    | 3.33                         | 0.92                                      | 1.33                        |
| <i>Antennaria parvifolia</i>       | 0.03           | 0.41                                    | 3.33                         | 0.92                                      | 1.33                        |
| <i>Arabis hirsuta</i>              | 0.03           | 0.41                                    | 3.33                         | 0.92                                      | 1.33                        |
| <i>Arabis holboellii</i>           | 0.07           | 0.82                                    | 6.67                         | 1.83                                      | 2.65                        |
| <i>Artemisia dracunculus</i>       | 0.07           | 0.82                                    | 6.67                         | 1.83                                      | 2.65                        |
| <i>Artemisia frigida</i>           | 0.47           | 5.76                                    | 40.00                        | 11.01                                     | 16.77                       |
| <i>Collomia linearis</i>           | 0.13           | 1.65                                    | 3.33                         | 0.92                                      | 2.57                        |
| <i>Grindelia squarrosa</i>         | 0.07           | 0.82                                    | 6.67                         | 1.83                                      | 2.65                        |
| <i>Gutierrezia sarothrae</i>       | 0.07           | 0.82                                    | 3.33                         | 0.92                                      | 1.74                        |
| <i>Hedeoma hispida</i>             | 0.93           | 11.52                                   | 43.33                        | 11.93                                     | 23.45                       |
| <i>Lactuca oblongifolia</i>        | 0.13           | 1.65                                    | 6.67                         | 1.83                                      | 3.48                        |
| <i>Linum rigidum</i>               | 0.10           | 1.23                                    | 10.00                        | 2.75                                      | 3.98                        |
| <i>Lotus americanus</i>            | 0.03           | 0.41                                    | 3.33                         | 0.92                                      | 1.33                        |
| <i>Orthocarpus luteus</i>          | 0.03           | 0.41                                    | 3.33                         | 0.92                                      | 1.33                        |
| <i>Penstemon albidus</i>           | 0.10           | 1.23                                    | 3.33                         | 0.92                                      | 2.15                        |
| <i>Penstemon gracilis</i>          | 0.07           | 0.82                                    | 3.33                         | 0.92                                      | 1.74                        |
| <i>Phlox hoodii</i>                | 0.77           | 9.47                                    | 23.33                        | 6.42                                      | 15.89                       |
| <i>Plantago purshii</i>            | 0.27           | 3.29                                    | 10.00                        | 2.75                                      | 6.04                        |
| <i>Polygala alba</i>               | 0.07           | 0.82                                    | 6.67                         | 1.83                                      | 2.65                        |
| <i>Psoralea esculenta</i>          | 0.10           | 1.23                                    | 6.67                         | 1.83                                      | 3.06                        |
| <i>Ratibida columnifera</i>        | 0.77           | 9.47                                    | 46.67                        | 12.84                                     | 22.31                       |
| <i>Sphaeralcea coccinea</i>        | 1.13           | 13.99                                   | 60.00                        | 16.51                                     | 30.50                       |
| <i>Taraxacum officinale</i>        | 0.53           | 6.58                                    | 26.67                        | 7.34                                      | 13.92                       |
| <i>Symphoricarpos occidentalis</i> | 0.07           | 0.82                                    | 6.67                         | 1.83                                      | 2.65                        |

**Table 27. Density Analysis per 0.1 Sq. Meter of the Urea Treatment at the 40 Pounds of Nitrogen per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium  | 1.80           | 16.31                                   | 53.33                        | 10.53                                     | 26.84                       |
| Antennaria parvifolia | 0.60           | 5.44                                    | 23.33                        | 4.61                                      | 10.05                       |
| Arabis hirsuta        | 0.13           | 1.21                                    | 10.00                        | 1.97                                      | 3.18                        |
| Arabis holboellii     | 0.10           | 0.91                                    | 10.00                        | 1.97                                      | 2.88                        |
| Artemisia dracunculus | 0.07           | 0.60                                    | 6.67                         | 1.32                                      | 1.92                        |
| Artemisia frigida     | 0.57           | 5.14                                    | 40.00                        | 7.89                                      | 13.03                       |
| Astragalus agrestis   | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Cerastium arvense     | 0.37           | 3.32                                    | 10.00                        | 1.97                                      | 5.29                        |
| Draba nemorosa        | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Erigeron glabellus    | 0.50           | 4.53                                    | 33.33                        | 6.58                                      | 11.11                       |
| Grindelia squarrosa   | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Hedeoma hispida       | 1.73           | 15.71                                   | 56.67                        | 11.18                                     | 26.89                       |
| Lactuca oblongifolia  | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Linum rigidum         | 0.30           | 2.72                                    | 23.33                        | 4.61                                      | 7.33                        |
| Lotus americanus      | 0.10           | 0.91                                    | 10.00                        | 1.97                                      | 2.88                        |
| Opuntia fragilis      | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Penstemon gracilis    | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Phlox hoodii          | 0.93           | 8.46                                    | 33.33                        | 6.58                                      | 15.04                       |
| Plantago purshii      | 0.63           | 5.74                                    | 33.33                        | 6.58                                      | 12.32                       |
| Potentilla arguta     | 0.03           | 0.30                                    | 3.33                         | 0.66                                      | 0.96                        |
| Psoralea argophylla   | 0.13           | 1.21                                    | 10.00                        | 1.97                                      | 3.18                        |
| Ratibida columnifera  | 1.33           | 12.08                                   | 43.33                        | 8.55                                      | 20.63                       |
| Solidago rigida       | 0.07           | 0.60                                    | 3.33                         | 0.66                                      | 1.26                        |
| Sphaeralcea coccinea  | 0.87           | 7.85                                    | 46.67                        | 9.21                                      | 17.06                       |
| Taraxacum officinale  | 0.57           | 5.14                                    | 36.67                        | 7.24                                      | 12.38                       |

**Table 28. Density Analysis per 0.1 Sq. Meter of the Urea Treatment at the 40 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                       | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Achillea millefolium</i>   | 0.57    | 5.61                           | 26.67                | 5.59                             | 11.20               |
| <i>Androsace occidentalis</i> | 0.07    | 0.66                           | 3.33                 | 0.70                             | 1.36                |
| <i>Antennaria parvifolia</i>  | 0.53    | 5.28                           | 16.67                | 3.50                             | 8.78                |
| <i>Arabis hirsuta</i>         | 0.03    | 0.33                           | 3.33                 | 0.70                             | 1.03                |
| <i>Arabis holboellii</i>      | 0.03    | 0.33                           | 3.33                 | 0.70                             | 1.03                |
| <i>Artemisia dracunculus</i>  | 0.20    | 1.98                           | 20.00                | 4.20                             | 6.18                |
| <i>Artemisia frigida</i>      | 0.67    | 6.60                           | 46.67                | 9.79                             | 16.39               |
| <i>Aster ericoides</i>        | 0.57    | 5.61                           | 3.33                 | 0.70                             | 6.31                |
| <i>Cirsium undulatum</i>      | 0.03    | 0.33                           | 3.33                 | 0.70                             | 1.03                |
| <i>Collomia linearis</i>      | 0.03    | 0.33                           | 3.33                 | 0.70                             | 1.03                |
| <i>Erigeron glabellus</i>     | 0.33    | 3.30                           | 16.67                | 3.50                             | 6.80                |
| <i>Grindelia squarrosa</i>    | 0.07    | 0.66                           | 6.67                 | 1.40                             | 2.06                |
| <i>Hedeoma hispida</i>        | 2.17    | 21.45                          | 56.67                | 11.89                            | 33.34               |
| <i>Liatris punctata</i>       | 0.13    | 1.32                           | 13.33                | 2.80                             | 4.12                |
| <i>Linum rigidum</i>          | 0.17    | 1.65                           | 16.67                | 3.50                             | 5.15                |
| <i>Phlox hoodii</i>           | 1.00    | 9.90                           | 36.67                | 7.69                             | 17.59               |
| <i>Plantago purshii</i>       | 0.23    | 2.31                           | 20.00                | 4.20                             | 6.51                |
| <i>Polygala alba</i>          | 0.07    | 0.66                           | 6.67                 | 1.40                             | 2.06                |
| <i>Potentilla arguta</i>      | 0.03    | 0.33                           | 3.33                 | 0.70                             | 1.03                |
| <i>Psoralea esculenta</i>     | 0.23    | 2.31                           | 16.67                | 3.50                             | 5.81                |
| <i>Ratibida columnifera</i>   | 1.10    | 10.89                          | 56.67                | 11.89                            | 22.78               |
| <i>Sphaeralcea coccinea</i>   | 1.43    | 14.19                          | 76.67                | 16.08                            | 30.27               |
| <i>Taraxacum officinale</i>   | 0.23    | 2.31                           | 10.00                | 2.10                             | 4.41                |
| <i>Vicia americana</i>        | 0.17    | 1.65                           | 10.00                | 2.10                             | 3.75                |

**Table 29. Density Analysis per 0.1 Sq. Meter of the Urea Treatment at the 60 Pounds of Nitrogen per Acre Rate Applied Annually for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium  | 1.37           | 17.52                                   | 36.67                        | 10.48                                     | 28.00                       |
| Antennaria parvifolia | 0.37           | 4.70                                    | 6.67                         | 1.90                                      | 6.60                        |
| Arabis holboellii     | 0.03           | 0.43                                    | 3.33                         | 0.95                                      | 1.38                        |
| Artemisia dracunculus | 0.13           | 1.71                                    | 13.33                        | 3.81                                      | 5.52                        |
| Artemisia frigida     | 0.87           | 11.11                                   | 56.67                        | 16.19                                     | 27.30                       |
| Aster ericoides       | 0.23           | 2.99                                    | 10.00                        | 2.86                                      | 5.85                        |
| Astragalus agrestis   | 0.17           | 2.14                                    | 6.67                         | 1.90                                      | 4.04                        |
| Cirsium undulatum     | 0.07           | 0.85                                    | 6.67                         | 1.90                                      | 2.75                        |
| Erigeron glabellus    | 0.03           | 0.43                                    | 3.33                         | 0.95                                      | 1.38                        |
| Hedeoma hispida       | 0.80           | 10.26                                   | 30.00                        | 8.57                                      | 18.83                       |
| Lepidium densiflorum  | 0.03           | 0.43                                    | 3.33                         | 0.95                                      | 1.38                        |
| Liatris punctata      | 0.03           | 0.43                                    | 3.33                         | 0.95                                      | 1.38                        |
| Linum lewisii         | 0.07           | 0.85                                    | 6.67                         | 1.90                                      | 2.75                        |
| Linum rigidum         | 0.07           | 0.85                                    | 6.67                         | 1.90                                      | 2.75                        |
| Lotus americanus      | 0.03           | 0.43                                    | 3.33                         | 0.95                                      | 1.38                        |
| Penstemon albidus     | 0.43           | 5.56                                    | 3.33                         | 0.95                                      | 6.51                        |
| Phlox hoodii          | 1.07           | 13.68                                   | 30.00                        | 8.57                                      | 22.25                       |
| Plantago purshii      | 0.53           | 6.84                                    | 23.33                        | 6.67                                      | 13.51                       |
| Potentilla arguta     | 0.07           | 0.85                                    | 6.67                         | 1.90                                      | 2.75                        |
| Psoralea esculenta    | 0.03           | 0.43                                    | 3.33                         | 0.95                                      | 1.38                        |
| Ratibida columnifera  | 0.67           | 8.55                                    | 46.67                        | 13.33                                     | 21.88                       |
| Sphaeralcea coccinea  | 0.70           | 8.97                                    | 40.00                        | 11.43                                     | 20.40                       |

**Table 30. Density Analysis per 0.1 Sq. Meter of the Urea Treatment at the 60 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Species                        | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|--------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Achillea millefolium</i>    | 0.43    | 3.28                           | 20.00                | 4.17                             | 7.45                |
| <i>Androsace occidentalis</i>  | 0.33    | 2.53                           | 6.67                 | 1.39                             | 3.92                |
| <i>Antennaria parvifolia</i>   | 2.97    | 22.47                          | 20.00                | 4.17                             | 26.64               |
| <i>Arabis holboellii</i>       | 0.03    | 0.25                           | 3.33                 | 0.69                             | 0.94                |
| <i>Artemisia dracunculus</i>   | 0.03    | 0.25                           | 3.33                 | 0.69                             | 0.94                |
| <i>Artemisia frigida</i>       | 0.40    | 3.03                           | 26.67                | 5.56                             | 8.59                |
| <i>Aster ericoides</i>         | 0.60    | 4.55                           | 20.00                | 4.17                             | 8.72                |
| <i>Astragalus crassicaupus</i> | 0.03    | 0.25                           | 3.33                 | 0.69                             | 0.94                |
| <i>Echinacea angustifolia</i>  | 0.77    | 5.81                           | 30.00                | 6.25                             | 12.06               |
| <i>Erigeron glabellus</i>      | 0.10    | 0.76                           | 6.67                 | 1.39                             | 2.15                |
| <i>Erysimum asperum</i>        | 0.03    | 0.25                           | 3.33                 | 0.69                             | 0.94                |
| <i>Gaura coccinea</i>          | 0.37    | 2.78                           | 16.67                | 3.47                             | 6.25                |
| <i>Grindelia squarrosa</i>     | 0.13    | 1.01                           | 13.33                | 2.78                             | 3.79                |
| <i>Gutierrezia sarothrae</i>   | 0.03    | 0.25                           | 3.33                 | 0.69                             | 0.94                |
| <i>Haplopappus spinulosus</i>  | 0.07    | 0.51                           | 6.67                 | 1.39                             | 1.90                |
| <i>Hedeoma hispida</i>         | 1.63    | 12.37                          | 36.67                | 7.64                             | 20.01               |
| <i>Lepidium densiflorum</i>    | 0.13    | 1.01                           | 6.67                 | 1.39                             | 2.40                |
| <i>Liatris punctata</i>        | 0.30    | 2.27                           | 23.33                | 4.86                             | 7.13                |
| <i>Linum rigidum</i>           | 0.20    | 1.52                           | 16.67                | 3.47                             | 4.99                |
| <i>Lotus americanus</i>        | 0.60    | 4.55                           | 30.00                | 6.25                             | 10.80               |
| <i>Orthocarpus luteus</i>      | 0.03    | 0.25                           | 3.33                 | 0.69                             | 0.94                |
| <i>Oxytropis lambertii</i>     | 0.07    | 0.51                           | 6.67                 | 1.39                             | 1.90                |
| <i>Petalostemon purpureum</i>  | 0.13    | 1.01                           | 10.00                | 2.08                             | 3.09                |
| <i>Phlox hoodii</i>            | 0.73    | 5.56                           | 23.33                | 4.86                             | 10.42               |
| <i>Plantago purshii</i>        | 1.47    | 11.11                          | 40.00                | 8.33                             | 19.44               |
| <i>Polygala alba</i>           | 0.07    | 0.51                           | 6.67                 | 1.39                             | 1.90                |
| <i>Psoralea argophylla</i>     | 0.20    | 1.52                           | 10.00                | 2.08                             | 3.60                |
| <i>Ratibida columnifera</i>    | 0.70    | 5.30                           | 43.33                | 9.03                             | 14.33               |
| <i>Sphaeralcea coccinea</i>    | 0.50    | 3.79                           | 30.00                | 6.25                             | 10.04               |
| <i>Taraxacum officinale</i>    | 0.10    | 0.76                           | 10.00                | 2.08                             | 2.84                |

**Table 31. Density Analysis per 0.1 Sq. Meter of the Urea Treatment at the 100 Pounds of Nitrogen per Acre Rate Applied Biennially for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>           | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium     | 0.47           | 10.69                                   | 16.67                        | 7.46                                      | 18.15                       |
| Antennaria parvifolia    | 0.07           | 1.53                                    | 3.33                         | 1.49                                      | 3.02                        |
| Arabis holboellii        | 0.03           | 0.76                                    | 3.33                         | 1.49                                      | 2.25                        |
| Artemisia dracunculus    | 0.17           | 3.82                                    | 13.33                        | 5.97                                      | 9.79                        |
| Artemisia frigida        | 0.40           | 9.16                                    | 23.33                        | 10.45                                     | 19.61                       |
| Astragalus missouriensis | 0.03           | 0.76                                    | 3.33                         | 1.49                                      | 2.25                        |
| Bahia oppositifolia      | 0.17           | 3.82                                    | 13.33                        | 5.97                                      | 9.79                        |
| Hedeoma hispida          | 0.67           | 15.27                                   | 16.67                        | 7.46                                      | 22.73                       |
| Lepidium densiflorum     | 0.07           | 1.53                                    | 6.67                         | 2.99                                      | 4.52                        |
| Liatris punctata         | 0.07           | 1.53                                    | 6.67                         | 2.99                                      | 4.52                        |
| Lotus americanus         | 0.03           | 0.76                                    | 3.33                         | 1.49                                      | 2.25                        |
| Phlox hoodii             | 0.53           | 12.21                                   | 13.33                        | 5.97                                      | 18.18                       |
| Plantago purshii         | 0.47           | 10.69                                   | 20.00                        | 8.96                                      | 19.65                       |
| Polygala alba            | 0.03           | 0.76                                    | 3.33                         | 1.49                                      | 2.25                        |
| Psoralea esculenta       | 0.10           | 2.29                                    | 10.00                        | 4.48                                      | 6.77                        |
| Ratibida columnifera     | 0.20           | 4.58                                    | 16.67                        | 7.46                                      | 12.04                       |
| Sphaeralcea coccinea     | 0.60           | 13.74                                   | 26.67                        | 11.94                                     | 25.68                       |
| Taraxacum officinale     | 0.10           | 2.29                                    | 10.00                        | 4.48                                      | 6.77                        |
| Vicia americana          | 0.17           | 3.82                                    | 13.33                        | 5.97                                      | 9.79                        |

**Table 32. Mean Density per 0.1 Sq. Meter for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| <b>Treatment</b>        | <b>Application Rate</b> | <b>Forbs</b> | <b>Shrubs</b> |
|-------------------------|-------------------------|--------------|---------------|
| <b>Control</b>          | 0 lbs                   | 10.38        | 0.00          |
|                         |                         |              |               |
| <b>Ammonium Nitrate</b> | 40 lbs EY               | 9.28         | 0.00          |
|                         | 40 lbs EOY              | 10.85        | 0.00          |
|                         | 60 lbs EY               | 8.19         | 0.00          |
|                         | 60 lbs EOY              | 7.14         | 0.33          |
|                         | 100 lbs EOY             | 8.66         | 0.07          |
|                         |                         |              |               |
| <b>Urea</b>             | 40 lbs EY               | 11.01        | 0.00          |
|                         | 40 lbs EOY              | 10.09        | 0.00          |
|                         | 60 lbs EY               | 7.80         | 0.00          |
|                         | 60 lbs EOY              | 13.18        | 0.00          |
|                         | 100 lbs EOY             | 4.38         | 0.00          |

**Table 33. Percentage of Soil Moisture for the Native Range Fertilization Trial  
At the Dickinson Experiment Station, 1984**

| Sample<br>Location | 26 Jun      |             |      | 25 Jul      |             |      | 27 Aug      |             |      |
|--------------------|-------------|-------------|------|-------------|-------------|------|-------------|-------------|------|
|                    | East<br>Rep | West<br>Rep | Mean | East<br>Rep | West<br>Rep | Mean | East<br>Rep | West<br>Rep | Mean |
| <b>North:</b>      |             |             |      |             |             |      |             |             |      |
| 0-6                | 21.8        | 32.0        | 26.9 | 10.3        | 9.6         | 10.0 | 9.6         | 9.4         | 9.5  |
| 6-12               | 22.7        | 25.7        | 24.2 | 12.0        | 9.8         | 10.9 | 10.2        | 10.2        | 10.2 |
| 12-24              | 10.8        | 19.7        | 15.3 | 12.2        | 5.3         | 8.8  | 11.0        | 10.3        | 10.7 |
| 24-36              | 12.3        | 12.9        | 12.6 | 13.8        | 11.8        | 12.8 | 12.4        | 11.0        | 11.7 |
| 36-48              | 13.9        | 11.1        | 12.5 | 14.6        | 14.8        | 14.7 | 14.2        | 12.5        | 13.4 |
|                    |             |             |      |             |             |      |             |             |      |
| <b>Central:</b>    |             |             |      |             |             |      |             |             |      |
| 0-6                | 24.1        | 23.0        | 23.6 | 9.7         | 10.1        | 9.9  | 10.9        | 9.6         | 10.3 |
| 6-12               | 24.7        | 23.7        | 24.2 | 9.7         | 8.7         | 9.2  | 8.6         | 8.4         | 8.5  |
| 12-24              | 19.6        | 13.3        | 16.5 | 9.4         | 9.1         | 9.3  | 8.8         | 10.9        | 9.9  |
| 24-36              | 13.4        | 12.8        | 13.1 | 12.8        | 12.2        | 12.5 | 10.2        | 10.9        | 10.6 |
| 36-48              | 14.7        | 14.3        | 14.5 | 15.2        | 17.1        | 16.2 | 12.3        | 7.2         | 9.8  |
|                    |             |             |      |             |             |      |             |             |      |
| <b>South:</b>      |             |             |      |             |             |      |             |             |      |
| 0-6                | 20.6        | 26.3        | 23.5 | 10.0        | 8.0         | 9.0  | 9.8         | 11.6        | 10.7 |
| 6-12               | 20.6        | 25.8        | 23.2 | 9.9         | 10.5        | 10.2 | 8.3         | 7.9         | 8.1  |
| 12-24              | 12.3        | 11.9        | 12.1 | 10.2        | 11.0        | 10.6 | 7.9         | 4.3         | 6.1  |
| 24-36              | 13.3        | 13.2        | 13.3 | 17.8        | 11.5        | 14.7 | 11.5        | 12.8        | 12.2 |
| 36-48              | 14.7        | 19.1        | 16.9 | 16.3        | 12.8        | 14.6 | 15.7        | 14.4        | 15.1 |

**Table 34. Mean Percentage of Soil Moisture for the Native Range Fertilization Trial  
At the Dickinson Experiment Station, 1984**

| <b>Depth in<br/>Inches</b> | <b>26 JUN</b> | <b>25 JUL</b> | <b>27 AUG</b> |
|----------------------------|---------------|---------------|---------------|
| 0-6                        | 24.6          | 9.6           | 10.2          |
| 6-12                       | 23.9          | 10.1          | 8.9           |
| 12-24                      | 14.6          | 9.5           | 8.9           |
| 24-36                      | 13.0          | 13.3          | 11.5          |
| 36-48                      | 14.6          | 15.1          | 12.7          |

**Table 35. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 14 Jun 1982**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.  | Org.   | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos | Matter |                    |
|                |       |     |                    |     |       | /cm   | %      | ppm                |
| <b>Control</b> | 0-6   | 7.7 | 10.8               | 5.5 | 588.8 | 0.89  |        |                    |
|                | 6-12  | 8.5 | 12.0               | 2.8 | 392.5 | 0.91  |        |                    |
|                | 12-24 | 6.5 | 24.0               | 1.5 | 253.8 | 0.88  |        | 10.0               |
|                | 24-36 | 8.9 | 23.0               | 1.3 | 188.8 | 2.00  |        | 30.0               |
|                | 36-48 | 8.9 | 22.0               | 2.3 | 227.5 | 1.84  |        | 61.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EY</b>   | 0-6   | 8.0 | 7.5                | 4.0 | 707.5 | 1.23  |        | 13.0               |
|                | 6-12  | 8.0 | 6.0                | 2.5 | 530.0 | 0.62  |        |                    |
|                | 12-24 | 8.3 | 23.0               | 3.0 | 280.0 | 0.61  |        | 7.5                |
|                | 24-36 | 8.8 | 19.0               | 1.0 | 207.5 | 0.65  |        | 8.5                |
|                | 36-48 | 9.0 | 24.0               | 2.5 | 215.0 | 0.81  |        | 60.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.8 | 9.5                | 4.0 | 547.5 | 0.79  |        |                    |
|                | 6-12  | 8.1 | 7.5                | 3.5 | 482.5 | 0.66  |        | 7.0                |
|                | 12-24 | 8.4 | 15.0               | 1.0 | 280.0 | 0.67  |        | 8.5                |
|                | 24-36 | 9.0 | 15.0               | 1.0 | 172.5 | 0.76  |        | 11.0               |
|                | 36-48 | 9.2 | 12.0               | 2.0 | 200.0 | 1.35  |        | 68.5               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.5 | 10.5               | 3.5 | 570.0 | 0.59  |        | 80.0               |
|                | 6-12  | 7.8 | 5.5                | 2.0 | 360.0 | 0.45  |        |                    |
|                | 12-24 | 8.3 | 18.5               | 2.0 | 262.5 | 0.58  |        | 9.0                |
|                | 24-36 | 9.1 | 15.0               | 1.0 | 182.5 | 0.84  |        | 46.5               |
|                | 36-48 | 9.0 | 16.0               | 2.0 | 382.5 | 0.54  |        | 52.5               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.6 | 11.0               | 4.0 | 625.0 | 0.95  |        | 80.0               |
|                | 6-12  | 7.8 | 11.0               | 2.0 | 450.0 | 1.00  |        | 80.0               |
|                | 12-24 | 8.6 | 14.0               | 1.0 | 247.5 | 0.70  |        |                    |
|                | 24-36 | 9.0 | 14.0               | 1.0 | 172.5 | 0.90  |        | 11.0               |
|                | 36-48 | 8.3 | 18.0               | 1.5 | 212.5 | 0.83  |        | 47.5               |
|                |       |     |                    |     |       |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.7 | 10.5               | 4.0 | 640.0 | 0.70  |        | 7.0                |
|                | 6-12  | 8.0 | 10.5               | 3.5 | 490.0 | 0.50  |        |                    |
|                | 12-24 | 8.3 | 30.0               | 1.5 | 265.0 | 0.65  |        | 10.0               |
|                | 24-36 | 8.8 | 17.0               | 1.0 | 165.0 | 0.68  |        | 10.5               |
|                | 36-48 | 9.1 | 18.0               | 1.5 | 180.0 | 0.81  |        | 20.5               |

**Table 36. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 19 Jul 1982**

|                | Depth |     | NO <sub>3</sub> -N | P   | K      | E.C.  | Org.   | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|--------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |        | Mmhos | Matter |                    |
|                |       |     |                    |     |        | /cm   | %      | ppm                |
| <b>Control</b> | 0-6   | 7.6 | 11.9               | 4.7 | 553.3  | 0.63  |        | 6.7                |
|                | 6-12  | 7.7 | 10.8               | 3.0 | 503.8  | 0.56  |        | 6.5                |
|                | 12-24 | 8.6 | 19.0               | 1.2 | 213.8  | 0.73  |        | 27.0               |
|                | 24-36 | 8.9 | 20.5               | 1.3 | 157.9  | 0.65  |        | 34.3               |
|                | 36-48 | 9.0 | 22.7               | 2.2 | 170.0  | 0.65  |        | 46.9               |
|                |       |     |                    |     |        |       |        |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 15.7               | 4.7 | 711.7  | 0.55  |        | 5.0                |
|                | 6-12  | 7.7 | 14.0               | 2.7 | 495.0  | 0.56  |        | 6.7                |
|                | 12-24 | 8.5 | 23.3               | 1.3 | 228.3  | 0.67  |        | 19.3               |
|                | 24-36 | 8.7 | 21.3               | 1.0 | 205.0  | 0.42  |        | 47.3               |
|                | 36-48 | 8.9 | 20.7               | 1.7 | 211.7  | 1.03  |        | 29.0               |
|                |       |     |                    |     |        |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 11.7               | 3.7 | 621.7  | 0.53  |        | 6.0                |
|                | 6-12  | 7.9 | 11.7               | 2.0 | 413.3  | 0.57  |        | 5.0                |
|                | 12-24 | 8.5 | 20.0               | 1.0 | 178.3  | 0.47  |        | 7.3                |
|                | 24-36 | 9.3 | 23.3               | 1.3 | 155.0  | 0.55  |        | 14.0               |
|                | 36-48 | 9.3 | 22.0               | 2.0 | 197.5  | 0.93  |        | 80.0               |
|                |       |     |                    |     |        |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.5 | 6.0                | 4.0 | 716.7  | 0.58  |        | 5.7                |
|                | 6-12  | 7.8 | 6.3                | 1.7 | 440.0  | 0.86  |        | 14.7               |
|                | 12-24 | 8.5 | 15.3               | 1.7 | 173.3  | 0.54  |        | 6.0                |
|                | 24-36 | 9.1 | 15.3               | 1.3 | 136.7  | 0.76  |        | 22.0               |
|                | 36-48 | 8.9 | 13.3               | 2.0 | 205.0  | 0.46  |        | 65.7               |
|                |       |     |                    |     |        |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.6 | 9.5                | 4.0 | 1082.5 | 0.56  |        | 5.0                |
|                | 6-12  | 8.0 | 6.0                | 1.5 | 525.0  | 0.58  |        | 3.0                |
|                | 12-24 | 8.4 | 16.0               | 1.5 | 200.0  | 0.49  |        | 8.5                |
|                | 24-36 | 9.0 | 16.0               | 1.0 | 135.0  | 0.55  |        | 30.0               |
|                | 36-48 | 9.2 | 18.0               | 2.0 | 192.5  | 0.96  |        | 30.5               |
|                |       |     |                    |     |        |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.5 | 13.7               | 8.3 | 721.7  | 0.55  |        | 6.3                |
|                | 6-12  | 7.9 | 21.0               | 2.0 | 397.5  | 0.64  |        | 7.5                |
|                | 12-24 | 8.6 | 40.0               | 1.0 | 182.3  | 0.71  |        | 25.3               |
|                | 24-36 | 8.7 | 38.7               | 1.7 | 168.3  | 0.50  |        | 32.3               |
|                | 36-48 | 9.0 | 38.7               | 3.3 | 241.7  | 0.70  |        | 49.3               |

**Table 37. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 12 Aug 1982**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.3 | 12.7               | 4.7 | 766.7 | 0.66     |          | 6.5                |
|                | 6-12  | 8.2 | 12.2               | 2.3 | 451.7 | 0.53     |          | 4.8                |
|                | 12-24 | 8.7 | 23.7               | 1.2 | 203.3 | 0.75     |          | 11.0               |
|                | 24-36 | 8.5 | 20.7               | 1.2 | 160.0 | 1.41     |          | 38.3               |
|                | 36-48 | 8.5 | 20.0               | 2.8 | 189.2 | 1.56     |          | 68.8               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.5 | 5.3                | 4.3 | 751.7 | 0.57     |          | 43.5               |
|                | 6-12  | 7.9 | 4.0                | 2.3 | 466.7 | 0.53     |          | 2.0                |
|                | 12-24 | 8.5 | 12.7               | 1.0 | 201.7 | 0.77     |          | 12.5               |
|                | 24-36 | 8.7 | 14.0               | 1.3 | 185.0 | 1.26     |          | 51.5               |
|                | 36-48 | 8.8 | 16.0               | 2.7 | 213.3 | 1.41     |          | 58.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.7 | 11.0               | 4.3 | 663.3 | 0.54     |          | 5.0                |
|                | 6-12  | 7.9 | 9.7                | 2.3 | 463.3 | 0.53     |          | 6.0                |
|                | 12-24 | 8.4 | 16.7               | 1.0 | 171.7 | 0.49     |          | 7.5                |
|                | 24-36 | 9.1 | 18.7               | 2.0 | 168.3 | 0.67     |          | 19.0               |
|                | 36-48 | 8.9 | 20.0               | 2.7 | 185.0 | 1.77     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.7 | 15.3               | 5.0 | 756.7 | 0.67     |          | 6.0                |
|                | 6-12  | 8.1 | 9.3                | 2.3 | 441.7 | 0.59     |          | 8.0                |
|                | 12-24 | 8.5 | 19.3               | 1.0 | 158.3 | 0.58     |          | 9.0                |
|                | 24-36 | 9.1 | 20.7               | 1.0 | 133.3 | 0.95     |          | 53.7               |
|                | 36-48 | 8.7 | 22.7               | 1.7 | 191.7 | 1.14     |          | 70.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.9 | 13.0               | 4.3 | 601.7 | 0.60     |          | 14.5               |
|                | 6-12  | 8.3 | 13.0               | 2.3 | 356.7 | 0.61     |          | 7.0                |
|                | 12-24 | 8.4 | 25.3               | 1.7 | 143.3 | 0.56     |          | 14.0               |
|                | 24-36 | 8.8 | 20.0               | 1.0 | 110.0 | 0.58     |          | 11.0               |
|                | 36-48 | 8.5 | 20.7               | 2.3 | 158.3 | 0.88     |          | 49.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.3 | 6.7                | 3.3 | 835.0 | 0.52     |          | 3.5                |
|                | 6-12  | 7.6 | 9.3                | 2.3 | 478.3 | 0.52     |          |                    |
|                | 12-24 | 8.5 | 18.0               | 1.3 | 178.3 | 0.75     |          | 9.5                |
|                | 24-36 | 8.7 | 24.7               | 1.7 | 165.0 | 1.96     |          | 35.7               |
|                | 36-48 | 8.8 | 22.0               | 3.3 | 218.3 | 1.91     |          | 67.0               |

**Table 38. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 14 Jun 1982**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | Ph  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.7 | 10.8               | 5.5 | 558.8 | 0.89     |          |                    |
|                | 6-12  | 8.5 | 12.0               | 2.8 | 392.5 | 0.91     |          |                    |
|                | 12-24 | 6.5 | 24.0               | 1.5 | 253.8 | 0.88     |          | 10.0               |
|                | 24-36 | 8.9 | 23.0               | 1.3 | 188.8 | 2.00     |          | 30.0               |
|                | 36-48 | 8.9 | 22.0               | 2.3 | 227.5 | 1.84     |          | 61.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.5 | 10.0               | 5.5 | 645.0 | 0.57     |          |                    |
|                | 6-12  |     | 10.0               | 2.5 | 527.5 |          |          |                    |
|                | 12-24 | 8.5 | 13.0               | 1.0 | 270.0 | 2.46     |          | 9.0                |
|                | 24-36 | 8.3 | 15.0               | 2.0 | 200.0 | 2.67     |          | 80.0               |
|                | 36-48 | 8.3 | 15.0               | 4.0 | 302.5 | 2.00     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.7 | 10.0               | 4.0 | 645.0 | 0.85     |          | 7.0                |
|                | 6-12  | 8.2 | 6.5                | 2.5 | 277.5 | 0.66     |          |                    |
|                | 12-24 | 8.5 | 17.0               | 1.0 | 152.5 | 0.70     |          | 9.0                |
|                | 24-36 | 9.0 | 7.5                | 1.0 | 160.0 | 0.58     |          | 7.0                |
|                | 36-48 | 9.1 | 17.0               | 3.0 | 177.5 | 1.04     |          | 45.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.8 | 12.0               | 5.5 | 637.5 | 0.83     |          | 7.0                |
|                | 6-12  | 8.1 | 9.0                | 2.0 | 482.5 | 0.74     |          |                    |
|                | 12-24 | 8.5 | 16.0               | 2.0 | 230.0 | 0.70     |          | 9.0                |
|                | 24-36 | 9.0 | 16.0               | 1.0 | 182.5 | 0.90     |          | 11.0               |
|                | 36-48 | 8.5 | 22.0               | 3.5 | 215.0 | 0.85     |          | 43.5               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.8 | 9.0                | 5.0 | 517.5 | 0.98     |          | 9.0                |
|                | 6-12  | 8.3 | 7.5                | 2.5 | 347.5 | 0.90     |          | 6.0                |
|                | 12-24 | 8.8 | 15.0               | 1.0 | 177.5 | 1.05     |          | 8.0                |
|                | 24-36 | 9.1 | 13.0               | 2.0 | 200.0 | 1.26     |          | 44.5               |
|                | 36-48 | 8.8 | 16.0               | 3.0 | 260.0 | 2.15     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.8 | 85.0               | 8.0 | 717.5 | 1.51     |          | 7.0                |
|                | 6-12  | 8.1 | 66.5               | 3.0 | 532.5 | 0.96     |          | 8.0                |
|                | 12-24 | 8.7 | 28.0               | 2.0 | 225.0 | 0.74     |          | 9.0                |
|                | 24-36 | 9.2 | 24.0               | 1.0 | 157.5 | 1.23     |          | 42.0               |
|                | 36-48 | 9.0 | 21.0               | 3.5 | 520.0 | 1.35     |          | 80.0               |

**Table 39. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 19 Jul 1982**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.6 | 11.9               | 4.7 | 553.3 | 0.63     |          | 6.7                |
|                | 6-12  | 7.7 | 10.8               | 3.0 | 503.8 | 0.56     |          | 6.5                |
|                | 12-24 | 8.6 | 19.0               | 1.2 | 213.8 | 0.73     |          | 27.0               |
|                | 24-36 | 8.9 | 20.5               | 1.3 | 157.9 | 0.65     |          | 34.3               |
|                | 36-48 | 9.0 | 22.7               | 2.2 | 170.0 | 0.65     |          | 46.9               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 10.7               | 5.0 | 673.3 | 0.58     |          | 7.3                |
|                | 6-12  | 7.9 | 10.0               | 3.0 | 428.3 | 0.56     |          | 27.0               |
|                | 12-24 | 8.8 | 20.0               | 1.7 | 213.3 | 0.88     |          | 44.3               |
|                | 24-36 | 8.8 | 21.3               | 2.3 | 205.0 | 1.15     |          | 80.0               |
|                | 36-48 | 8.7 | 20.0               | 4.3 | 265.0 | 0.74     |          | 62.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 11.0               | 4.3 | 515.0 | 0.56     |          | 8.0                |
|                | 6-12  | 8.2 | 11.7               | 1.7 | 275.0 | 0.58     |          | 4.0                |
|                | 12-24 | 8.6 | 16.0               | 1.0 | 163.3 | 0.70     |          | 56.0               |
|                | 24-36 | 8.9 | 16.0               | 1.3 | 121.7 | 0.50     |          | 59.3               |
|                | 36-48 | 9.0 | 18.7               | 2.0 | 173.3 | 0.74     |          | 72.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.5 | 9.3                | 4.3 | 606.7 | 0.64     |          | 24.3               |
|                | 6-12  | 8.0 | 13.7               | 2.3 | 445.0 | 0.53     |          | 6.0                |
|                | 12-24 | 8.5 | 20.7               | 1.3 | 165.0 | 0.47     |          | 5.0                |
|                | 24-36 | 9.2 | 22.7               | 1.3 | 140.0 | 0.73     |          | 27.0               |
|                | 36-48 | 9.3 | 18.0               | 3.0 | 210.0 | 1.38     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.8 | 10.3               | 4.0 | 556.7 | 0.55     |          | 6.0                |
|                | 6-12  | 8.1 | 9.7                | 2.3 | 363.3 | 0.61     |          | 5.0                |
|                | 12-24 | 8.8 | 21.3               | 1.3 | 145.0 | 0.58     |          | 9.7                |
|                | 24-36 | 9.2 | 21.3               | 1.7 | 165.0 | 0.56     |          | 45.7               |
|                | 36-48 | 8.8 | 21.3               | 2.3 | 208.3 | 1.34     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.5 | 67.0               | 4.3 | 671.7 | 0.79     |          | 8.0                |
|                | 6-12  | 8.1 | 24.7               | 2.7 | 486.7 | 0.65     |          | 9.3                |
|                | 12-24 | 8.6 | 17.3               | 2.0 | 198.3 | 0.50     |          | 10.7               |
|                | 24-36 | 9.4 | 16.7               | 1.3 | 138.3 | 1.17     |          | 40.0               |
|                | 36-48 | 9.1 | 18.0               | 1.3 | 216.7 | 1.06     |          | 80.0               |

**Table 40. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 12 Aug 1982**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.3 | 12.7               | 4.7 | 766.7 | 0.66     |          | 6.5                |
|                | 6-12  | 8.2 | 12.2               | 2.3 | 451.7 | 0.53     |          | 4.8                |
|                | 12-24 | 8.7 | 23.7               | 1.2 | 203.3 | 0.75     |          | 11.0               |
|                | 24-36 | 8.5 | 20.7               | 1.2 | 160.0 | 1.41     |          | 38.3               |
|                | 36-48 | 8.5 | 20.0               | 2.8 | 189.2 | 1.56     |          | 68.8               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.1 | 6.0                | 4.3 | 641.7 | 0.53     |          | 7.0                |
|                | 6-12  | 7.8 | 7.0                | 2.3 | 458.3 | 0.55     |          |                    |
|                | 12-24 | 8.7 | 12.7               | 1.0 | 185.0 | 0.99     |          | 22.0               |
|                | 24-36 | 8.7 | 16.0               | 1.3 | 198.3 | 2.33     |          | 80.0               |
|                | 36-48 | 8.5 | 18.7               | 2.7 | 273.3 | 2.10     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 12.7               | 4.3 | 543.3 | 0.53     |          | 2.0                |
|                | 6-12  | 8.2 | 11.0               | 2.3 | 266.7 | 0.53     |          |                    |
|                | 12-24 | 8.4 | 20.0               | 1.0 | 146.7 | 0.55     |          | 10.0               |
|                | 24-36 | 9.0 | 25.3               | 2.0 | 115.0 | 0.73     |          | 10.0               |
|                | 36-48 | 9.0 | 27.3               | 2.7 | 166.7 | 1.81     |          | 59.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.7 | 12.0               | 5.0 | 620.0 | 0.58     |          | 7.0                |
|                | 6-12  | 8.2 | 14.0               | 2.3 | 363.3 | 0.53     |          | 8.5                |
|                | 12-24 | 8.6 | 24.0               | 1.0 | 150.0 | 0.55     |          | 8.0                |
|                | 24-36 | 8.9 | 24.7               | 1.0 | 141.7 | 0.52     |          | 35.0               |
|                | 36-48 | 8.7 | 29.0               | 1.7 | 265.0 | 0.78     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.9 | 12.3               | 4.3 | 571.7 | 0.70     |          | 14.0               |
|                | 6-12  | 8.2 | 9.0                | 2.3 | 351.7 | 0.56     |          | 2.0                |
|                | 12-24 | 8.5 | 12.0               | 1.7 | 186.7 | 1.02     |          | 52.5               |
|                | 24-36 | 8.8 | 12.7               | 1.0 | 388.3 | 0.80     |          | 72.3               |
|                | 36-48 | 8.3 | 12.0               | 2.3 | 251.7 | 2.54     |          | 54.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.7 | 26.7               | 3.3 | 676.7 | 0.84     |          | 7.0                |
|                | 6-12  | 8.0 | 9.0                | 2.3 | 471.7 | 1.01     |          | 21.0               |
|                | 12-24 | 8.5 | 26.0               | 1.3 | 183.3 | 0.96     |          | 15.0               |
|                | 24-36 | 9.2 | 23.3               | 1.7 | 131.7 | 0.85     |          | 34.3               |
|                | 36-48 | 8.7 | 21.3               | 3.3 | 186.7 | 2.38     |          | 80.0               |

**Table 41. Soil Nitrogen Content in Lbs/Acre for the Native Range Fertilization Trial At the Dickinson Experiment Station, 1982**

|                |       | Ammonium Nitrate |        |        | Urea   |        |        |
|----------------|-------|------------------|--------|--------|--------|--------|--------|
|                |       | 14 Jun           | 19 Jul | 12 Aug | 14 Jun | 19 Jul | 12 Aug |
| <b>Control</b> | 0-6   | 10.8             | 11.9   | 12.7   | 10.8   | 11.9   | 12.7   |
|                | 6-12  | 12.0             | 10.8   | 12.2   | 12.0   | 10.8   | 12.2   |
|                | 12-24 | 24.0             | 19.0   | 23.7   | 24.0   | 19.0   | 23.7   |
|                | 24-36 | 23.0             | 20.5   | 20.7   | 23.0   | 20.5   | 20.7   |
|                | 36-48 | 22.0             | 22.7   | 20.0   | 22.0   | 22.7   | 20.0   |
|                |       |                  |        |        |        |        |        |
| <b>40 EY</b>   | 0-6   | 7.5              | 15.7   | 5.3    | 10.0   | 10.7   | 6.0    |
|                | 6-12  | 6.0              | 14.0   | 4.0    | 10.0   | 10.0   | 7.0    |
|                | 12-24 | 23.0             | 23.3   | 12.7   | 13.0   | 20.0   | 12.7   |
|                | 24-36 | 19.0             | 21.3   | 14.0   | 15.0   | 21.3   | 16.0   |
|                | 36-48 | 24.0             | 20.7   | 16.0   | 15.0   | 20.0   | 18.7   |
|                |       |                  |        |        |        |        |        |
| <b>40 EOY</b>  | 0-6   | 9.5              | 11.7   | 11.0   | 10.0   | 11.0   | 12.7   |
|                | 6-12  | 7.5              | 11.7   | 9.7    | 6.5    | 11.7   | 11.0   |
|                | 12-24 | 15.0             | 20.0   | 16.7   | 17.0   | 16.0   | 20.0   |
|                | 24-36 | 15.0             | 23.3   | 18.7   | 7.5    | 16.0   | 25.3   |
|                | 36-48 | 12.0             | 22.0   | 20.0   | 17.0   | 18.7   | 27.3   |
|                |       |                  |        |        |        |        |        |
| <b>60 EY</b>   | 0-6   | 10.5             | 6.0    | 15.3   | 12.0   | 9.3    | 12.0   |
|                | 6-12  | 5.5              | 6.3    | 9.3    | 9.0    | 13.7   | 14.0   |
|                | 12-24 | 18.5             | 15.3   | 19.3   | 16.0   | 20.7   | 24.0   |
|                | 24-36 | 15.0             | 15.3   | 20.7   | 16.0   | 22.7   | 24.7   |
|                | 36-48 | 16.0             | 13.3   | 22.7   | 22.0   | 18.0   | 29.0   |
|                |       |                  |        |        |        |        |        |
| <b>60 EOY</b>  | 0-6   | 11.0             | 9.5    | 13.0   | 9.0    | 10.3   | 12.3   |
|                | 6-12  | 11.0             | 6.0    | 13.0   | 7.5    | 9.7    | 9.0    |
|                | 12-24 | 14.0             | 16.0   | 25.3   | 15.0   | 21.3   | 12.0   |
|                | 24-36 | 14.0             | 16.0   | 20.0   | 13.0   | 21.3   | 12.7   |
|                | 36-48 | 18.0             | 18.0   | 20.7   | 16.0   | 21.3   | 12.0   |
|                |       |                  |        |        |        |        |        |
| <b>100 EOY</b> | 0-6   | 10.5             | 13.7   | 6.7    | 85.0   | 67.0   | 26.7   |
|                | 6-12  | 10.5             | 21.0   | 9.3    | 66.5   | 24.7   | 9.0    |
|                | 12-24 | 30.0             | 40.0   | 18.0   | 28.0   | 17.3   | 26.0   |
|                | 24-36 | 17.0             | 38.7   | 24.7   | 24.0   | 16.7   | 23.3   |
|                | 36-48 | 18.0             | 38.7   | 22.0   | 21.0   | 18.0   | 21.3   |

**Table 42. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 21 Jun 1983**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.<br>Mmhos | Org.<br>Matter | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|---------------|----------------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | /cm           | %              | ppm                |
| <b>Control</b> | 0-6   | 7.7 | 14.3               | 7.3 | 625.0 | 0.36          | 7.1            | 21.3               |
|                | 6-12  | 7.7 | 8.3                | 2.8 | 476.7 | 0.35          |                | 11.2               |
|                | 12-24 | 8.4 | 11.7               | 1.3 | 310.0 | 0.92          |                | 19.0               |
|                | 24-36 | 8.9 | 12.0               | 1.5 | 320.8 | 1.26          |                | 55.5               |
|                | 36-48 | 8.7 | 13.3               | 3.3 | 368.3 | 2.28          |                | 77.2               |
|                |       |     |                    |     |       |               |                |                    |
| <b>40 EY</b>   | 0-6   | 7.3 | 32.3               | 4.7 | 605.0 | 0.37          | 5.9            | 23.7               |
|                | 6-12  | 7.8 | 6.7                | 2.0 | 440.0 | 0.33          |                | 12.3               |
|                | 12-24 | 8.5 | 12.7               | 2.3 | 298.3 | 0.50          |                | 10.7               |
|                | 24-36 | 8.7 | 10.0               | 1.7 | 331.7 | 1.12          |                | 48.3               |
|                | 36-48 | 8.6 | 11.3               | 4.0 | 356.7 | 1.57          |                | 80.0               |
|                |       |     |                    |     |       |               |                |                    |
| <b>40 EOY</b>  | 0-6   | 7.6 | 23.3               | 5.7 | 695.0 | 0.40          | 6.0            | 11.3               |
|                | 6-12  | 8.0 | 10.0               | 2.7 | 515.0 | 0.32          |                | 4.7                |
|                | 12-24 | 8.4 | 14.7               | 2.7 | 338.3 | 0.36          |                | 6.3                |
|                | 24-36 | 9.0 | 14.7               | 2.7 | 308.3 | 0.63          |                | 30.3               |
|                | 36-48 | 8.7 | 22.7               | 1.3 | 360.0 | 1.95          |                | 75.7               |
|                |       |     |                    |     |       |               |                |                    |
| <b>60 EY</b>   | 0-6   | 7.4 | 47.0               | 7.3 | 763.3 | 0.44          | 6.0            | 17.3               |
|                | 6-12  | 7.7 | 8.7                | 2.7 | 465.0 | 0.31          |                | 6.3                |
|                | 12-24 | 8.3 | 12.0               | 1.7 | 271.7 | 0.37          |                | 6.0                |
|                | 24-36 | 9.0 | 12.0               | 1.3 | 238.3 | 0.54          |                | 33.7               |
|                | 36-48 | 8.6 | 16.7               | 2.3 | 330.0 | 0.73          |                | 68.3               |
|                |       |     |                    |     |       |               |                |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 14.3               | 6.3 | 660.0 | 0.52          | 5.5            | 22.7               |
|                | 6-12  | 7.9 | 7.0                | 3.7 | 570.0 | 0.33          |                | 7.0                |
|                | 12-24 | 8.3 | 12.7               | 2.0 | 360.0 | 0.44          |                | 6.7                |
|                | 24-36 | 9.1 | 10.7               | 1.3 | 293.3 | 0.65          |                | 23.7               |
|                | 36-48 | 8.9 | 18.0               | 2.0 | 345.0 | 1.61          |                | 85.7               |
|                |       |     |                    |     |       |               |                |                    |
| <b>100 EOY</b> | 0-6   | 7.5 | 17.7               | 4.0 | 638.3 | 0.44          | 5.4            | 12.0               |
|                | 6-12  | 8.3 | 8.7                | 2.0 | 425.0 | 0.45          |                | 7.0                |
|                | 12-24 | 8.3 | 11.3               | 1.7 | 336.7 | 0.31          |                | 20.7               |
|                | 24-36 | 8.7 | 9.3                | 2.3 | 363.3 | 0.75          |                | 32.0               |
|                | 36-48 | 8.9 | 16.7               | 2.3 | 358.3 | 0.78          |                | 56.3               |

**Table 43. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 15 Jul 1983**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 9.0                | 4.7 | 618.3 | 0.45     | 5.7      | 16.3               |
|                | 6-12  | 7.8 | 4.5                | 4.0 | 506.7 | 0.39     |          | 8.0                |
|                | 12-24 | 8.7 | 11.0               | 2.0 | 350.9 | 0.51     |          | 9.5                |
|                | 24-36 | 9.0 | 19.0               | 2.3 | 346.7 | 1.03     |          | 67.3               |
|                | 36-48 | 8.5 | 21.3               | 3.2 | 355.9 | 3.18     |          | 72.8               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.2 | 4.0                | 3.7 | 643.3 | 0.37     | 5.7      | 10.0               |
|                | 6-12  | 7.6 | 4.0                | 1.7 | 481.7 | 0.34     |          | 5.7                |
|                | 12-24 | 8.5 | 8.0                | 1.0 | 308.3 | 0.38     |          | 9.3                |
|                | 24-36 | 8.6 | 11.0               | 2.3 | 340.0 | 1.50     |          | 32.0               |
|                | 36-48 | 8.6 | 24.0               | 5.0 | 331.7 | 1.41     |          | 56.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.7 | 6.0                | 5.3 | 620.0 | 0.43     | 5.6      | 13.0               |
|                | 6-12  | 8.0 | 5.0                | 4.0 | 463.3 | 0.37     |          | 7.0                |
|                | 12-24 | 8.6 | 11.3               | 2.0 | 355.0 | 0.43     |          | 11.3               |
|                | 24-36 | 9.1 | 18.0               | 1.7 | 311.7 | 0.75     |          | 35.7               |
|                | 36-48 | 8.5 | 23.3               | 2.0 | 363.3 | 2.10     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.5 | 6.0                | 4.7 | 571.7 | 0.43     | 5.5      | 13.3               |
|                | 6-12  | 7.7 | 4.3                | 3.3 | 461.7 | 0.37     |          | 5.0                |
|                | 12-24 | 8.4 | 9.3                | 2.7 | 341.7 | 0.43     |          | 6.3                |
|                | 24-36 | 8.9 | 12.7               | 1.7 | 335.0 | 0.74     |          | 70.7               |
|                | 36-48 | 8.3 | 14.7               | 2.0 | 355.0 | 2.45     |          | 67.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.4 | 4.7                | 4.7 | 621.7 | 0.48     | 6.3      | 10.7               |
|                | 6-12  | 7.7 | 4.3                | 3.0 | 518.3 | 0.44     |          | 9.0                |
|                | 12-24 | 8.4 | 8.7                | 2.0 | 288.3 | 0.36     |          | 6.0                |
|                | 24-36 | 9.0 | 10.0               | 2.3 | 275.0 | 0.54     |          | 18.7               |
|                | 36-48 | 9.1 | 18.0               | 2.0 | 310.0 | 1.14     |          | 58.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.2 | 3.7                | 5.3 | 603.3 | 0.32     | 5.2      | 10.0               |
|                | 6-12  | 7.8 | 4.3                | 3.0 | 441.7 | 0.37     |          | 8.0                |
|                | 12-24 | 8.5 | 9.3                | 1.3 | 303.3 | 0.49     |          | 11.0               |
|                | 24-36 | 8.7 | 10.0               | 2.0 | 318.3 | 1.53     |          | 38.3               |
|                | 36-48 | 8.6 | 15.3               | 4.7 | 370.0 | 1.48     |          | 76.7               |

**Table 44. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 8 Aug 1983**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.  | Org.   | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos | Matter |                    |
|                |       |     |                    |     |       | /cm   | %      | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 8.7                | 6.3 | 631.7 | 0.54  | 6.0    | 17.3               |
|                | 6-12  | 7.9 | 5.5                | 3.2 | 443.4 | 0.43  |        | 7.5                |
|                | 12-24 | 8.5 | 7.7                | 2.5 | 307.5 | 0.39  |        | 7.5                |
|                | 24-36 | 9.0 | 13.3               | 1.5 | 311.7 | 0.71  |        | 33.5               |
|                | 36-48 | 8.8 | 21.0               | 2.5 | 355.0 | 1.71  |        | 70.7               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EY</b>   | 0-6   | 7.5 | 5.3                | 4.7 | 653.3 | 0.36  | 5.8    | 9.0                |
|                | 6-12  | 7.8 | 5.0                | 4.0 | 518.3 | 0.41  |        | 7.0                |
|                | 12-24 | 8.5 | 9.3                | 1.7 | 345.0 | 0.45  |        | 5.3                |
|                | 24-36 | 8.6 | 9.3                | 2.7 | 380.0 | 1.40  |        | 34.0               |
|                | 36-48 | 8.7 | 12.0               | 4.0 | 381.7 | 1.19  |        | 44.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.8 | 9.0                | 5.7 | 611.7 | 0.43  | 5.9    | 22.0               |
|                | 6-12  | 8.1 | 4.0                | 3.0 | 458.3 | 0.43  |        | 5.0                |
|                | 12-24 | 8.7 | 9.3                | 1.7 | 313.3 | 0.39  |        | 9.3                |
|                | 24-36 | 8.9 | 12.0               | 1.3 | 293.3 | 1.17  |        | 32.7               |
|                | 36-48 | 8.6 | 22.7               | 2.0 | 375.0 | 2.11  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.3 | 6.7                | 4.0 | 665.0 | 0.41  | 6.0    | 13.0               |
|                | 6-12  | 7.7 | 4.0                | 3.3 | 403.3 | 0.36  |        | 9.3                |
|                | 12-24 | 8.5 | 8.0                | 2.0 | 296.7 | 0.44  |        | 6.7                |
|                | 24-36 | 8.9 | 10.7               | 1.3 | 291.7 | 0.71  |        | 48.0               |
|                | 36-48 | 8.7 | 10.7               | 1.3 | 340.0 | 1.99  |        | 77.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.7 | 6.7                | 4.3 | 673.3 | 0.50  | 5.7    | 14.0               |
|                | 6-12  | 7.8 | 4.0                | 2.7 | 515.0 | 0.40  |        | 6.3                |
|                | 12-24 | 8.5 | 9.3                | 2.3 | 310.0 | 0.39  |        | 6.3                |
|                | 24-36 | 9.0 | 9.3                | 1.7 | 233.3 | 0.50  |        | 9.3                |
|                | 36-48 | 8.9 | 16.7               | 2.0 | 310.0 | 0.94  |        | 57.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.3 | 6.7                | 4.0 | 586.7 | 0.90  | 5.1    | 32.7               |
|                | 6-12  | 7.5 | 5.0                | 3.0 | 426.7 | 0.33  |        | 9.7                |
|                | 12-24 | 8.5 | 9.3                | 1.3 | 303.3 | 0.50  |        | 15.7               |
|                | 24-36 | 8.7 | 10.7               | 2.0 | 306.7 | 1.37  |        | 38.0               |
|                | 36-48 | 8.7 | 15.3               | 4.7 | 408.3 | 1.34  |        | 80.0               |

**Table 45. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 21 Jun 1983**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.  | Org.   | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos | Matter |                    |
|                |       |     |                    |     |       | /cm   | %      | ppm                |
| <b>Control</b> | 0-6   | 7.7 | 14.3               | 7.3 | 625.0 | 0.36  | 7.1    | 21.3               |
|                | 6-12  | 7.7 | 8.3                | 2.8 | 476.7 | 0.35  |        | 11.2               |
|                | 12-24 | 8.4 | 11.7               | 1.3 | 310.0 | 0.92  |        | 19.0               |
|                | 24-36 | 8.9 | 12.0               | 1.5 | 320.8 | 1.26  |        | 55.5               |
|                | 36-48 | 8.7 | 13.3               | 3.3 | 368.3 | 2.28  |        | 77.2               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EY</b>   | 0-6   | 7.2 | 18.0               | 4.3 | 600.0 | 0.46  | 5.4    | 16.0               |
|                | 6-12  | 7.8 | 7.7                | 2.0 | 540.0 | 0.32  |        | 7.0                |
|                | 12-24 | 8.6 | 14.7               | 1.0 | 486.7 | 0.53  |        | 15.3               |
|                | 24-36 | 8.4 | 11.3               | 4.3 | 521.7 | 2.48  |        | 70.0               |
|                | 36-48 | 8.5 | 12.0               | 7.3 | 436.7 | 3.20  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 17.3               | 4.3 | 570.0 | 0.41  | 6.1    | 10.0               |
|                | 6-12  | 8.1 | 8.3                | 2.0 | 371.7 | 0.37  |        | 6.7                |
|                | 12-24 | 8.5 | 12.0               | 1.0 | 283.3 | 0.52  |        | 21.0               |
|                | 24-36 | 8.7 | 11.3               | 1.0 | 248.3 | 1.52  |        | 40.7               |
|                | 36-48 | 8.8 | 14.7               | 2.0 | 326.7 | 1.82  |        | 66.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.4 | 36.7               | 4.7 | 585.0 | 0.35  | 5.9    | 18.0               |
|                | 6-12  | 8.0 | 8.3                | 1.7 | 405.0 | 0.36  |        | 7.0                |
|                | 12-24 | 8.6 | 16.7               | 1.3 | 278.3 | 0.49  |        | 10.7               |
|                | 24-36 | 9.0 | 11.3               | 1.3 | 288.3 | 0.68  |        | 21.3               |
|                | 36-48 | 8.9 | 13.3               | 1.7 | 325.0 | 0.94  |        | 76.7               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.7 | 22.0               | 6.3 | 548.3 | 0.49  | 5.7    | 20.0               |
|                | 6-12  | 8.1 | 8.0                | 2.3 | 376.7 | 0.31  |        | 7.7                |
|                | 12-24 | 8.8 | 13.3               | 1.7 | 256.7 | 0.47  |        | 11.0               |
|                | 24-36 | 9.0 | 18.0               | 3.3 | 331.7 | 1.17  |        | 72.0               |
|                | 36-48 | 8.2 | 11.3               | 5.0 | 385.0 | 3.60  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.6 | 31.0               | 7.0 | 656.7 | 0.57  | 6.4    | 32.0               |
|                | 6-12  | 8.0 | 10.0               | 4.0 | 386.7 | 0.33  |        | 6.3                |
|                | 12-24 | 8.6 | 14.7               | 2.0 | 240.0 | 0.35  |        | 7.3                |
|                | 24-36 | 9.1 | 19.3               | 1.0 | 280.0 | 0.80  |        | 64.0               |
|                | 36-48 | 8.3 | 15.3               | 2.0 | 353.3 | 2.44  |        | 80.0               |

**Table 46. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 15 Jul 1983**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 9.0                | 4.7 | 618.3 | 0.45     | 5.7      | 16.3               |
|                | 6-12  | 7.8 | 4.5                | 4.0 | 506.7 | 0.39     |          | 8.0                |
|                | 12-24 | 8.7 | 11.0               | 2.0 | 350.9 | 0.51     |          | 9.5                |
|                | 24-36 | 9.0 | 19.0               | 2.3 | 346.7 | 1.03     |          | 67.3               |
|                | 36-48 | 8.5 | 21.3               | 3.2 | 355.9 | 3.18     |          | 72.8               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 3.7                | 3.0 | 538.3 | 0.46     | 4.8      | 17.7               |
|                | 6-12  | 7.8 | 4.3                | 2.3 | 488.3 | 0.39     |          | 14.3               |
|                | 12-24 | 8.7 | 13.3               | 3.3 | 390.0 | 1.10     |          | 62.3               |
|                | 24-36 | 8.4 | 11.3               | 4.3 | 443.3 | 1.84     |          | 59.7               |
|                | 36-48 | 8.0 | 10.7               | 7.0 | 423.3 | 3.37     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 4.3                | 3.3 | 525.0 | 0.44     | 5.5      | 14.0               |
|                | 6-12  | 7.8 | 3.0                | 2.3 | 403.3 | 0.34     |          | 6.7                |
|                | 12-24 | 8.5 | 10.7               | 2.3 | 300.0 | 0.58     |          | 23.0               |
|                | 24-36 | 8.6 | 10.0               | 1.3 | 295.0 | 1.53     |          | 36.7               |
|                | 36-48 | 8.7 | 12.7               | 1.7 | 345.0 | 1.51     |          | 51.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.5 | 16.3               | 4.7 | 748.3 | 0.55     | 6.2      | 11.7               |
|                | 6-12  | 7.9 | 9.7                | 1.7 | 435.0 | 0.31     |          | 6.0                |
|                | 12-24 | 8.6 | 14.7               | 1.0 | 256.7 | 0.38     |          | 6.0                |
|                | 24-36 | 8.9 | 22.7               | 2.3 | 325.0 | 0.86     |          | 56.7               |
|                | 36-48 | 8.6 | 21.3               | 3.3 | 361.7 | 1.71     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 3.7                | 6.7 | 575.0 | 0.55     | 5.7      | 70.0               |
|                | 6-12  | 7.9 | 3.3                | 4.0 | 498.3 | 0.46     |          | 11.7               |
|                | 12-24 | 8.6 | 8.7                | 2.0 | 283.3 | 0.45     |          | 13.7               |
|                | 24-36 | 8.8 | 12.0               | 3.3 | 330.0 | 1.35     |          | 67.7               |
|                | 36-48 | 8.1 | 10.0               | 4.7 | 413.3 | 3.33     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.3 | 9.7                | 8.0 | 576.7 | 0.56     | 5.3      | 29.0               |
|                | 6-12  | 7.6 | 25.3               | 5.7 | 523.3 | 0.39     |          | 9.0                |
|                | 12-24 | 8.4 | 42.7               | 2.0 | 265.0 | 0.37     |          | 7.7                |
|                | 24-36 | 9.0 | 36.7               | 1.7 | 273.3 | 0.63     |          | 37.3               |
|                | 36-48 | 8.5 | 25.3               | 2.3 | 400.0 | 2.03     |          | 79.7               |

**Table 47. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 8 Aug 1983**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 8.7                | 6.3 | 631.7 | 0.54     | 6.0      | 17.3               |
|                | 6-12  | 7.9 | 5.5                | 3.2 | 443.4 | 0.43     |          | 7.5                |
|                | 12-24 | 8.5 | 7.7                | 2.5 | 307.5 | 0.39     |          | 7.5                |
|                | 24-36 | 9.0 | 13.3               | 1.5 | 311.7 | 0.71     |          | 33.5               |
|                | 36-48 | 8.8 | 21.0               | 2.5 | 355.0 | 1.71     |          | 70.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.2 | 6.3                | 4.0 | 578.3 | 0.52     | 6.2      | 24.3               |
|                | 6-12  | 8.0 | 4.3                | 1.7 | 425.0 | 0.35     |          | 12.3               |
|                | 12-24 | 8.7 | 11.3               | 1.3 | 323.3 | 0.71     |          | 36.7               |
|                | 24-36 | 8.4 | 13.3               | 3.7 | 380.0 | 2.30     |          | 80.0               |
|                | 36-48 | 8.2 | 13.3               | 7.0 | 461.7 | 2.98     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 3.7                | 3.3 | 573.3 | 0.43     | 5.9      | 16.7               |
|                | 6-12  | 8.0 | 4.0                | 1.7 | 386.7 | 0.35     |          | 9.0                |
|                | 12-24 | 8.5 | 8.7                | 1.0 | 298.3 | 0.52     |          | 28.7               |
|                | 24-36 | 8.7 | 9.3                | 1.3 | 285.0 | 1.44     |          | 37.0               |
|                | 36-48 | 8.7 | 12.0               | 4.0 | 345.0 | 1.77     |          | 63.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.5 | 10.0               | 4.0 | 556.7 | 0.40     | 5.4      | 13.3               |
|                | 6-12  | 8.0 | 5.0                | 2.0 | 421.7 | 0.34     |          | 5.3                |
|                | 12-24 | 8.7 | 12.0               | 1.3 | 291.7 | 0.43     |          | 10.7               |
|                | 24-36 | 8.7 | 14.7               | 1.0 | 340.0 | 1.57     |          | 63.3               |
|                | 36-48 | 8.4 | 11.3               | 2.7 | 346.7 | 2.52     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 6.3                | 6.3 | 673.3 | 2.62     | 5.7      | 23.0               |
|                | 6-12  | 7.8 | 4.3                | 3.3 | 458.3 | 0.44     |          | 17.3               |
|                | 12-24 | 8.6 | 9.3                | 2.7 | 315.0 | 0.50     |          | 11.7               |
|                | 24-36 | 8.9 | 10.7               | 3.3 | 346.7 | 1.03     |          | 61.3               |
|                | 36-48 | 8.4 | 14.7               | 4.3 | 415.0 | 2.68     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.8 | 13.7               | 7.7 | 833.3 | 0.41     | 5.9      | 14.0               |
|                | 6-12  | 8.0 | 6.3                | 4.7 | 578.3 | 0.37     |          | 10.3               |
|                | 12-24 | 8.6 | 12.0               | 2.0 | 296.7 | 0.40     |          | 8.3                |
|                | 24-36 | 9.2 | 27.3               | 2.0 | 275.0 | 0.77     |          | 53.7               |
|                | 36-48 | 8.6 | 18.7               | 1.0 | 340.0 | 1.93     |          | 80.0               |

**Table 48. Soil Nitrogen Content in Lbs/Acre for the Native Range Fertilization Trial At the Dickinson Experiment Station, 1983**

|                |       | Ammonium Nitrate |        |       | Urea   |        |       |
|----------------|-------|------------------|--------|-------|--------|--------|-------|
|                |       | 21 Jun           | 15 Jul | 8 Aug | 21 Jun | 15 Jul | 8 Aug |
| <b>Control</b> | 0-6   | 14.3             | 9.0    | 8.7   | 14.3   | 9.0    | 8.7   |
|                | 6-12  | 8.3              | 4.5    | 5.5   | 8.3    | 4.5    | 5.5   |
|                | 12-24 | 11.7             | 11.0   | 7.7   | 11.7   | 11.0   | 7.7   |
|                | 24-36 | 12.0             | 19.0   | 13.3  | 12.0   | 19.0   | 13.3  |
|                | 36-48 | 13.3             | 21.3   | 21.0  | 13.3   | 21.3   | 21.0  |
|                |       |                  |        |       |        |        |       |
| <b>40 EY</b>   | 0-6   | 32.3             | 4.0    | 5.3   | 18.0   | 3.7    | 6.3   |
|                | 6-12  | 6.7              | 4.0    | 5.0   | 7.7    | 4.3    | 4.3   |
|                | 12-24 | 12.7             | 8.0    | 9.3   | 14.7   | 13.3   | 11.3  |
|                | 24-36 | 10.0             | 11.0   | 9.3   | 11.3   | 11.3   | 13.3  |
|                | 36-48 | 11.3             | 24.0   | 12.0  | 12.0   | 10.7   | 13.3  |
|                |       |                  |        |       |        |        |       |
| <b>40 EOY</b>  | 0-6   | 23.3             | 6.0    | 9.0   | 17.3   | 4.3    | 3.7   |
|                | 6-12  | 10.0             | 5.0    | 4.0   | 8.3    | 3.0    | 4.0   |
|                | 12-24 | 14.7             | 11.3   | 9.3   | 12.0   | 10.7   | 8.7   |
|                | 24-36 | 14.7             | 18.0   | 12.0  | 11.3   | 10.0   | 9.3   |
|                | 36-48 | 22.7             | 23.3   | 22.7  | 14.7   | 12.7   | 12.0  |
|                |       |                  |        |       |        |        |       |
| <b>60 EY</b>   | 0-6   | 47.0             | 6.0    | 6.7   | 36.7   | 16.3   | 10.0  |
|                | 6-12  | 8.7              | 4.3    | 4.0   | 8.3    | 9.7    | 5.0   |
|                | 12-24 | 12.0             | 9.3    | 8.0   | 16.7   | 14.7   | 12.0  |
|                | 24-36 | 12.0             | 12.7   | 10.7  | 11.3   | 22.7   | 14.7  |
|                | 36-48 | 16.7             | 14.7   | 10.7  | 13.3   | 21.3   | 11.3  |
|                |       |                  |        |       |        |        |       |
| <b>60 EOY</b>  | 0-6   | 14.3             | 4.7    | 6.7   | 22.0   | 3.7    | 6.3   |
|                | 6-12  | 7.0              | 4.3    | 4.0   | 8.0    | 3.3    | 4.3   |
|                | 12-24 | 12.7             | 8.7    | 9.3   | 13.3   | 8.7    | 9.3   |
|                | 24-36 | 10.7             | 10.0   | 9.3   | 18.0   | 12.0   | 10.7  |
|                | 36-48 | 18.0             | 18.0   | 16.7  | 11.3   | 10.0   | 14.7  |
|                |       |                  |        |       |        |        |       |
| <b>100 EOY</b> | 0-6   | 17.7             | 3.7    | 6.7   | 31.0   | 9.7    | 13.7  |
|                | 6-12  | 8.7              | 4.3    | 5.0   | 10.0   | 25.3   | 6.3   |
|                | 12-24 | 11.3             | 9.3    | 9.3   | 14.7   | 42.7   | 12.0  |
|                | 24-36 | 9.3              | 10.0   | 10.7  | 19.3   | 36.7   | 27.3  |
|                | 36-48 | 16.7             | 15.3   | 15.3  | 15.3   | 25.3   | 18.7  |

**Table 49. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 26 Jun 1984**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.  | Org.   | So <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos | Matter | ppm                |
|                |       |     |                    |     |       | /cm   | %      |                    |
| <b>Control</b> | 0-6   | 7.5 | 10.7               | 4.5 | 691.7 | 0.69  | 6.7    | 19.0               |
|                | 6-12  |     | 10.7               | 2.5 | 527.5 |       | 3.6    |                    |
|                | 12-24 | 8.4 | 11.7               | 1.0 | 365.8 | 0.66  |        | 10.0               |
|                | 24-36 | 8.9 | 15.3               | 1.2 | 377.5 | 1.07  |        | 55.3               |
|                | 36-48 | 8.6 | 18.7               | 3.2 | 371.7 | 2.96  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 16.3               | 4.3 | 665.0 | 0.66  | 5.9    | 4.0                |
|                | 6-12  | 8.2 | 7.0                | 1.7 | 530.0 | 0.56  | 3.4    |                    |
|                | 12-24 | 8.7 | 16.7               | 1.0 | 411.7 | 0.72  |        | 4.0                |
|                | 24-36 | 8.6 | 9.3                | 1.3 | 430.0 | 1.93  |        | 36.7               |
|                | 36-48 | 8.7 | 10.0               | 4.0 | 421.7 | 2.09  |        | 50.7               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.7 | 17.7               | 7.3 | 561.7 | 0.61  | 7.8    | 20.0               |
|                | 6-12  |     | 9.0                | 4.0 | 341.7 |       | 3.0    |                    |
|                | 12-24 | 8.5 | 11.3               | 1.0 | 211.7 | 0.62  |        | 25.0               |
|                | 24-36 | 8.8 | 12.7               | 1.3 | 336.7 | 1.62  |        | 37.7               |
|                | 36-48 | 8.6 | 12.0               | 1.7 | 338.3 | 2.59  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.3 | 29.3               | 5.3 | 778.3 | 0.59  | 8.4    | 18.0               |
|                | 6-12  | 7.8 | 14.7               | 3.0 | 478.3 | 0.54  | 3.9    | 2.0                |
|                | 12-24 | 8.2 | 23.3               | 1.3 | 278.3 | 0.55  |        | 12.0               |
|                | 24-36 | 8.9 | 11.3               | 1.0 | 243.3 | 0.71  |        | 26.0               |
|                | 36-48 | 8.6 | 10.7               | 2.0 | 340.0 | 2.33  |        | 77.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 19.7               | 5.3 | 711.7 | 0.64  | 6.5    | 19.0               |
|                | 6-12  | 7.9 | 11.7               | 2.3 | 578.3 | 0.49  | 3.7    |                    |
|                | 12-24 | 8.3 | 10.7               | 2.3 | 345.0 | 0.57  |        | 9.0                |
|                | 24-36 | 8.8 | 10.0               | 1.0 | 285.0 | 0.73  |        | 29.0               |
|                | 36-48 | 8.7 | 15.3               | 2.3 | 348.3 | 0.90  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.5 | 26.0               | 4.0 | 670.0 | 0.61  | 5.2    | 18.0               |
|                | 6-12  |     | 22.7               | 2.3 | 496.7 |       | 3.7    |                    |
|                | 12-24 | 8.2 | 13.3               | 1.0 | 370.0 | 1.73  |        | 33.3               |
|                | 24-36 | 8.4 | 10.7               | 1.3 | 328.3 | 2.04  |        | 44.0               |
|                | 36-48 | 8.5 | 25.3               | 4.7 | 366.7 | 2.32  |        | 80.0               |

**Table 50. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 25 Jul 1984**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 3.0                | 4.0 | 558.3 | 0.59     | 6.2      | 17.7               |
|                | 6-12  | 7.8 | 3.3                | 3.2 | 450.0 | 0.55     | 3.6      | 14.0               |
|                | 12-24 | 8.4 | 6.0                | 1.3 | 354.2 | 0.62     |          | 8.7                |
|                | 24-36 | 8.8 | 11.3               | 2.3 | 324.2 | 1.37     |          | 42.2               |
|                | 36-48 | 8.6 | 14.7               | 3.0 | 355.0 | 2.42     |          | 72.5               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 2.7                | 3.7 | 598.3 | 0.54     | 5.6      | 10.5               |
|                | 6-12  | 7.9 | 4.0                | 1.3 | 480.0 | 0.55     | 3.2      | 2.0                |
|                | 12-24 | 8.5 | 10.0               | 1.0 | 361.7 | 0.63     |          | 26.7               |
|                | 24-36 | 8.6 | 10.0               | 2.3 | 415.0 | 1.75     |          | 59.0               |
|                | 36-48 | 8.6 | 10.0               | 5.0 | 398.3 | 5.06     |          | 56.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.7 | 3.0                | 3.3 | 771.7 | 0.61     | 5.0      | 9.3                |
|                | 6-12  | 7.9 | 3.0                | 3.0 | 486.7 | 0.54     | 2.5      | 12.0               |
|                | 12-24 | 8.5 | 11.3               | 1.3 | 351.7 | 0.62     |          | 12.0               |
|                | 24-36 | 8.7 | 8.0                | 1.7 | 370.0 | 2.06     |          | 35.0               |
|                | 36-48 | 8.6 | 14.0               | 1.0 | 363.3 | 2.64     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.4 | 4.0                | 3.3 | 615.0 | 0.67     | 5.6      | 10.0               |
|                | 6-12  | 7.7 | 5.0                | 2.3 | 446.7 | 0.57     | 3.8      | 6.0                |
|                | 12-24 | 8.3 | 9.3                | 2.0 | 313.3 | 0.59     |          | 8.0                |
|                | 24-36 | 8.6 | 12.0               | 1.3 | 296.7 | 0.85     |          | 32.0               |
|                | 36-48 | 8.6 | 9.3                | 2.0 | 345.0 | 2.40     |          | 62.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 4.0                | 5.3 | 678.3 | 0.69     | 5.2      | 13.0               |
|                | 6-12  | 7.7 | 3.7                | 3.0 | 498.3 | 0.58     | 3.7      | 16.0               |
|                | 12-24 | 8.2 | 7.3                | 2.3 | 345.0 | 0.61     |          | 8.0                |
|                | 24-36 | 8.7 | 13.3               | 1.3 | 303.3 | 0.87     |          | 34.7               |
|                | 36-48 | 8.6 | 9.3                | 2.3 | 401.7 | 0.82     |          | 70.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.3 | 7.3                | 3.7 | 535.0 | 0.68     | 5.4      | 15.5               |
|                | 6-12  | 7.5 | 15.3               | 2.3 | 481.7 | 0.57     | 5.1      | 9.0                |
|                | 12-24 | 8.0 | 10.0               | 1.0 | 355.0 | 1.76     |          | 30.0               |
|                | 24-36 | 8.5 | 12.0               | 1.7 | 403.3 | 2.13     |          | 34.7               |
|                | 36-48 | 8.7 | 22.7               | 4.0 | 413.3 | 1.83     |          | 67.7               |

**Table 51. Soil Analysis of the Ammonium Nitrate Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 27 Aug 1984**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 2.7                | 4.7 | 566.7 | 0.60     | 5.7      | 15.0               |
|                | 6-12  | 7.7 | 4.2                | 2.7 | 457.5 | 0.55     | 3.3      | 15.5               |
|                | 12-24 | 8.4 | 7.7                | 1.3 | 356.7 | 0.63     |          | 9.2                |
|                | 24-36 | 8.8 | 14.7               | 1.3 | 362.5 | 0.89     |          | 46.2               |
|                | 36-48 | 8.8 | 13.3               | 2.3 | 359.2 | 2.16     |          | 69.5               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.3 | 4.7                | 4.7 | 726.7 | 2.58     | 5.4      | 12.3               |
|                | 6-12  | 7.7 | 4.0                | 1.7 | 530.0 | 0.58     | 2.8      | 5.7                |
|                | 12-24 | 8.4 | 11.3               | 2.0 | 413.3 | 0.76     |          | 44.0               |
|                | 24-36 | 8.4 | 26.7               | 3.3 | 485.0 | 2.10     |          | 55.3               |
|                | 36-48 | 8.5 | 14.0               | 3.0 | 410.0 | 2.11     |          | 67.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.7 | 3.0                | 5.0 | 638.3 | 0.58     | 6.6      | 12.3               |
|                | 6-12  | 8.0 | 2.7                | 2.0 | 436.7 | 0.51     | 2.7      | 8.5                |
|                | 12-24 | 8.5 | 6.7                | 1.7 | 350.0 | 0.61     |          | 9.3                |
|                | 24-36 | 8.7 | 9.3                | 1.7 | 341.7 | 2.02     |          | 37.3               |
|                | 36-48 | 8.6 | 10.0               | 2.0 | 368.3 | 2.61     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.4 | 13.3               | 4.7 | 670.0 | 0.67     | 6.8      | 13.3               |
|                | 6-12  | 7.8 | 7.3                | 1.7 | 448.3 | 0.55     | 4.0      | 4.0                |
|                | 12-24 | 8.2 | 10.7               | 1.7 | 266.7 | 0.54     |          | 15.7               |
|                | 24-36 | 8.9 | 12.0               | 1.0 | 270.0 | 0.79     |          | 36.0               |
|                | 36-48 | 8.6 | 11.3               | 1.3 | 360.0 | 2.43     |          | 76.7               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 4.7                | 3.0 | 693.3 | 0.58     | 6.4      | 20.7               |
|                | 6-12  | 7.8 | 3.3                | 2.3 | 543.3 | 0.57     | 3.8      | 10.5               |
|                | 12-24 | 8.2 | 6.7                | 1.3 | 330.0 | 0.57     |          | 12.7               |
|                | 24-36 | 8.8 | 8.0                | 1.3 | 285.0 | 0.75     |          | 34.7               |
|                | 36-48 | 8.7 | 9.3                | 1.7 | 375.0 | 2.24     |          | 77.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.4 | 9.7                | 3.3 | 623.3 | 0.58     | 5.3      | 8.5                |
|                | 6-12  | 7.8 | 7.7                | 2.0 | 438.3 | 0.54     | 3.3      | 2.0                |
|                | 12-24 | 8.3 | 11.3               | 1.0 | 386.7 | 0.88     |          | 30.0               |
|                | 24-36 | 8.5 | 10.0               | 1.7 | 376.7 | 2.13     |          | 31.0               |
|                | 36-48 | 8.6 | 10.7               | 3.7 | 421.7 | 2.28     |          | 80.0               |

**Table 52. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 26 Jun 1984**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.     | Org.     | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|----------|----------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos/cm | Matter % | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 10.7               | 4.5 | 691.7 | 0.69     | 6.7      | 19.0               |
|                | 6-12  |     | 10.7               | 2.5 | 527.5 |          | 3.6      |                    |
|                | 12-24 | 8.4 | 11.7               | 1.0 | 365.8 | 0.66     |          | 10.0               |
|                | 24-36 | 8.9 | 15.3               | 1.2 | 377.5 | 1.07     |          | 55.3               |
|                | 36-48 | 8.6 | 18.7               | 3.2 | 371.7 | 2.96     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 29.0               | 5.0 | 631.7 | 0.73     | 5.6      | 15.0               |
|                | 6-12  | 8.4 | 14.0               | 3.3 | 510.0 | 0.85     | 3.3      |                    |
|                | 12-24 | 8.8 | 18.0               | 1.3 | 400.0 | 0.66     |          | 80.0               |
|                | 24-36 | 8.3 | 9.3                | 2.7 | 398.3 | 3.87     |          | 80.0               |
|                | 36-48 | 8.0 | 7.3                | 5.7 | 493.3 | 5.30     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>40 EOY</b>  | 0-6   | 7.5 | 17.3               | 4.7 | 596.7 | 0.60     | 6.7      | 19.5               |
|                | 6-12  |     | 6.0                | 1.3 | 413.3 |          | 3.2      |                    |
|                | 12-24 | 8.6 | 10.7               | 1.0 | 335.0 | 0.61     |          | 13.0               |
|                | 24-36 | 8.9 | 14.7               | 1.0 | 281.7 | 0.83     |          | 18.3               |
|                | 36-48 | 8.9 | 24.0               | 2.3 | 328.3 | 1.20     |          | 64.3               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EY</b>   | 0-6   | 7.6 | 33.0               | 4.7 | 715.0 | 0.66     | 6.3      | 16.0               |
|                | 6-12  | 8.0 | 15.3               | 2.0 | 370.0 | 0.58     | 3.4      | 20.0               |
|                | 12-24 | 8.4 | 16.0               | 1.3 | 261.7 | 0.56     |          | 9.0                |
|                | 24-36 | 8.7 | 13.3               | 1.0 | 358.3 | 0.88     |          | 49.3               |
|                | 36-48 | 8.7 | 10.7               | 1.3 | 343.3 | 2.49     |          | 61.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>60 EOY</b>  | 0-6   | 7.5 | 22.7               | 4.3 | 603.3 | 0.60     | 6.0      | 31.0               |
|                | 6-12  | 7.9 | 7.5                | 1.3 | 466.7 | 0.59     | 3.1      | 13.0               |
|                | 12-24 | 8.6 | 10.0               | 1.0 | 285.0 | 0.68     |          | 8.0                |
|                | 24-36 | 8.9 | 13.3               | 1.3 | 353.3 | 1.89     |          | 68.7               |
|                | 36-48 | 8.1 | 7.3                | 3.3 | 433.3 | 5.27     |          | 80.0               |
|                |       |     |                    |     |       |          |          |                    |
| <b>100 EOY</b> | 0-6   | 7.7 | 49.7               | 7.3 | 650.0 | 0.71     | 6.6      | 22.0               |
|                | 6-12  | 7.9 | 28.7               | 2.3 | 481.7 | 0.56     | 4.4      |                    |
|                | 12-24 | 8.4 | 23.3               | 1.3 | 315.0 | 0.56     |          | 14.3               |
|                | 24-36 | 8.9 | 13.3               | 1.0 | 265.0 | 0.94     |          | 55.0               |
|                | 36-48 | 8.2 | 6.0                | 1.0 | 293.3 | 4.60     |          | 80.0               |

**Table 53. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 25 Jul 1984**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.  | Org.   |                    |
|----------------|-------|-----|--------------------|-----|-------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos | Matter | SO <sub>4</sub> -S |
|                |       |     |                    |     |       | /cm   | %      | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 3.0                | 4.0 | 558.3 | 0.59  | 6.2    | 17.7               |
|                | 6-12  | 7.8 | 3.3                | 3.2 | 450.0 | 0.55  | 3.6    | 14.0               |
|                | 12-24 | 8.4 | 6.0                | 1.3 | 354.2 | 0.62  |        | 8.7                |
|                | 24-36 | 8.8 | 11.3               | 2.3 | 324.2 | 1.37  |        | 42.2               |
|                | 36-48 | 8.6 | 14.7               | 3.0 | 355.0 | 2.42  |        | 72.5               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 3.3                | 3.7 | 561.7 | 0.74  | 6.1    | 58.5               |
|                | 6-12  | 7.7 | 4.0                | 2.3 | 465.0 | 0.61  | 4.1    | 13.0               |
|                | 12-24 | 8.6 | 10.0               | 2.0 | 400.0 | 1.09  |        | 62.0               |
|                | 24-36 | 8.4 | 10.0               | 3.3 | 446.7 | 3.35  |        | 106.7              |
|                | 36-48 | 8.1 | 7.3                | 6.0 | 483.3 | 5.02  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.4 | 3.3                | 4.0 | 568.3 | 0.57  | 5.5    | 10.0               |
|                | 6-12  | 7.9 | 3.7                | 1.3 | 421.7 | 0.52  | 3.2    | 7.0                |
|                | 12-24 | 8.3 | 8.0                | 1.0 | 396.7 | 0.71  |        | 29.0               |
|                | 24-36 | 8.4 | 8.0                | 1.7 | 350.0 | 2.14  |        | 51.5               |
|                | 36-48 | 8.6 | 12.7               | 2.7 | 415.0 | 2.14  |        | 59.7               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.6 | 3.7                | 3.7 | 531.7 | 0.63  | 5.8    | 17.0               |
|                | 6-12  | 7.8 | 4.7                | 2.0 | 413.3 | 0.56  | 3.5    | 8.7                |
|                | 12-24 | 8.4 | 8.0                | 1.3 | 315.0 | 1.04  |        | 13.0               |
|                | 24-36 | 8.6 | 10.7               | 1.3 | 361.7 | 2.27  |        | 41.7               |
|                | 36-48 | 8.6 | 13.3               | 3.0 | 371.7 | 2.56  |        | 73.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.6 | 3.3                | 3.3 | 561.7 | 0.65  | 5.1    | 9.7                |
|                | 6-12  | 8.1 | 4.0                | 2.3 | 445.0 | 0.59  | 3.6    | 4.0                |
|                | 12-24 | 8.5 | 9.3                | 2.3 | 361.7 | 0.80  |        | 32.7               |
|                | 24-36 | 8.6 | 10.0               | 1.3 | 398.3 | 2.86  |        | 80.0               |
|                | 36-48 | 8.2 | 7.3                | 3.0 | 448.3 | 4.37  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.4 | 13.7               | 5.7 | 538.3 | 0.65  | 4.7    | 14.7               |
|                | 6-12  | 7.8 | 10.3               | 2.3 | 430.0 | 0.56  | 3.7    | 7.0                |
|                | 12-24 | 8.4 | 10.0               | 1.3 | 283.3 | 0.59  |        | 9.7                |
|                | 24-36 | 8.8 | 12.0               | 1.0 | 355.0 | 0.90  |        | 42.0               |
|                | 36-48 | 8.3 | 8.7                | 1.3 | 381.7 | 3.77  |        | 80.0               |

**Table 54. Soil Analysis of the Urea Treatments for the Native Range Fertilization Trial at the Dickinson Experiment Station, 27 Aug 1984**

|                | Depth |     | NO <sub>3</sub> -N | P   | K     | E.C.  | Org.   | SO <sub>4</sub> -S |
|----------------|-------|-----|--------------------|-----|-------|-------|--------|--------------------|
| Treatment      | In.   | pH  | Lbs/Acre           |     |       | Mmhos | Matter |                    |
|                |       |     |                    |     |       | /cm   | %      | ppm                |
| <b>Control</b> | 0-6   | 7.5 | 2.7                | 4.7 | 566.7 | 0.60  | 5.7    | 15.0               |
|                | 6-12  | 7.7 | 4.2                | 2.7 | 457.5 | 0.55  | 3.3    | 15.5               |
|                | 12-24 | 8.4 | 7.7                | 1.3 | 356.7 | 0.63  |        | 9.2                |
|                | 24-36 | 8.8 | 14.7               | 1.3 | 362.5 | 0.89  |        | 46.2               |
|                | 36-48 | 8.8 | 13.3               | 2.3 | 359.2 | 2.16  |        | 69.5               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EY</b>   | 0-6   | 7.4 | 9.0                | 4.7 | 608.3 | 0.72  | 5.0    | 30.0               |
|                | 6-12  | 7.8 | 3.7                | 2.3 | 505.0 | 0.60  | 2.8    | 12.0               |
|                | 12-24 | 8.6 | 10.0               | 1.0 | 393.3 | 0.79  |        | 13.0               |
|                | 24-36 | 8.5 | 11.3               | 3.0 | 416.7 | 2.68  |        | 105.3              |
|                | 36-48 | 8.1 | 8.7                | 5.3 | 481.7 | 4.37  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>40 EOY</b>  | 0-6   | 7.6 | 4.0                | 4.3 | 506.7 | 0.56  | 4.9    | 8.7                |
|                | 6-12  | 8.0 | 4.3                | 1.7 | 403.3 | 0.52  | 2.9    | 4.0                |
|                | 12-24 | 8.4 | 10.0               | 2.0 | 398.3 | 0.71  |        | 27.7               |
|                | 24-36 | 8.4 | 10.0               | 1.7 | 391.7 | 1.97  |        | 36.3               |
|                | 36-48 | 8.5 | 14.0               | 2.7 | 405.0 | 2.71  |        | 40.7               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EY</b>   | 0-6   | 7.6 | 4.7                | 3.7 | 535.0 | 0.53  | 6.2    | 15.3               |
|                | 6-12  | 7.9 | 3.3                | 1.3 | 358.3 | 0.53  | 2.9    | 5.7                |
|                | 12-24 | 8.5 | 7.3                | 1.0 | 266.7 | 0.51  |        | 8.7                |
|                | 24-36 | 8.8 | 10.7               | 1.0 | 350.0 | 0.99  |        | 37.3               |
|                | 36-48 | 8.8 | 13.3               | 2.7 | 385.0 | 1.98  |        | 73.3               |
|                |       |     |                    |     |       |       |        |                    |
| <b>60 EOY</b>  | 0-6   | 7.7 | 4.0                | 2.7 | 533.3 | 0.64  | 5.2    | 20.7               |
|                | 6-12  | 7.8 | 4.3                | 2.0 | 473.3 | 0.58  | 3.6    | 15.0               |
|                | 12-24 | 8.7 | 9.3                | 1.3 | 331.7 | 0.64  |        | 13.0               |
|                | 24-36 | 8.8 | 11.3               | 2.3 | 371.7 | 1.70  |        | 55.7               |
|                | 36-48 | 8.1 | 8.7                | 2.7 | 420.0 | 3.79  |        | 80.0               |
|                |       |     |                    |     |       |       |        |                    |
| <b>100 EOY</b> | 0-6   | 7.7 | 14.3               | 3.7 | 608.3 | 2.65  | 7.9    | 12.5               |
|                | 6-12  | 7.6 | 21.3               | 2.3 | 441.7 | 0.68  | 4.2    | 12.5               |
|                | 12-24 | 8.4 | 18.0               | 1.0 | 281.7 | 0.58  |        | 9.7                |
|                | 24-36 | 8.7 | 16.7               | 2.7 | 328.3 | 0.90  |        | 51.3               |
|                | 36-48 | 8.4 | 11.3               | 2.0 | 333.3 | 3.57  |        | 80.0               |

**Table 55. Soil Nitrogen Content in Lbs/Acre for the Native Range Fertilization Trial At the Dickinson Experiment Station, 1984**

|                |       | Ammonium Nitrate |        |        | Urea   |        |        |
|----------------|-------|------------------|--------|--------|--------|--------|--------|
|                |       | 26 Jun           | 25 Jul | 27 Aug | 26 Jun | 25 Jul | 27 Aug |
| <b>Control</b> | 0-6   | 10.7             | 3.0    | 2.7    | 10.7   | 3.0    | 2.7    |
|                | 6-12  | 10.7             | 3.3    | 4.2    | 10.7   | 3.3    | 4.2    |
|                | 12-24 | 11.7             | 6.0    | 7.7    | 11.7   | 6.0    | 7.7    |
|                | 24-36 | 15.3             | 11.3   | 14.7   | 15.3   | 11.3   | 14.7   |
|                | 36-48 | 18.7             | 14.7   | 13.3   | 18.7   | 14.7   | 13.3   |
|                |       |                  |        |        |        |        |        |
| <b>40 EY</b>   | 0-6   | 16.3             | 2.7    | 4.7    | 29.0   | 3.3    | 9.0    |
|                | 6-12  | 7.0              | 4.0    | 4.0    | 14.0   | 4.0    | 3.7    |
|                | 12-24 | 16.7             | 10.0   | 11.3   | 18.0   | 10.0   | 10.0   |
|                | 24-36 | 9.3              | 10.0   | 26.7   | 9.3    | 10.0   | 11.3   |
|                | 36-48 | 10.0             | 10.0   | 14.0   | 7.3    | 7.3    | 8.7    |
|                |       |                  |        |        |        |        |        |
| <b>40 EOY</b>  | 0-6   | 17.7             | 3.0    | 3.0    | 17.3   | 3.3    | 4.0    |
|                | 6-12  | 9.0              | 3.0    | 2.7    | 6.0    | 3.7    | 4.3    |
|                | 12-24 | 11.3             | 11.3   | 6.7    | 10.7   | 8.0    | 10.0   |
|                | 24-36 | 12.7             | 8.0    | 9.3    | 14.7   | 8.0    | 10.0   |
|                | 36-48 | 12.0             | 14.0   | 10.0   | 24.0   | 12.7   | 14.0   |
|                |       |                  |        |        |        |        |        |
| <b>60 EY</b>   | 0-6   | 29.3             | 4.0    | 13.3   | 33.0   | 3.7    | 4.7    |
|                | 6-12  | 14.7             | 5.0    | 7.3    | 15.3   | 4.7    | 3.3    |
|                | 12-24 | 23.3             | 9.3    | 10.7   | 16.0   | 8.0    | 7.3    |
|                | 24-36 | 11.3             | 12.0   | 12.0   | 13.3   | 10.7   | 10.7   |
|                | 36-48 | 10.7             | 9.3    | 11.3   | 10.7   | 13.3   | 13.3   |
|                |       |                  |        |        |        |        |        |
| <b>60 EOY</b>  | 0-6   | 19.7             | 4.0    | 4.7    | 22.7   | 3.3    | 4.0    |
|                | 6-12  | 11.7             | 3.7    | 3.3    | 7.5    | 4.0    | 4.3    |
|                | 12-24 | 10.7             | 7.3    | 6.7    | 10.0   | 9.3    | 9.3    |
|                | 24-36 | 10.0             | 13.3   | 8.0    | 13.3   | 10.0   | 11.3   |
|                | 36-48 | 15.3             | 9.3    | 9.3    | 7.3    | 7.3    | 8.7    |
|                |       |                  |        |        |        |        |        |
| <b>100 EOY</b> | 0-6   | 26.0             | 7.3    | 9.7    | 49.7   | 13.7   | 14.3   |
|                | 6-12  | 22.7             | 15.3   | 7.7    | 28.7   | 10.3   | 21.3   |
|                | 12-24 | 13.3             | 10.0   | 11.3   | 23.3   | 10.0   | 18.0   |
|                | 24-36 | 10.7             | 12.0   | 10.0   | 13.3   | 12.0   | 16.7   |
|                | 36-48 | 25.3             | 22.7   | 10.7   | 6.0    | 8.7    | 11.3   |

**Table 56. Soil Texture by Rep for the Native Range Fertilization Trial at the Dickinson Experiment Station, 1984**

| Ammonium Nitrate |       |         |       |       |      | Urea    |       |       |       |
|------------------|-------|---------|-------|-------|------|---------|-------|-------|-------|
|                  |       | Rep 1   | Rep 2 | Rep 3 |      |         | Rep 1 | Rep 2 | Rep 3 |
| Control          | 0-6   | (SOUTH) | L     | L     | L    | (NORTH) | L     | L     | L     |
|                  | 6-12  |         | L     | L     | L    |         | SiL   | L     | SiL   |
|                  | 12-24 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |
|                  | 24-36 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |
|                  | 36-48 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |
| 40 EY            | 0-6   |         | L     | [L]   | [L]  |         | [L]   | L     | L     |
|                  | 6-12  |         | SiL   | L     | [L]  |         | [SiL] | L     | L     |
|                  | 12-24 |         | SiL   | L     | SiCL |         | SiL   | L     | SiCL  |
|                  | 24-36 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |
|                  | 36-48 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |
| 40 Eoy           | 0-6   |         | L     | L     | L    |         | L     | L     | L     |
|                  | 6-12  |         | L     | L     | L    |         | [L]   | L     | L     |
|                  | 12-24 |         | SiCL  | SiCL  | L    |         | SiCL  | SiCL  | SiCL  |
|                  | 24-36 |         | SiCL  | SiCL  | SiL  |         | SiCL  | SiCL  | SiCL  |
|                  | 36-48 |         | SiCL  | SiCL  | SiL  |         | SiCL  | SiCL  | SiCL  |
| 60 EY            | 0-6   |         | L     | L     | L    |         | L     | L     | L     |
|                  | 6-12  |         | SiL   | L     | L    |         | L     | L     | SiL   |
|                  | 12-24 |         | SiCL  | SiCL  | L    |         | SiCL  | L     | SiL   |
|                  | 24-36 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiL   |
|                  | 36-48 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiL   |
| 60 EOY           | 0-6   |         | L     | L     | L    |         | L     | L     | L     |
|                  | 6-12  |         | [SiL] | L     | L    |         | [L]   | L     | L     |
|                  | 12-24 |         | SiCL  | SiL   | SiCL |         | SiL   | SiCL  | SiL   |
|                  | 24-36 |         | SiCL  | SiL   | SiCL |         | SiL   | SiCL  | SiCL  |
|                  | 36-48 |         | SiCL  | SiL   | SiCL |         | SiL   | SiCL  | SiCL  |
| 100 EOY          | 0-6   |         | L     | L     | L    |         | L     | L     | L     |
|                  | 6-12  |         | SiL   | L     | L    |         | [L]   | L     | L     |
|                  | 12-24 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | L     |
|                  | 24-36 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |
|                  | 36-48 |         | SiCL  | SiCL  | SiCL |         | SiCL  | SiCL  | SiCL  |

L: Loam  
 SiCL: Silty clay loam  
 SiL: Silty loam  
 [ ]: Tentative classification

**PLANT SPECIES LIST OF THE NATIVE RANGE FERTILIZATION TRIAL,  
DICKINSON EXPERIMENT STATION, 1984**

**Graminoids:**

|       |                           |                      |
|-------|---------------------------|----------------------|
| Ag sm | Agropyron smithii         | Western wheatgrass   |
| Ag sp | Agropyron spicatum        | Bluebunch wheatgrass |
| Ag tr | Agropyron trachycaulum    | Slender wheatgrass   |
| An sc | Andropogon scoparius      | Little bluestem      |
| Ar lo | Aristida longiseta        | Red threeawn         |
| Bo gr | Bouteloua gracilis        | Blue gramma          |
| Bu da | Buchloe dactyloides       | Buffalo grass        |
| Ca mo | Calamagrostis montanensis | Plains reedgrass     |
| Ca lo | Calamovilfa longifolia    | Prairie sandreed     |
| Ko py | Koeleria pyramidata       | Prairie junegrass    |
| Mu cu | Muhlenbergia cuspidata    | Plains muhly         |
| Mu sq | Munroa squarrosa          | False buffalo grass  |
| Pa ol | Panicum oligosanthos      | Scribner panic grass |
| Po co | Poa compressa             | Canada bluegrass     |
| St co | Stipa comata              | Needleandthread      |
| St vi | Stipa viridula            | Green needlegrass    |
| Ca fi | Carex filifolia           | Threadleaved sedge   |
| Ca he | Carex heliophila          | Yellow sedge         |

**Forbs:**

|       |                        |                   |
|-------|------------------------|-------------------|
| Ac mi | Achillea millefolium   | Yarrow            |
| Ag gl | Agoseris glauca        | Prairie dandelion |
| An oc | Androsace occidentalis | Fairy candelabra  |
| An cy | Anemone cylindrica     | Cottonweed        |
| An pa | Antennaria parvifolia  | Pussytoes         |
| Ar hi | Arabis hirsuta         | Hairy rockcress   |

**Forbs (Continued):**

|       |                                 |                     |
|-------|---------------------------------|---------------------|
| Ar ho | <i>Arabis holboellii</i>        | Slim rockcress      |
| Ar fu | <i>Arnica fulgens</i>           | Arnica              |
| Ar dr | <i>Artemisia dracunculus</i>    | Green sage          |
| Ar fr | <i>Artemisia frigida</i>        | Fringed sage        |
| Ar lu | <i>Artemisia ludoviciana</i>    | White sage          |
| As er | <i>Aster ericoides</i>          | White prairie aster |
| As ob | <i>Aster oblongifolius</i>      | Aromatic aster      |
| As ag | <i>Astragalus agrestis</i>      | Wild milkvetch      |
| As ca | <i>Astragalus canadensis</i>    | Little rattlepod    |
| As cr | <i>Astragalus crassicaulus</i>  | Ground plum         |
| As mi | <i>Astragalus missouriensis</i> | Missouri milkvetch  |
| Ba op | <i>Bahia oppositifolia</i>      | Bahia beggartick    |
| Ce ar | <i>Cerastium arvense</i>        | Prairie chickweed   |
| Ch al | <i>Chenopodium album</i>        | Lamb's quarters     |
| Ch vi | <i>Chrysopsis villosa</i>       | Golden aster        |
| Ci un | <i>Cirsium undulatum</i>        | Prairie thistle     |
| Co li | <i>Collomia linearis</i>        | Collomia            |
| Co um | <i>Commandra umbellata</i>      | Bastard toadflax    |
| Co ar | <i>Convolvulus arvensis</i>     | Field bindweed      |
| Co ca | <i>Conyza canadensis</i>        | Horseweed           |
| Dr ne | <i>Draba nemorosa</i>           | Yellow whitlowwort  |
| Ec an | <i>Echinacea angustifolia</i>   | Purple coneflower   |
| Er gl | <i>Erigeron glabellus</i>       | Rough erigeron      |
| Er as | <i>Erysimum asperum</i>         | Western wallflower  |
| Ga bo | <i>Galium boreale</i>           | Northern bedstraw   |
| Ga co | <i>Gaura coccinea</i>           | Gaura               |
| Gr sq | <i>Grindelia squarrosa</i>      | Gumweed             |
| Gu sa | <i>Gutierrezia sarothrae</i>    | Broomweed           |
| Ha sp | <i>Haplopappus spinulosus</i>   | Spiny ironweed      |
| He hi | <i>Hedeoma pinnatifida</i>      | Rough pennyroyal    |

**Forbs (Continued):**

|       |                         |                             |
|-------|-------------------------|-----------------------------|
| He ri | Helianthus rigidus      | Stiff sunflower             |
| Hi vu | Hippuris vulgaris       | Marestail                   |
| Ko sc | Kochia scoparia         | Kochia                      |
| La ob | Lactuca oblongifolia    | Blue wild lettuce           |
| Le de | Lepidium densiflorum    | Peppergrass                 |
| Li pu | Liatris punctata        | Blazing star                |
| Li le | Linum lewisii           | Wild blueflax               |
| Le ri | Linum rigidum           | Stiffstem flax              |
| Li in | Lithospermum incisum    | Narrow-leaved puccoon       |
| Lo am | Lotus americanus        | Prairie bird's foot trefoil |
| Me of | Melilotus officinalis   | Yellow sweetclover          |
| Ne pa | Neslia paniculata       | Ball mustard                |
| Op fr | Opuntia fragilis        | Brittle prickly pear        |
| Or lu | Orthocarpus luteus      | Owl clover                  |
| Ox la | Oxytropis lambertii     | Purple loco                 |
| Pe al | Penstemon albidus       | White beardtongue           |
| Pe gr | Penstemon gracilis      | Slender beardtongue         |
| Pe pu | Petalostemon purpureum  | Purple prairie clover       |
| Ph ho | Phlox hoodii            | Moss phlox                  |
| Pl pu | Plantago purshii        | Woolly plantain             |
| Po al | Polygala alba           | White milkwort              |
| Po ar | Potentilla arguta       | Tall cinguefoil             |
| Po pe | Potentilla pensylvanica | Potentilla                  |
| Ps ar | Psoralea argophylla     | Silverleaf scurfpea         |
| Ps es | Psoralea esculenta      | Indian breadroot            |
| Ra co | Ratibida columnifera    | Long headed coneflower      |
| Sa ka | Salsola kali            | Russian thistle             |
| Se pl | Senecio plattensis      | Prairie ragwort             |
| Si mo | Sisyrinchium montanum   | Blue-eyed grass             |
| So mi | Solidago missouriensis  | Early goldenrod             |

**Forbs (Continued):**

|       |                             |                     |
|-------|-----------------------------|---------------------|
| So mo | <i>Solidago mollis</i>      | Soft goldenrod      |
| So ri | <i>Solidago rigida</i>      | Stiff goldenrod     |
| Sp co | <i>Sphaeralcea coccinea</i> | Scarlet globemallow |
| Ta of | <i>Taraxacum officinale</i> | Dandelion           |
| Ve fa | <i>Veronica fasciculata</i> | Ironweed            |
| Vi am | <i>Vicia americana</i>      | Wild vetch          |
| Vi nu | <i>Viola nuttallii</i>      | Nuttall's violet    |

**Shrubs:**

|       |                                    |                   |
|-------|------------------------------------|-------------------|
| Ro ar | <i>Rosa arkansana</i>              | Prairie wild rose |
| Sy oc | <i>Symphoricarpos occidentalis</i> | Wolfberry         |

**Lycopods:**

|       |                          |           |
|-------|--------------------------|-----------|
| Se de | <i>Selaginella densa</i> | Club moss |
|-------|--------------------------|-----------|

**Eumycota:**

|         |                    |         |
|---------|--------------------|---------|
| Li spp. | Species of lichens | Lichens |
|---------|--------------------|---------|

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## **ALFALFA INTERSEEDING TECHNIQUES TRIAL – 1984**

### **Dickinson Experiment Station**

Llewellyn Manske

The alfalfa interseeding techniques trial is separated into three separate segments. These are: alfalfa interseeding row spacing techniques trial, alfalfa interseeding furrow width techniques trial, and interseeded alfalfa variety response to grazing trial.

The personnel at the Dickinson Experiment Station built an interseeding machine during the winter of 1982-83. The plans from a machine designed and tested at South Dakota State University (Chisholms et al. 1980) were used for the construction with slight alterations. This interseeder was used to establish the alfalfa interseeding plots in 1983.

### **ALFALFA INTERSEEDING ROW SPACING TECHNIQUES TRIAL**

This trial was designed to evaluate alfalfa interseeding into rangeland with different intervals between the rows. The intended purpose of the data will be primarily to assist in the determination of a recommended row spacing or row spacings for alfalfa interseeding into rangeland for pasture use in western North Dakota.

These plots were established on one acre located on the NE $\frac{1}{4}$ , NW $\frac{1}{4}$ , SW $\frac{1}{4}$  sec. 23, T. 143 N., R. 96 W. at the ranch headquarters of the Dickinson Experiment Station. The 33 x 50 foot plots were arranged in a randomized block design with three replication. The soil was vebar fine sandy loam. The range site was sandy with a few thin claypan sites. Travois alfalfa was seeded at a rate of 0.50 lbs PLS/row/acre on 21 April 1983. A four inch twisted chisel plow shovel was used as the furrow opener. The intervals between the rows were 2, 3, 4, 5, 8 and 10 feet. A control plot of no interseeding was included in each replication.

The data that were collected from these plots were: above ground herbage production separated into nine categories, alfalfa seedling counts per meter of row, species composition by point frame and forb densities by use of one tenth meter square quadrats.

The above ground herbage production was sampled by clipping the vegetation to ground level in two  $\frac{1}{4}$  m<sup>2</sup> quadrats for each plot on 22 June 1984. The herbage was separated into nine categories, cool short, warm short, cool mid, western wheatgrass, warm mid, warm tall, sedge, forbs and shrubs. The samples were oven dried at 80°C. The dried samples were then weighted in grams. The average weight of each category for the two  $\frac{1}{4}$  m<sup>2</sup> quadrats was determined and the average pounds per acre of herbage production was calculated for each category by multiplying the average weight in grams by 35.68. The total average production for each plot was found by the summation of the average pounds per acre for each category. The reported figures are means of the three replications for each treatment.

The alfalfa seedling counts were made by counting the number of seedlings along two randomly placed meter sticks for each row of each plot. The mean number of seedlings per meter of row was determined for each treatment. Seedling counts were conducted on 27 June 1984.

Quantitative species composition data for each plot was collected on 10 August 1984. The herbacious plants were sampled by the ten pin point frame method (Levy and Madden 1933, Tinney, Aamodt, and Ahlgren 1937, Heady and Rader 1958 and Smith 1959). Fifteen hundred points were read for each treatment (500 points per plot). A systematic sampling scheme was used for each plot. A permanent major transect was established three feet inside and parallel to the east boundary of each plot. Five minor transects were established perpendicular to the major transect at nine foot intervals starting nine feet from the south boundary of the plot. One hundred points were read on each minor transect equally spaced across the plot.

Forb and shrub densities were sampled by the use of one tenth meter square quadrats on 28 August 1984. The forbs and shrubs that were rooted within the frame were counted by species in each of the 25 quadrats per plot. Five 0.1 m<sup>2</sup> quadrats were spaced at 6 foot intervals along each of the five minor transects.

### Alfalfa Interseeding Row Spacing Techniques Trial

|                            |                                                                                                  |                         |
|----------------------------|--------------------------------------------------------------------------------------------------|-------------------------|
| <b>Location:</b>           | Dickinson Experiment Station<br>Ranch Headquarters<br>NE¼, NW¼, SW¼ Sec. 23, T. 143 N., R. 96 W. |                         |
| <b>Replications:</b>       | Three                                                                                            | Randomized Block Design |
| <b>Study Size:</b>         | 183' x 241'                                                                                      | 1.01 acres              |
| <b>Plot Size:</b>          | 33' x 50'                                                                                        | 0.04 acres              |
| <b>Perimeter border:</b>   | 10' on west and south, 3' on north and 0' on east                                                |                         |
| <b>Alleys:</b>             | 10'                                                                                              |                         |
| <b>Soil:</b>               | Vebar                                                                                            |                         |
| <b>Range Site:</b>         | Sandy with a few thin claypen sites                                                              |                         |
| <b>Seeding Date:</b>       | 21 Apr 1983                                                                                      |                         |
| <b>Seeding Rate:</b>       | 0.50 lbs. PLS/row/acre                                                                           |                         |
| <b>Alfalfa Variety:</b>    | Travois                                                                                          |                         |
| <b>Chisel Plow Shovel:</b> | 4" twisted                                                                                       |                         |
| <b>Row Spacings:</b>       | 0, 2, 3, 4, 5, 8 and 10 foot                                                                     |                         |

**Figure 1:** Alfalfa Interseeding Row Spacing Techniques Trial

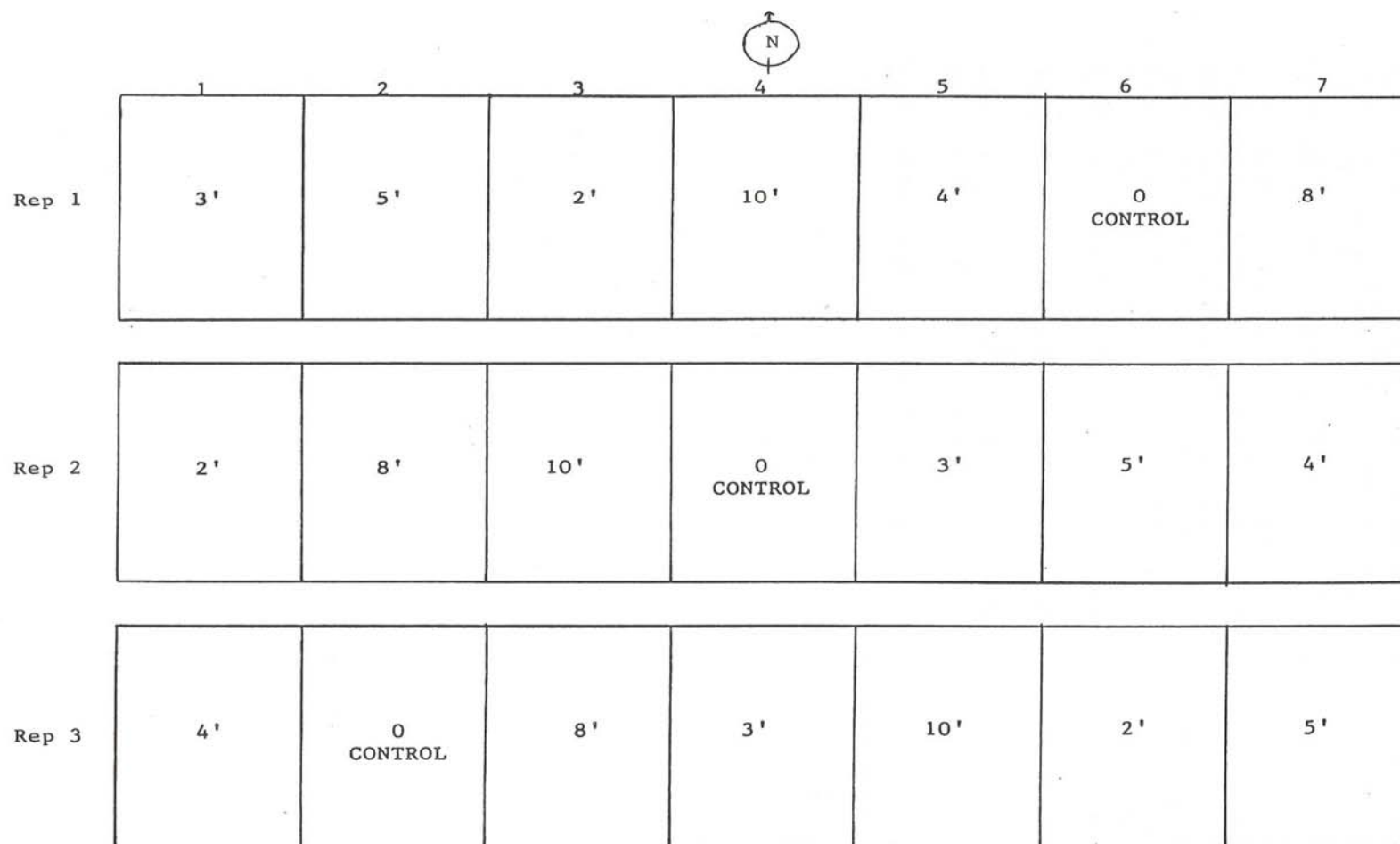


Figure 1. Alfalfa interseeding row spacing techniques trial with 0, 2, 3, 4, 5, 8 and 10 foot row spacings, seeded 21 Apr 1983.

**Table 1. Mean Above Ground Herbage Production by Category in Lbs/Acre for the Alfalfa Interseeding Row Spacing Techniques Trial at the Dickinson Experiment Station, 1984**

| Clip Categories    | Row Spacing |           |           |           |           |           |            |
|--------------------|-------------|-----------|-----------|-----------|-----------|-----------|------------|
|                    | 0<br>Foot   | 2<br>Foot | 3<br>Foot | 4<br>Foot | 5<br>Foot | 8<br>Foot | 10<br>Foot |
| Cool Short         | 126.7       | 205.8     | 79.1      | 139.2     | 174.8     | 93.8      | 142.1      |
| Warm Short         | 130.8       | 163.1     | 220.0     | 91.6      | 157.6     | 108.8     | 179.6      |
| Cool Mid           | 144.0       | 215.9     | 264.6     | 318.2     | 274.1     | 195.7     | 105.3      |
| Western Wheatgrass | 14.2        | 38.1      | 11.9      | 5.4       | 6.5       | 7.1       | 31.5       |
| Warm Mid           | 16.7        | 0.0       | 0.6       | 4.2       | 20.8      | 0.0       | 19.0       |
| Warm Tall          | 25.0        | 0.0       | 3.6       | 10.1      | 0.6       | 0.0       | 27.4       |
| Sedge              | 196.8       | 236.1     | 165.9     | 164.7     | 101.3     | 146.9     | 208.7      |
| <b>Total Grass</b> | 714.2       | 843.8     | 745.7     | 733.2     | 735.9     | 552.0     | 696.9      |
| Forbs              | 75.5        | 111.2     | 96.3      | 145.1     | 127.9     | 88.6      | 66.0       |
| Shrubs             | 0.0         | 0.0       | 1.2       | 20.2      | 3.0       | 2.4       | 0.0        |
| <b>Total</b>       | 789.7       | 955.0     | 843.2     | 898.5     | 866.7     | 643.0     | 762.9      |

**Table 2. Alfalfa Plant Count per Meter of Row for the Alfalfa Interseeding Row Spacing Techniques Trial  
At the Dickinson Experiment Station, 27 Jun 1984**

| Row<br>Spacing | Rep 1    |       |       | Rep 2    |       |       | Rep 3    |       |       | Mean     |       |       |
|----------------|----------|-------|-------|----------|-------|-------|----------|-------|-------|----------|-------|-------|
|                | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total |
| Control        | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  |
| 2 foot         | 0.53     | 3.69  | 4.22  | 0.22     | 0.53  | 0.75  | 1.13     | 2.94  | 4.06  | 0.63     | 2.39  | 3.01  |
| 3 foot         | 0.92     | 4.00  | 4.92  | 0.21     | 0.92  | 1.13  | 0.08     | 0.33  | 0.42  | 0.42     | 1.75  | 2.15  |
| 4 foot         | 0.25     | 0.19  | 0.44  | 0.31     | 0.31  | 0.63  | 0.19     | 0.44  | 0.63  | 0.25     | 0.31  | 0.56  |
| 5 foot         | 0.58     | 4.58  | 5.17  | 0.17     | 0.50  | 0.67  | 0.50     | 2.08  | 2.58  | 0.42     | 2.39  | 2.81  |
| 8 foot         | 0.13     | 0.38  | 0.50  | 0.50     | 0.75  | 1.25  | 0.50     | 0.75  | 1.25  | 0.38     | 0.63  | 1.00  |
| 10 foot        | 0.50     | 0.75  | 1.25  | 0.25     | 0.50  | 0.75  | 0.38     | 0.50  | 0.88  | 0.38     | 0.58  | 0.96  |

**Table 3. Alfalfa Plant Count per Foot of Row for the Alfalfa Interseeding Row Spacing Techniques Trial  
At the Dickinson Experiment Station, 27 Jun 1984**

|             | Rep 1    |       |       | Rep 2    |       |       | Rep 3    |       |       | Mean     |       |       |
|-------------|----------|-------|-------|----------|-------|-------|----------|-------|-------|----------|-------|-------|
| Row Spacing | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total |
| Control     | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  |
| 2 foot      | 0.16     | 1.13  | 1.29  | 0.07     | 0.16  | 0.23  | 0.34     | 0.90  | 1.24  | 0.19     | 0.73  | 0.92  |
| 3 foot      | 0.28     | 1.22  | 1.50  | 0.06     | 0.28  | 0.34  | 0.02     | 0.10  | 0.13  | 0.13     | 0.53  | 0.66  |
| 4 foot      | 0.08     | 0.06  | 0.13  | 0.09     | 0.09  | 0.19  | 0.06     | 0.13  | 0.19  | 0.08     | 0.09  | 0.17  |
| 5 foot      | 0.18     | 1.40  | 1.58  | 0.05     | 0.15  | 0.20  | 0.15     | 0.63  | 0.79  | 0.13     | 0.73  | 0.86  |
| 8 foot      | 0.04     | 0.12  | 0.15  | 0.15     | 0.23  | 0.38  | 0.15     | 0.23  | 0.38  | 0.12     | 0.19  | 0.30  |
| 10 foot     | 0.15     | 0.23  | 0.38  | 0.08     | 0.15  | 0.23  | 0.12     | 0.15  | 0.27  | 0.12     | 0.18  | 0.29  |

**Table 4. Points Analysis of the 0 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                     | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii           | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Bouteloua gracilis          | 11.27       | 35.73                | 56.00             | 24.93                      | 60.66            |
| Calamovilfa longifolia      | 1.73        | 5.50                 | 16.00             | 7.12                       | 12.62            |
| Koeleria pyramidata         | 1.13        | 3.59                 | 9.33              | 4.15                       | 7.74             |
| Muhlenbergia cuspidata      | 0.47        | 1.48                 | 4.67              | 2.08                       | 3.56             |
| Panicum oligosanthos        | 0.13        | 0.42                 | 0.67              | 0.30                       | 0.72             |
| Stipa comata                | 3.47        | 10.99                | 26.67             | 11.87                      | 22.86            |
| Carex filifolia             | 3.60        | 11.42                | 29.33             | 13.06                      | 24.48            |
| Carex heliophila            | 3.20        | 10.15                | 22.67             | 10.09                      | 20.24            |
| Achillea millefolium        | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Antennaria parvifolia       | 0.47        | 1.48                 | 2.67              | 1.19                       | 2.67             |
| Artemisia dracunculus       | 0.40        | 1.27                 | 4.00              | 1.78                       | 3.05             |
| Artemisia frigida           | 0.27        | 0.85                 | 2.67              | 1.19                       | 2.04             |
| Aster ericoides             | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Echinacea angustifolia      | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Glycyrrhiza lepidota        | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Grindelia squarrosa         | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Haplopappus spinulosus      | 0.27        | 0.85                 | 2.67              | 1.19                       | 2.04             |
| Hedeoma hispida             | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Liatris punctata            | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Lygodesmia juncea           | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Opuntia fragilis            | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Petalostemon purpureum      | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Phlox hoodii                | 0.53        | 1.69                 | 4.67              | 2.08                       | 3.77             |
| Psoralea argophylla         | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Psoralea esculenta          | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Solidago missouriensis      | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Solidago rigida             | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Taraxacum officinale        | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Rosa arkansana              | 0.33        | 1.06                 | 3.33              | 1.48                       | 2.54             |
| Symphoricarpos occidentalis | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Lichen spp.                 | 2.07        | 6.55                 | 17.33             | 7.72                       | 14.27            |
| Furrow                      | 0.00        |                      | 0.00              |                            |                  |
| Litter                      | 65.33       |                      | 100.00            |                            |                  |
| Rock                        | 0.67        |                      | 4.00              |                            |                  |
| Sod                         | 0.00        |                      | 0.00              |                            |                  |
| Soil                        | 2.47        |                      | 11.33             |                            |                  |

**Table 5. Points Analysis of the 2 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>        | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|-----------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii     | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Bouteloua gracilis    | 11.80              | 51.75                       | 62.67                    | 40.52                             | 92.27                   |
| Koeleria pyramidata   | 1.20               | 5.26                        | 10.00                    | 6.47                              | 11.73                   |
| Stipa comata          | 2.73               | 11.99                       | 24.67                    | 15.95                             | 27.94                   |
| Stipa viridula        | 0.40               | 1.75                        | 3.33                     | 2.16                              | 3.91                    |
| Carex filifolia       | 3.60               | 15.79                       | 25.33                    | 16.38                             | 32.17                   |
| Carex heliophila      | 0.27               | 1.17                        | 2.00                     | 1.29                              | 2.46                    |
| Artemisia dracunculus | 0.87               | 3.80                        | 8.67                     | 5.60                              | 9.40                    |
| Artemisia frigida     | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Aster ericoides       | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Cirsium undulatum     | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Grindelia squarrosa   | 0.27               | 1.17                        | 2.67                     | 1.72                              | 2.89                    |
| Hedeoma hispida       | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Lactuca oblongifolia  | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Liatris punctata      | 0.13               | 0.58                        | 1.33                     | 0.86                              | 1.44                    |
| Lygodesmia juncea     | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Phlox hoodii          | 0.60               | 2.63                        | 5.33                     | 3.45                              | 6.08                    |
| Psoralea argophylla   | 0.13               | 0.58                        | 1.33                     | 0.86                              | 1.44                    |
| Rosa arkansana        | 0.07               | 0.29                        | 0.67                     | 0.43                              | 0.72                    |
| Lichen spp.           | 0.27               | 1.17                        | 2.00                     | 1.29                              | 2.46                    |
| Furrow                | 17.80              |                             | 79.33                    |                                   |                         |
| Litter                | 36.13              |                             | 95.33                    |                                   |                         |
| Rock                  | 0.07               |                             | 0.67                     |                                   |                         |
| Sod                   | 22.00              |                             | 59.33                    |                                   |                         |
| Soil                  | 1.20               |                             | 3.33                     |                                   |                         |

**Table 6. Points Analysis of the 3 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                        | Basal<br>Cover | Basal<br>Cover | Relative<br>Percent<br>Frequency | Percent<br>Frequency | Relative<br>Importance<br>Value |
|--------------------------------|----------------|----------------|----------------------------------|----------------------|---------------------------------|
| Bouteloua gracilis             | 12.47          | 46.98          | 64.67                            | 35.02                | 82.00                           |
| Calamovilfa longifolia         | 0.13           | 0.50           | 1.33                             | 0.72                 | 1.22                            |
| Koeleria pyramidata            | 1.73           | 6.53           | 13.33                            | 7.22                 | 13.75                           |
| Stipa comata                   | 3.33           | 12.56          | 30.00                            | 16.25                | 28.81                           |
| Stipa viridula                 | 0.53           | 2.01           | 4.67                             | 2.53                 | 4.54                            |
| Carex filifolia                | 2.67           | 10.05          | 22.00                            | 11.91                | 21.96                           |
| Carex heliophila               | 1.07           | 4.02           | 8.67                             | 4.69                 | 8.71                            |
| Achillea millefolium           | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Antennaria parvifolia          | 0.20           | 0.75           | 1.33                             | 0.72                 | 1.47                            |
| Artemisia dracunculus          | 0.67           | 2.51           | 5.33                             | 2.89                 | 5.40                            |
| Artemisia frigida              | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Artemisia ludoviciana          | 0.27           | 1.01           | 2.67                             | 1.44                 | 2.45                            |
| Aster ericoides                | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Chrysopsis villosa             | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Glycyrrhiza lepidota           | 0.20           | 0.75           | 2.00                             | 1.08                 | 1.83                            |
| Grindelia squarrosa            | 0.20           | 0.75           | 1.33                             | 0.72                 | 1.47                            |
| Haplopappus spinulosus         | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Hedeoma hispida                | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Liatris punctata               | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Lygodesmia juncea              | 0.13           | 0.50           | 1.33                             | 0.72                 | 1.22                            |
| Phlox hoodii                   | 0.73           | 2.76           | 6.67                             | 3.61                 | 6.37                            |
| Psoralea argophylla            | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Psoralea esculenta             | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Rosa arkansana                 | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Symphoricarpos<br>occidentalis | 0.07           | 0.25           | 0.67                             | 0.36                 | 0.61                            |
| Lichen spp.                    | 1.47           | 5.53           | 12.00                            | 6.50                 | 12.03                           |
| Furrow                         | 13.27          |                | 53.33                            |                      |                                 |
| Litter                         | 45.40          |                | 97.33                            |                      |                                 |
| Rock                           | 0.00           |                | 0.00                             |                      |                                 |
| Sod                            | 14.00          |                | 42.00                            |                      |                                 |
| Soil                           | 0.80           |                | 4.67                             |                      |                                 |

**Table 7. Points Analysis of the 4 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.27               | 0.98                        | 2.00                     | 0.99                              | 1.97                    |
| Bouteloua gracilis     | 7.27               | 26.59                       | 39.33                    | 19.54                             | 46.13                   |
| Calamovilfa longifolia | 1.93               | 7.07                        | 15.33                    | 7.62                              | 14.69                   |
| Koeleria pyramidata    | 0.47               | 1.71                        | 4.00                     | 1.99                              | 3.70                    |
| Muhlenbergia cuspidata | 0.93               | 3.41                        | 6.67                     | 3.31                              | 6.72                    |
| Stipa comata           | 4.73               | 17.32                       | 36.67                    | 18.21                             | 35.53                   |
| Carex filifolia        | 2.80               | 10.24                       | 19.33                    | 9.60                              | 19.84                   |
| Carex heliophila       | 4.00               | 14.63                       | 30.00                    | 14.90                             | 29.53                   |
| Antennaria parvifolia  | 0.27               | 0.98                        | 2.67                     | 1.32                              | 2.30                    |
| Artemisia dracunculus  | 0.67               | 2.44                        | 6.67                     | 3.31                              | 5.75                    |
| Artemisia frigida      | 0.47               | 1.71                        | 4.67                     | 2.32                              | 4.03                    |
| Artemisia ludoviciana  | 0.13               | 0.49                        | 1.33                     | 0.66                              | 1.15                    |
| Aster ericoides        | 0.20               | 0.73                        | 2.00                     | 0.99                              | 1.72                    |
| Chrysopsis villosa     | 0.07               | 0.24                        | 0.67                     | 0.33                              | 0.57                    |
| Echinacea angustifolia | 0.13               | 0.49                        | 1.33                     | 0.66                              | 1.15                    |
| Erysimum asperum       | 0.13               | 0.49                        | 1.33                     | 0.66                              | 1.15                    |
| Glycyrrhiza lepidota   | 0.07               | 0.24                        | 0.67                     | 0.33                              | 0.57                    |
| Grindelia squarrosa    | 0.13               | 0.49                        | 1.33                     | 0.66                              | 1.15                    |
| Liatis punctata        | 0.07               | 0.24                        | 0.67                     | 0.33                              | 0.57                    |
| Lygodesmia juncea      | 0.07               | 0.24                        | 0.67                     | 0.33                              | 0.57                    |
| Oxytropis lambertii    | 0.33               | 1.22                        | 3.33                     | 1.66                              | 2.88                    |
| Petalostemon purpureum | 0.13               | 0.49                        | 1.33                     | 0.66                              | 1.15                    |
| Phlox hoodia           | 0.53               | 1.95                        | 4.67                     | 2.32                              | 4.27                    |
| Solidago rigida        | 0.40               | 1.46                        | 3.33                     | 1.66                              | 3.12                    |
| Rosa arkansana         | 0.13               | 0.49                        | 1.33                     | 0.66                              | 1.15                    |
| Lichen spp.            | 1.00               | 3.66                        | 10.00                    | 4.97                              | 8.63                    |
| Furrow                 | 5.27               |                             | 23.33                    |                                   |                         |
| Litter                 | 54.13              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 12.13              |                             | 33.33                    |                                   |                         |
| Soil                   | 1.13               |                             | 6.00                     |                                   |                         |

**Table 8. Points Analysis of the 5 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                            | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|------------------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| <i>Bouteloua gracilis</i>          | 13.33       | 43.38                | 68.67             | 32.80                      | 76.18            |
| <i>Calamovilfa longifolia</i>      | 0.27        | 0.87                 | 2.00              | 0.96                       | 1.83             |
| <i>Koeleria pyramidata</i>         | 1.73        | 5.64                 | 15.33             | 7.32                       | 12.96            |
| <i>Muhlenbergia cuspidata</i>      | 0.20        | 0.65                 | 2.00              | 0.96                       | 1.61             |
| <i>Panicum oligosanthes</i>        | 0.13        | 0.43                 | 1.33              | 0.64                       | 1.07             |
| <i>Stipa comata</i>                | 3.33        | 10.85                | 28.00             | 13.38                      | 24.23            |
| <i>Stipa viridula</i>              | 0.27        | 0.87                 | 2.67              | 1.27                       | 2.14             |
| <i>Carex filifolia</i>             | 4.47        | 14.53                | 30.67             | 14.65                      | 29.18            |
| <i>Carex heliophila</i>            | 1.40        | 4.56                 | 10.67             | 5.10                       | 9.66             |
| <i>Antennaria parvifolia</i>       | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Artemisia dracunculus</i>       | 0.67        | 2.17                 | 6.67              | 3.18                       | 5.35             |
| <i>Artemisia frigida</i>           | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Aster ericoides</i>             | 0.20        | 0.65                 | 1.33              | 0.64                       | 1.29             |
| <i>Gaura coccinea</i>              | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Glycyrrhiza lepidota</i>        | 0.27        | 0.87                 | 2.67              | 1.27                       | 2.14             |
| <i>Haplopappus spinulosus</i>      | 0.20        | 0.65                 | 2.00              | 0.96                       | 1.61             |
| <i>Hedeoma hispida</i>             | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Lactuca oblongifolia</i>        | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Lygodesmia juncea</i>           | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Oxytropis lambertii</i>         | 0.13        | 0.43                 | 1.33              | 0.64                       | 1.07             |
| <i>Petalostemon purpureum</i>      | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Phlox hoodii</i>                | 1.40        | 4.56                 | 10.67             | 5.10                       | 9.66             |
| <i>Potentilla pensylvanica</i>     | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Psoralea argophylla</i>         | 0.13        | 0.43                 | 1.33              | 0.64                       | 1.07             |
| <i>Sphaeralcea coccinea</i>        | 0.13        | 0.43                 | 1.33              | 0.64                       | 1.07             |
| <i>Rosa arkansana</i>              | 0.33        | 1.08                 | 3.33              | 1.59                       | 2.67             |
| <i>Symphoricarpos occidentalis</i> | 0.07        | 0.22                 | 0.67              | 0.32                       | 0.54             |
| <i>Selaginella densa</i>           | 0.27        | 0.87                 | 0.67              | 0.32                       | 1.19             |
| Lichen spp.                        | 1.27        | 4.12                 | 10.67             | 5.10                       | 9.22             |
| Furrow                             | 8.47        |                      | 30.00             |                            |                  |
| Litter                             | 49.40       |                      | 98.00             |                            |                  |
| Rock                               | 0.00        |                      | 0.00              |                            |                  |
| Sod                                | 11.13       |                      | 27.33             |                            |                  |
| Soil                               | 0.27        |                      | 1.33              |                            |                  |

**Table 9. Points Analysis of the 8 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Bouteloua gracilis     | 9.60               | 30.97                       | 58.00                    | 25.97                             | 56.94                   |
| Calamovilfa longifolia | 0.87               | 2.80                        | 6.00                     | 2.69                              | 5.49                    |
| Koeleria pyramidata    | 1.40               | 4.52                        | 14.00                    | 6.27                              | 10.79                   |
| Muhlenbergia cuspidata | 0.20               | 0.65                        | 2.00                     | 0.90                              | 1.55                    |
| Stipa comata           | 5.27               | 16.99                       | 37.33                    | 16.72                             | 33.71                   |
| Stipa viridula         | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Carex filifolia        | 5.07               | 16.34                       | 33.33                    | 14.93                             | 31.27                   |
| Carex heliophila       | 2.67               | 8.60                        | 20.00                    | 8.96                              | 17.56                   |
| Antennaria parvifolia  | 0.47               | 1.51                        | 4.00                     | 1.79                              | 3.30                    |
| Artemisia dracunculus  | 0.73               | 2.37                        | 7.33                     | 3.28                              | 5.65                    |
| Artemisia frigida      | 0.27               | 0.86                        | 2.67                     | 1.19                              | 2.05                    |
| Artemisia ludoviciana  | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Aster ericoides        | 0.40               | 1.29                        | 4.00                     | 1.79                              | 3.08                    |
| Erysimum asperum       | 0.13               | 0.43                        | 1.33                     | 0.60                              | 1.03                    |
| Grindelia squarrosa    | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Hedeoma hispida        | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Liatris punctata       | 0.33               | 1.08                        | 3.33                     | 1.49                              | 2.57                    |
| Oxytropis lambertii    | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Phlox hoodii           | 0.13               | 0.43                        | 1.33                     | 0.60                              | 1.03                    |
| Plantago purshii       | 0.13               | 0.43                        | 1.33                     | 0.60                              | 1.03                    |
| Psoralea argophylla    | 0.13               | 0.43                        | 1.33                     | 0.60                              | 1.03                    |
| Solidago rigida        | 0.67               | 2.15                        | 6.00                     | 2.69                              | 4.84                    |
| Sphaeralcea coccinea   | 0.07               | 0.22                        | 0.67                     | 0.30                              | 0.52                    |
| Rosa arkansana         | 0.33               | 1.08                        | 3.33                     | 1.49                              | 2.57                    |
| Selaginella densa      | 0.20               | 0.65                        | 0.67                     | 0.30                              | 0.95                    |
| Lichen spp.            | 1.53               | 4.95                        | 11.33                    | 5.07                              | 10.02                   |
| Furrow                 | 6.40               |                             | 28.00                    |                                   |                         |
| Litter                 | 56.60              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 5.60               |                             | 18.67                    |                                   |                         |
| Soil                   | 0.40               |                             | 3.33                     |                                   |                         |

**Table 10. Points Analysis of the 10 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                     | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii           | 0.53        | 1.79                 | 5.33              | 2.66                       | 4.45             |
| Andropogon scoparius        | 0.13        | 0.45                 | 0.67              | 0.33                       | 0.78             |
| Bouteloua gracilis          | 12.67       | 42.41                | 62.67             | 31.23                      | 73.64            |
| Calamovilfa longifolia      | 0.27        | 0.89                 | 2.00              | 1.00                       | 1.89             |
| Koeleria pyramidata         | 1.47        | 4.91                 | 13.33             | 6.64                       | 11.55            |
| Muhlenbergia cuspidata      | 0.73        | 2.46                 | 5.33              | 2.66                       | 5.12             |
| Munroa squarrosa            | 0.27        | 0.89                 | 2.00              | 1.00                       | 1.89             |
| Stipa comata                | 2.20        | 7.37                 | 18.00             | 8.97                       | 16.34            |
| Stipa viridula              | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Carex filifolia             | 5.53        | 18.53                | 38.00             | 18.94                      | 37.47            |
| Carex heliophila            | 0.87        | 2.90                 | 5.33              | 2.66                       | 5.56             |
| Artemisia dracunculus       | 0.20        | 0.67                 | 2.00              | 1.00                       | 1.67             |
| Artemisia frigida           | 0.47        | 1.56                 | 4.67              | 2.33                       | 3.89             |
| Artemisia ludoviciana       | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Aster ericoides             | 0.40        | 1.34                 | 3.33              | 1.66                       | 3.00             |
| Astragalus triphyllus       | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Echinacea angustifolia      | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Grindelia squarrosa         | 0.40        | 1.34                 | 3.33              | 1.66                       | 3.00             |
| Gutierrezia sarothrae       | 0.20        | 0.67                 | 2.00              | 1.00                       | 1.67             |
| Haplopappus spinulosus      | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Liatris punctata            | 0.27        | 0.89                 | 2.00              | 1.00                       | 1.89             |
| Lygodesmia juncea           | 0.13        | 0.45                 | 1.33              | 0.66                       | 1.11             |
| Opuntia fragilis            | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Phlox hoodii                | 0.60        | 2.01                 | 6.00              | 2.99                       | 5.00             |
| Psoralea argophylla         | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Solidago rigida             | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Rosa arkansana              | 0.13        | 0.45                 | 1.33              | 0.66                       | 1.11             |
| Symphoricarpos occidentalis | 0.20        | 0.67                 | 1.33              | 0.66                       | 1.33             |
| Selaginella densa           | 0.07        | 0.22                 | 0.67              | 0.33                       | 0.55             |
| Lichen spp.                 | 1.60        | 5.36                 | 14.67             | 7.31                       | 12.67            |
| Furrow                      | 5.80        |                      | 24.36             |                            |                  |
| Litter                      | 55.27       |                      | 97.33             |                            |                  |
| Rock                        | 0.00        |                      | 0.00              |                            |                  |
| Sod                         | 7.87        |                      | 21.33             |                            |                  |
| Soil                        | 1.20        |                      | 6.00              |                            |                  |

**Table 11. Mean Percentage of Basal Cover for the Alfalfa Interseeding Row Spacing Trial at the Dickinson Experiment Station, 1984**

| <b>Row Spacing</b> | <b>Grass</b> | <b>Sedge</b> | <b>Forbs</b> | <b>Shrubs</b> | <b>Club Moss</b> | <b>Lichen</b> | <b>Furrow</b> | <b>Litter</b> | <b>Rock</b> | <b>Sod</b> | <b>Soil</b> |
|--------------------|--------------|--------------|--------------|---------------|------------------|---------------|---------------|---------------|-------------|------------|-------------|
| 0 foot             | 18.40        | 6.80         | 3.88         | 0.40          | 0.00             | 2.07          | 0.00          | 65.33         | 0.67        | 0.00       | 2.47        |
| 2 foot             | 16.20        | 3.87         | 2.42         | 0.07          | 0.00             | 0.27          | 17.80         | 36.13         | 0.07        | 22.00      | 1.20        |
| 3 foot             | 18.19        | 3.74         | 3.03         | 0.14          | 0.00             | 1.47          | 13.27         | 45.40         | 0.00        | 14.00      | 0.80        |
| 4 foot             | 15.60        | 6.80         | 3.80         | 0.13          | 0.00             | 1.00          | 5.27          | 54.13         | 0.00        | 12.13      | 1.13        |
| 5 foot             | 19.26        | 5.87         | 3.69         | 0.40          | 0.27             | 1.27          | 8.47          | 49.40         | 0.00        | 11.13      | 0.27        |
| 8 foot             | 17.48        | 7.74         | 3.74         | 0.33          | 0.20             | 1.53          | 6.40          | 56.60         | 0.00        | 5.60       | 0.40        |
| 10 foot            | 18.34        | 6.40         | 3.16         | 0.33          | 0.07             | 1.60          | 5.80          | 55.27         | 0.00        | 7.87       | 1.20        |

**Table 12. Density Analysis per 0.1 Sq. Meter of the 0 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                                | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|----------------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Achillea millefolium</i>            | 0.15    | 3.34                           | 5.33                 | 2.61                             | 5.95                |
| <i>Antennaria parvifolia</i>           | 0.01    | 0.30                           | 1.33                 | 0.65                             | 0.95                |
| <i>Artemisia dracunculus</i>           | 0.24    | 5.47                           | 17.33                | 8.50                             | 13.97               |
| <i>Artemisia frigida</i>               | 0.05    | 1.22                           | 4.00                 | 1.96                             | 3.18                |
| <i>Artemisia ludoviciana</i>           | 0.13    | 3.04                           | 4.00                 | 1.96                             | 5.00                |
| <i>Aster ericoides</i>                 | 1.28    | 29.18                          | 28.00                | 13.73                            | 42.91               |
| <i>Chrysopsis villosa</i>              | 0.04    | 0.91                           | 4.00                 | 1.96                             | 2.87                |
| <i>Echinacea angustifolia</i>          | 0.17    | 3.95                           | 10.67                | 5.23                             | 9.18                |
| <i>Erysimum asperum</i>                | 0.13    | 3.04                           | 10.67                | 5.23                             | 8.27                |
| <i>Gaura coccinea</i>                  | 0.17    | 3.95                           | 9.33                 | 4.58                             | 8.53                |
| <i>Glycyrrhiza lepidota</i>            | 0.01    | 0.30                           | 1.33                 | 0.65                             | 0.95                |
| <i>Grindelia squarrosa</i>             | 0.56    | 12.77                          | 17.33                | 8.50                             | 21.27               |
| <i>Gutierrezia sarothrae</i>           | 0.03    | 0.61                           | 2.67                 | 1.31                             | 1.92                |
| <i>Haplopappus spinulosus</i>          | 0.04    | 0.91                           | 4.00                 | 1.96                             | 2.87                |
| <i>Hedeoma hispida</i>                 | 0.08    | 1.82                           | 2.67                 | 1.31                             | 3.13                |
| <i>Helianthus rigidus</i>              | 0.29    | 6.69                           | 13.33                | 6.54                             | 13.23               |
| <i>Liatris punctata</i>                | 0.19    | 4.26                           | 10.67                | 5.23                             | 9.49                |
| <i>Linum rigidum</i>                   | 0.03    | 0.61                           | 2.67                 | 1.31                             | 1.92                |
| <i>Lygodesmia juncea</i>               | 0.01    | 0.30                           | 1.33                 | 0.65                             | 0.95                |
| <i>Oxytropis lambertii</i>             | 0.04    | 0.91                           | 4.00                 | 1.96                             | 2.87                |
| <i>Petalostemon purpureum</i>          | 0.27    | 6.08                           | 14.67                | 7.19                             | 13.27               |
| <i>Phlox hoodii</i>                    | 0.09    | 2.13                           | 4.00                 | 1.96                             | 4.09                |
| <i>Psoralea argophylla</i>             | 0.04    | 0.91                           | 4.00                 | 1.96                             | 2.87                |
| <i>Psoralea esculenta</i>              | 0.05    | 1.22                           | 5.33                 | 2.61                             | 3.83                |
| <i>Solidago missouriensis</i>          | 0.01    | 0.30                           | 1.33                 | 0.65                             | 0.95                |
| <i>Solidago rigida</i>                 | 0.03    | 0.61                           | 1.33                 | 0.65                             | 1.26                |
| <i>Sphaeralcea coccinea</i>            | 0.03    | 0.61                           | 2.67                 | 1.31                             | 1.92                |
| <i>Rosa arkansana</i>                  | 0.19    | 4.26                           | 14.67                | 7.19                             | 11.45               |
| <i>Symphoricarpos<br/>occidentalis</i> | 0.01    | 0.30                           | 1.33                 | 0.65                             | 0.95                |

**Table 13. Density Analysis per 0.1 Sq. Meter of the 2 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                 | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| Antennaria parvifolia   | 0.03    | 0.82                           | 1.33                 | 0.70                             | 1.52                |
| Artemisia dracunculus   | 0.47    | 14.40                          | 28.00                | 14.69                            | 29.09               |
| Artemisia frigida       | 0.08    | 2.47                           | 6.67                 | 3.50                             | 5.97                |
| Artemisia ludoviciana   | 0.11    | 3.29                           | 1.33                 | 0.70                             | 3.99                |
| Aster ericoides         | 0.63    | 19.34                          | 16.00                | 8.39                             | 27.73               |
| Chrysopsis villosa      | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Echinacea angustifolia  | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Erysimum asperum        | 0.11    | 3.29                           | 9.33                 | 4.90                             | 8.19                |
| Euphorbia geyeri        | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Gaura coccinea          | 0.07    | 2.06                           | 5.33                 | 2.80                             | 4.86                |
| Grindelia squarrosa     | 0.19    | 5.76                           | 13.33                | 6.99                             | 12.75               |
| Gutierrezia sarothrae   | 0.07    | 2.06                           | 2.67                 | 1.40                             | 3.46                |
| Haplopappus spinulosus  | 0.11    | 3.29                           | 9.33                 | 4.90                             | 8.19                |
| Hedeoma hispida         | 0.08    | 2.47                           | 8.00                 | 4.20                             | 6.67                |
| Lepidium densiflorum    | 0.04    | 1.23                           | 4.00                 | 2.10                             | 3.33                |
| Liatris punctata        | 0.33    | 10.29                          | 17.33                | 9.09                             | 19.38               |
| Linum rigidum           | 0.05    | 1.65                           | 4.00                 | 2.10                             | 3.75                |
| Lotus americanus        | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Lygodesmia juncea       | 0.11    | 3.29                           | 8.00                 | 4.20                             | 7.49                |
| Opuntia fragilis        | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Oxytropis lambertii     | 0.03    | 0.82                           | 2.67                 | 1.40                             | 2.22                |
| Petalostemon purpureum  | 0.03    | 0.82                           | 1.33                 | 0.70                             | 1.52                |
| Phlox hoodii            | 0.23    | 7.00                           | 12.00                | 6.29                             | 13.29               |
| Plantago purshii        | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Potentilla pensylvanica | 0.01    | 0.41                           | 1.33                 | 0.70                             | 1.11                |
| Psoralea argophylla     | 0.05    | 1.65                           | 5.33                 | 2.80                             | 4.45                |
| Psoralea esculenta      | 0.08    | 2.47                           | 8.00                 | 4.20                             | 6.67                |
| Ratibida columnifera    | 0.04    | 1.23                           | 4.00                 | 2.10                             | 3.33                |
| Solidago missouriensis  | 0.03    | 0.82                           | 1.33                 | 0.70                             | 1.52                |
| Sphaeralcea coccinea    | 0.15    | 4.53                           | 9.33                 | 4.90                             | 9.43                |
| Rosa arkansana          | 0.07    | 2.06                           | 2.67                 | 1.40                             | 3.46                |

**Table 14. Density Analysis per 0.1 Sq. Meter of the 3 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                            | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|------------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Achillea millefolium</i>        | 0.01    | 0.37                           | 1.33                 | 0.60                             | 0.97                |
| <i>Artemisia dracunculus</i>       | 0.41    | 11.52                          | 32.00                | 14.46                            | 25.98               |
| <i>Artemisia frigida</i>           | 0.09    | 2.60                           | 9.33                 | 4.22                             | 6.82                |
| <i>Artemisia ludoviciana</i>       | 0.41    | 11.52                          | 14.67                | 6.63                             | 18.15               |
| <i>Aster ericoides</i>             | 0.92    | 25.65                          | 26.67                | 12.05                            | 37.70               |
| <i>Chrysopsis villosa</i>          | 0.01    | 0.37                           | 1.33                 | 0.60                             | 0.97                |
| <i>Echinacea angustifolia</i>      | 0.07    | 1.86                           | 6.67                 | 3.01                             | 4.87                |
| <i>Erysimum asperum</i>            | 0.03    | 0.74                           | 2.67                 | 1.20                             | 1.94                |
| <i>Gaura coccinea</i>              | 0.08    | 2.23                           | 2.67                 | 1.20                             | 3.43                |
| <i>Glycyrrhiza lepidota</i>        | 0.11    | 2.97                           | 9.33                 | 4.22                             | 7.19                |
| <i>Grindelia squarrosa</i>         | 0.25    | 7.06                           | 17.33                | 7.83                             | 14.89               |
| <i>Gutierrezia sarothrae</i>       | 0.01    | 0.37                           | 1.33                 | 0.60                             | 0.97                |
| <i>Haplopappus spinulosus</i>      | 0.07    | 1.86                           | 5.33                 | 2.41                             | 4.27                |
| <i>Hedeoma hispida</i>             | 0.03    | 0.74                           | 2.67                 | 1.20                             | 1.94                |
| <i>Lepidium densiflorum</i>        | 0.04    | 1.12                           | 4.00                 | 1.81                             | 2.93                |
| <i>Liatris punctata</i>            | 0.24    | 6.69                           | 16.00                | 7.23                             | 13.92               |
| <i>Linum rigidum</i>               | 0.05    | 1.49                           | 5.33                 | 2.41                             | 3.90                |
| <i>Lotus americanus</i>            | 0.01    | 0.37                           | 1.33                 | 0.60                             | 0.97                |
| <i>Lygodesmia juncea</i>           | 0.08    | 2.23                           | 6.67                 | 3.01                             | 5.24                |
| <i>Medicago falcata</i>            | 0.03    | 0.74                           | 2.67                 | 1.20                             | 1.94                |
| <i>Petalostemon purpureum</i>      | 0.12    | 3.35                           | 10.67                | 4.82                             | 8.17                |
| <i>Phlox hoodii</i>                | 0.17    | 4.83                           | 12.00                | 5.42                             | 10.25               |
| <i>Plantago purshii</i>            | 0.03    | 0.74                           | 2.67                 | 1.20                             | 1.94                |
| <i>Potentilla pensylvanica</i>     | 0.03    | 0.74                           | 2.67                 | 1.20                             | 1.94                |
| <i>Psoralea argophylla</i>         | 0.03    | 0.74                           | 2.67                 | 1.20                             | 1.94                |
| <i>Psoralea esculenta</i>          | 0.13    | 3.72                           | 10.67                | 4.82                             | 8.54                |
| <i>Sphaeralcea coccinea</i>        | 0.04    | 1.12                           | 4.00                 | 1.81                             | 2.93                |
| <i>Rosa arkansana</i>              | 0.03    | 0.74                           | 1.33                 | 0.60                             | 1.34                |
| <i>Symphoricarpos occidentalis</i> | 0.05    | 1.49                           | 5.33                 | 2.41                             | 3.90                |

**Table 15. Density Analysis per 0.1 Sq. Meter of the 4 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                        | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|--------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| Achillea millefolium           | 0.01    | 0.33                           | 1.33                 | 0.53                             | 0.86                |
| Antennaria parvifolia          | 0.13    | 3.27                           | 5.33                 | 2.14                             | 5.41                |
| Artemisia dracunculus          | 0.11    | 2.61                           | 9.33                 | 3.74                             | 6.35                |
| Artemisia frigida              | 0.27    | 6.54                           | 18.67                | 7.49                             | 14.03               |
| Artemisia ludoviciana          | 0.31    | 7.52                           | 12.00                | 4.81                             | 12.33               |
| Aster ericoides                | 0.47    | 11.44                          | 14.67                | 5.88                             | 17.32               |
| Aster laevis                   | 0.01    | 0.33                           | 1.33                 | 0.53                             | 0.86                |
| Chrysopsis villosa             | 0.08    | 1.96                           | 2.67                 | 1.07                             | 3.03                |
| Echinacea angustifolia         | 0.44    | 10.78                          | 28.00                | 11.23                            | 22.01               |
| Erysimum asperum               | 0.03    | 0.65                           | 2.67                 | 1.07                             | 1.72                |
| Euphorbia geyeri               | 0.07    | 1.63                           | 1.33                 | 0.53                             | 2.16                |
| Gaura coccinea                 | 0.13    | 3.27                           | 9.33                 | 3.74                             | 7.01                |
| Glycyrrhiza lepidota           | 0.09    | 2.29                           | 5.33                 | 2.14                             | 4.43                |
| Grindelia squarrosa            | 0.19    | 4.58                           | 9.33                 | 3.74                             | 8.32                |
| Gutierrezia sarothrae          | 0.03    | 0.65                           | 2.67                 | 1.07                             | 1.72                |
| Hedeoma hispida                | 0.09    | 2.29                           | 5.33                 | 2.14                             | 4.43                |
| Liatis punctata                | 0.16    | 3.92                           | 12.00                | 4.81                             | 8.73                |
| Linum rigidum                  | 0.05    | 1.31                           | 5.33                 | 2.14                             | 3.45                |
| Lotus americanus               | 0.03    | 0.65                           | 2.67                 | 1.07                             | 1.72                |
| Lygodesmia juncea              | 0.05    | 1.31                           | 5.33                 | 2.14                             | 3.45                |
| Oxytropis lambertii            | 0.09    | 2.29                           | 6.67                 | 2.67                             | 4.96                |
| Petalostemon purpureum         | 0.47    | 11.44                          | 30.67                | 12.30                            | 23.74               |
| Phlox hoodii                   | 0.15    | 3.59                           | 12.00                | 4.81                             | 8.40                |
| Plantago purshii               | 0.01    | 0.33                           | 1.33                 | 0.53                             | 0.86                |
| Potentilla pensylvanica        | 0.01    | 0.33                           | 1.33                 | 0.53                             | 0.86                |
| Psoralea argophylla            | 0.04    | 0.98                           | 4.00                 | 1.60                             | 2.58                |
| Psoralea esculenta             | 0.03    | 0.65                           | 2.67                 | 1.07                             | 1.72                |
| Solidago missouriensis         | 0.03    | 0.65                           | 2.67                 | 1.07                             | 1.72                |
| Solidago rigida                | 0.19    | 4.58                           | 8.00                 | 3.21                             | 7.79                |
| Sphaeralcea coccinea           | 0.03    | 0.65                           | 1.33                 | 0.53                             | 1.18                |
| Taraxacum officinale           | 0.03    | 0.65                           | 1.33                 | 0.53                             | 1.18                |
| Rosa arkansana                 | 0.25    | 6.21                           | 21.33                | 8.56                             | 14.77               |
| Symphoricarpos<br>occidentalis | 0.01    | 0.33                           | 1.33                 | 0.53                             | 0.86                |

**Table 16. Density Analysis per 0.1 Sq. Meter of the 5 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>                 | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|--------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium           | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Antennaria parvifolia          | 0.08           | 2.56                                    | 2.67                         | 1.32                                      | 3.88                        |
| Artemisia dracunculus          | 0.19           | 5.98                                    | 17.33                        | 8.61                                      | 14.59                       |
| Artemisia frigida              | 0.05           | 1.71                                    | 5.33                         | 2.65                                      | 4.36                        |
| Artemisia ludoviciana          | 0.03           | 0.85                                    | 2.67                         | 1.32                                      | 2.17                        |
| Aster ericoides                | 0.44           | 14.10                                   | 14.67                        | 7.28                                      | 21.38                       |
| Chrysopsis villosa             | 0.05           | 1.71                                    | 4.00                         | 1.99                                      | 3.70                        |
| Cirsium undulatum              | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Echinacea angustifolia         | 0.21           | 6.84                                    | 17.33                        | 8.61                                      | 15.45                       |
| Erysimum asperum               | 0.12           | 3.85                                    | 9.33                         | 4.64                                      | 8.49                        |
| Euphorbia geyeri               | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Gaura coccinea                 | 0.05           | 1.71                                    | 4.00                         | 1.99                                      | 3.70                        |
| Glycyrrhiza lepidota           | 0.09           | 2.99                                    | 8.00                         | 3.97                                      | 6.96                        |
| Grindelia squarrosa            | 0.32           | 10.26                                   | 16.00                        | 7.95                                      | 18.21                       |
| Haplopappus spinulosus         | 0.08           | 2.56                                    | 8.00                         | 3.97                                      | 6.53                        |
| Hedeoma hispida                | 0.08           | 2.56                                    | 6.67                         | 3.31                                      | 5.87                        |
| Lepidium densiflorum           | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Liatris punctata               | 0.20           | 6.41                                    | 10.67                        | 5.30                                      | 11.71                       |
| Linum rigidum                  | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Lygodesmia juncea              | 0.09           | 2.99                                    | 9.33                         | 4.64                                      | 7.63                        |
| Medicago falcata               | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Opuntia fragilis               | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Oxytropis lambertii            | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Petalostemon purpureum         | 0.23           | 7.26                                    | 10.67                        | 5.30                                      | 12.56                       |
| Phlox hoodii                   | 0.29           | 9.40                                    | 16.00                        | 7.95                                      | 17.35                       |
| Plantago purshii               | 0.04           | 1.28                                    | 2.67                         | 1.32                                      | 2.60                        |
| Psoralea argophylla            | 0.05           | 1.71                                    | 5.33                         | 2.65                                      | 4.36                        |
| Psoralea esculenta             | 0.03           | 0.85                                    | 2.67                         | 1.32                                      | 2.17                        |
| Sphaeralcea coccinea           | 0.15           | 4.70                                    | 8.00                         | 3.97                                      | 8.67                        |
| Vicia americana                | 0.01           | 0.43                                    | 1.33                         | 0.66                                      | 1.09                        |
| Rosa arkansana                 | 0.09           | 2.99                                    | 6.67                         | 3.31                                      | 6.30                        |
| Symphoricarpos<br>occidentalis | 0.03           | 0.85                                    | 1.33                         | 0.66                                      | 1.51                        |

**Table 17. Density Analysis per 0.1 Sq. Meter of the 8 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium   | 0.04           | 1.35                                    | 2.67                         | 1.30                                      | 2.65                        |
| Antennaria parvifolia  | 0.09           | 3.14                                    | 4.00                         | 1.95                                      | 5.09                        |
| Arabis holboellii      | 0.03           | 0.90                                    | 2.67                         | 1.30                                      | 2.20                        |
| Artemisia dracunculus  | 0.24           | 8.07                                    | 20.00                        | 9.74                                      | 17.81                       |
| Artemisia frigida      | 0.12           | 4.04                                    | 12.00                        | 5.84                                      | 9.88                        |
| Artemisia ludoviciana  | 0.04           | 1.35                                    | 1.33                         | 0.65                                      | 2.00                        |
| Aster ericoides        | 0.24           | 8.07                                    | 12.00                        | 5.84                                      | 13.91                       |
| Aster laevis           | 0.15           | 4.93                                    | 4.00                         | 1.95                                      | 6.88                        |
| Cirsium undulatum      | 0.01           | 0.45                                    | 1.33                         | 0.65                                      | 1.10                        |
| Echinacea angustifolia | 0.11           | 3.59                                    | 5.33                         | 2.60                                      | 6.19                        |
| Erysimum asperum       | 0.12           | 4.04                                    | 10.67                        | 5.19                                      | 9.23                        |
| Gaura coccinea         | 0.09           | 3.14                                    | 8.00                         | 3.90                                      | 7.04                        |
| Grindelia squarrosa    | 0.12           | 4.04                                    | 10.67                        | 5.19                                      | 9.23                        |
| Haplopappus spinulosus | 0.11           | 3.59                                    | 8.00                         | 3.90                                      | 7.49                        |
| Hedeoma hispida        | 0.08           | 2.69                                    | 5.33                         | 2.60                                      | 5.29                        |
| Helianthus rigidus     | 0.20           | 6.73                                    | 10.67                        | 5.19                                      | 11.92                       |
| Liatis punctata        | 0.17           | 5.83                                    | 16.00                        | 7.79                                      | 13.62                       |
| Linum rigidum          | 0.03           | 0.90                                    | 2.67                         | 1.30                                      | 2.20                        |
| Lotus americanus       | 0.13           | 4.48                                    | 10.67                        | 5.19                                      | 9.67                        |
| Lygodesmia juncea      | 0.01           | 0.45                                    | 1.33                         | 0.65                                      | 1.10                        |
| Oxytropis lambertii    | 0.01           | 0.45                                    | 1.33                         | 0.65                                      | 1.10                        |
| Petalostemon purpureum | 0.17           | 5.83                                    | 10.67                        | 5.19                                      | 11.02                       |
| Phlox hoodii           | 0.05           | 1.79                                    | 2.67                         | 1.30                                      | 3.09                        |
| Plantago purshii       | 0.09           | 3.14                                    | 6.67                         | 3.25                                      | 6.39                        |
| Psoralea esculenta     | 0.04           | 1.35                                    | 4.00                         | 1.95                                      | 3.30                        |
| Solidago missouriensis | 0.07           | 2.24                                    | 4.00                         | 1.95                                      | 4.19                        |
| Solidago rigida        | 0.07           | 2.24                                    | 5.33                         | 2.60                                      | 4.84                        |
| Sphaeralcea coccinea   | 0.13           | 4.48                                    | 8.00                         | 3.90                                      | 8.38                        |
| Rosa arkansana         | 0.20           | 6.73                                    | 13.33                        | 6.49                                      | 13.22                       |

**Table 18. Density Analysis per 0.1 Sq. Meter of the 10 Foot Row Spacing Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                            | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|------------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Artemisia dracunculus</i>       | 0.29    | 8.37                           | 25.33                | 12.75                            | 21.12               |
| <i>Artemisia frigida</i>           | 0.13    | 3.80                           | 13.33                | 6.71                             | 10.51               |
| <i>Artemisia ludoviciana</i>       | 0.09    | 2.66                           | 5.33                 | 2.68                             | 5.34                |
| <i>Aster ericoides</i>             | 1.11    | 31.56                          | 25.33                | 12.75                            | 44.31               |
| <i>Astragalus triphyllus</i>       | 0.07    | 1.90                           | 4.00                 | 2.01                             | 3.91                |
| <i>Chrysopsis villosa</i>          | 0.01    | 0.38                           | 1.33                 | 0.67                             | 1.05                |
| <i>Echinacea angustifolia</i>      | 0.11    | 3.04                           | 5.33                 | 2.68                             | 5.72                |
| <i>Gaura coccinea</i>              | 0.13    | 3.80                           | 8.00                 | 4.03                             | 7.83                |
| <i>Grindelia squarrosa</i>         | 0.31    | 8.75                           | 17.33                | 8.72                             | 17.47               |
| <i>Gutierrezia sarothrae</i>       | 0.11    | 3.04                           | 10.67                | 5.37                             | 8.41                |
| <i>Haplopappus spinulosus</i>      | 0.11    | 3.04                           | 8.00                 | 4.03                             | 7.07                |
| <i>Hedeoma hispida</i>             | 0.08    | 2.28                           | 6.67                 | 3.36                             | 5.64                |
| <i>Lactuca oblongifolia</i>        | 0.01    | 0.38                           | 1.33                 | 0.67                             | 1.05                |
| <i>Lepidium densiflorum</i>        | 0.01    | 0.38                           | 1.33                 | 0.67                             | 1.05                |
| <i>Liatris punctata</i>            | 0.16    | 4.56                           | 10.67                | 5.37                             | 9.93                |
| <i>Linum rigidum</i>               | 0.03    | 0.76                           | 2.67                 | 1.34                             | 2.10                |
| <i>Lygodesmia juncea</i>           | 0.01    | 0.38                           | 1.33                 | 0.67                             | 1.05                |
| <i>Opuntia fragilis</i>            | 0.09    | 2.66                           | 5.33                 | 2.68                             | 5.34                |
| <i>Oxytropis lambertii</i>         | 0.05    | 1.52                           | 5.33                 | 2.68                             | 4.20                |
| <i>Petalostemon purpureum</i>      | 0.04    | 1.14                           | 4.00                 | 2.01                             | 3.15                |
| <i>Phlox hoodii</i>                | 0.15    | 4.18                           | 9.33                 | 4.70                             | 8.88                |
| <i>Psoralea argophylla</i>         | 0.04    | 1.14                           | 4.00                 | 2.01                             | 3.15                |
| <i>Psoralea esculenta</i>          | 0.07    | 1.90                           | 6.67                 | 3.36                             | 5.26                |
| <i>Solidago missouriensis</i>      | 0.04    | 1.14                           | 1.33                 | 0.67                             | 1.81                |
| <i>Sphaeralcea coccinea</i>        | 0.09    | 2.66                           | 6.67                 | 3.36                             | 6.02                |
| <i>Rosa arkansana</i>              | 0.08    | 2.28                           | 4.00                 | 2.01                             | 4.29                |
| <i>Symphoricarpos occidentalis</i> | 0.08    | 2.28                           | 4.00                 | 2.01                             | 4.29                |

**Table 19. Mean Density per 0.1 Sq. Meter for the Alfalfa Interseeding Row Spacing Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Row Spacing</b> | <b>Forbs</b> | <b>Shrubs</b> |
|--------------------|--------------|---------------|
| 0 foot             | 4.17         | 0.20          |
| 2 foot             | 3.19         | 0.07          |
| 3 foot             | 3.50         | 0.08          |
| 4 foot             | 3.83         | 0.26          |
| 5 foot             | 2.96         | 0.12          |
| 8 foot             | 2.76         | 0.20          |
| 10 foot            | 3.34         | 0.16          |

## ALFALFA INTERSEEDING FURROW WIDTH TECHNIQUES TRIAL

This trial was designed to evaluate alfalfa interseeding into rangeland with different widths of the furrow openings. The intended purpose of the data will be primarily to assist in the determination of a recommended furrow width for alfalfa interseeding into rangeland for pasture use in western North Dakota.

These plots were established on 0.60 acres located on the NE $\frac{1}{4}$ , NW $\frac{1}{4}$ , SW $\frac{1}{4}$  Sec. 23, T. 143 N., R. 96 W. at the ranch headquarters of the Dickinson Experiment Station. The 33 x 50 foot plots were arranged in a randomized block design with three replications. The soil was vebar fine sandy loam. The range site was sandy with a few thin claypan sites. Travois alfalfa was seeded at a rate of 0.50 lbs PLS/row/acre on 21 April 1983. A three foot row spacing was used. Two inch straight, three inch twisted and four inch twisted chisel plow shovels were used as the furrow openers. A control plot of no interseeding was included in each replication.

The data that were collected from these plots were: above ground herbage production separated into nine categories, alfalfa seedling counts per meter of row, species composition by point frame and forb densities by use of one tenth meter square quadrats.

The above ground herbage production was sampled by clipping the vegetation to ground level in two  $\frac{1}{4}$  m<sup>2</sup> quadrats for each plot on 22 June 1984. The herbage was separated into nine categories, cool short, warm short, cool mid, western wheatgrass, warm mid, warm tall, sedge, forbs and shrubs. The samples were oven dried at 80°C. The average herbage production for each category and the total production for each plot were determined. The reported figures are means of the three replications for each treatment.

The alfalfa seedling counts were made by counting the number of seedlings along two randomly placed meter sticks for each row of each plot. The mean number of seedlings per meter of row was determined for each treatment. Seedling counts were conducted on 27 June 1984.

Quantitative species composition data for each plot was collected on 10 August 1984. The herbacious plants were sampled by the ten pin point frame method (Levy and Madden 1933, Tinney, Aamodt, and Ahlgren 1937, Heady and Rader 1958, and Smith 1959). Fifteen hundred points were read for each treatment (500 points per plot). A systematic sampling scheme was used for each plot. A permanent major transect was established three feet inside and parallel to the east boundary of each plot. Five minor transects were established perpendicular to the major transect at nine foot intervals starting nine feet from the south boundary of the plot. One hundred points were read on each minor transect equally spaced across the plot.

Forb and shrub densities were sampled by the use of one tenth meter square quadrats on 28 August 1984. The forbs and shrubs that were rooted within the frame were counted by species in each of the 25 quadrats per plot. Five 0.1 m<sup>2</sup> quadrats were spaced at 6 foot intervals along each of the five minor transects.

### Alfalfa Interseeding Furrow Width Techniques Trial

|                             |                                                                                                                                           |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Location:</b>            | Dickinson Experiment Station<br>Ranch Headquarters<br>NE $\frac{1}{4}$ , NW $\frac{1}{4}$ , SW $\frac{1}{4}$ Sec. 23, T. 143 N., R. 96 W. |
| <b>Replications:</b>        | Three    Randomized Block Design                                                                                                          |
| <b>Study Size:</b>          | 183' x 142'    0.60 acres                                                                                                                 |
| <b>Plot Size:</b>           | 33' x 50'    0.04 acres                                                                                                                   |
| <b>Perimeter border:</b>    | 10' on east and south, 3' on north and 0' on west                                                                                         |
| <b>Alleys:</b>              | 10'                                                                                                                                       |
| <b>Soil:</b>                | Vebar                                                                                                                                     |
| <b>Range Site:</b>          | Sandy with a few thin claypen sites                                                                                                       |
| <b>Seedling Date:</b>       | 21 Apr 1983                                                                                                                               |
| <b>Seedling Rate:</b>       | 0.50 lbs. PLS/row/acre                                                                                                                    |
| <b>Alfalfa Variety:</b>     | Travois                                                                                                                                   |
| <b>Row Spacing:</b>         | 3'                                                                                                                                        |
| <b>Chisel Plow Shovels:</b> | 0", 2", 3" twisted and 4" twisted                                                                                                         |

**Figure 2:** Alfalfa Interseeding Furrow Width Techniques Trial

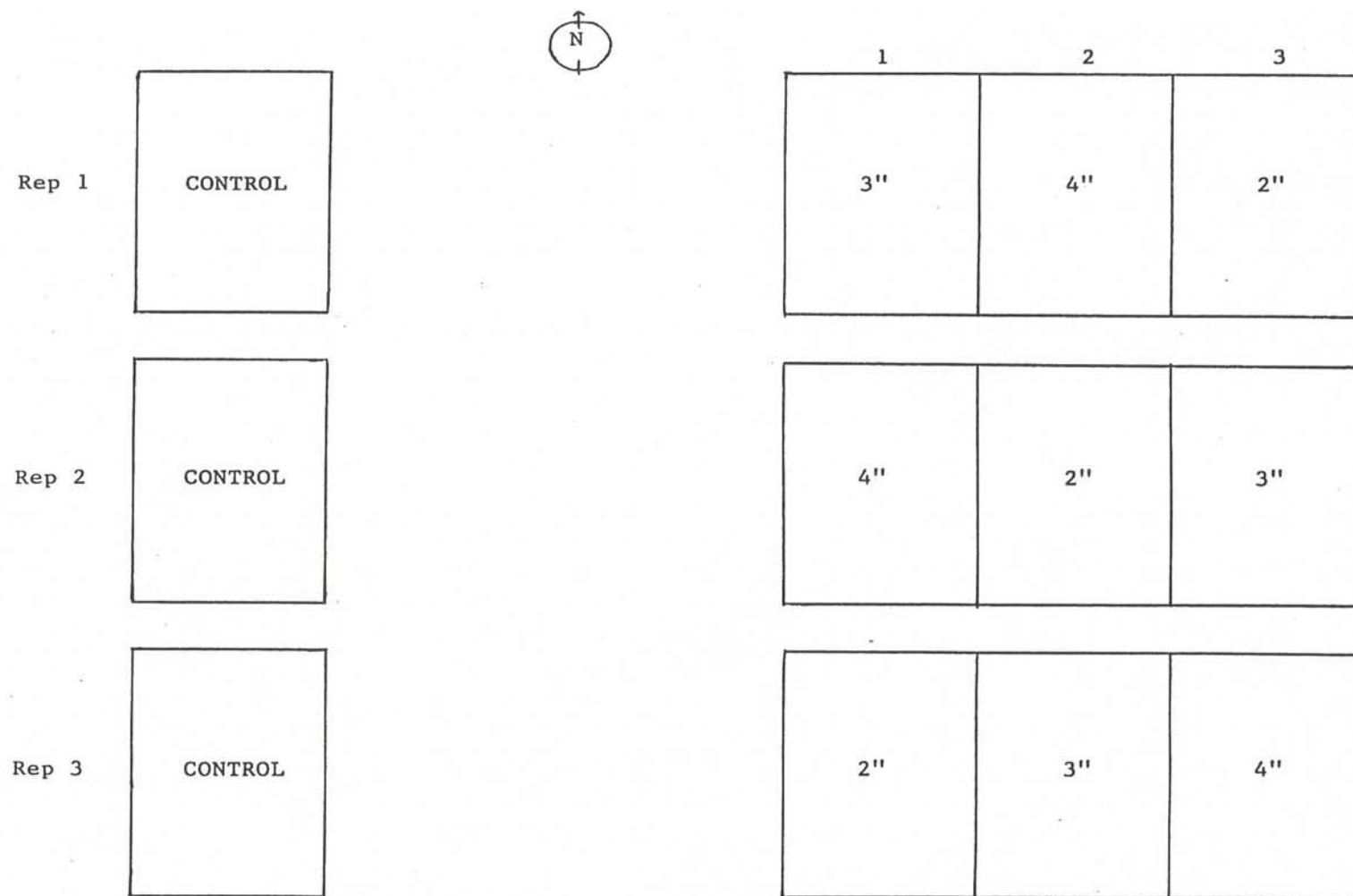


Figure 2 . Alfalfa interseeding furrow width techniques trial using 2, 3 and 4 inch chisel plow shovels, seeded 21 Apr 1983.

**Table 20. Mean Above Ground Herbage Production by Category in Lbs/Acre  
For the Alfalfa Interseeding Furrow Width Techniques Trial at the  
Dickinson Experiment Station, 1984**

| Clip<br>Categories | Furrow Width |           |           |           |
|--------------------|--------------|-----------|-----------|-----------|
|                    | 0<br>Inch    | 2<br>Inch | 3<br>Inch | 4<br>Inch |
| Cool Short         | 126.7        | 133.2     | 217.1     | 178.4     |
| Warm Short         | 130.8        | 197.4     | 331.8     | 93.4      |
| Cool Mid           | 144.0        | 180.8     | 208.7     | 330.6     |
| Western Wheatgrass | 14.2         | 5.4       | 12.5      | 31.5      |
| Warm Mid           | 16.7         | 0.6       | 1.8       | 17.8      |
| Warm Tall          | 25.0         | 0.0       | 4.2       | 22.0      |
| Sedge              | 196.8        | 135.6     | 143.3     | 140.9     |
| <b>Total Grass</b> | 714.2        | 652.9     | 919.4     | 814.7     |
| Forbs              | 75.5         | 79.1      | 97.5      | 73.7      |
| Shrubs             | 0.0          | 0.0       | 7.7       | 16.1      |
| <b>Total</b>       | 789.7        | 732.0     | 1024.6    | 904.5     |

**Table 21. Alfalfa Plant Count per Meter of Row for the Alfalfa Interseeding Furrow Width Techniques Trial  
At the Dickinson Experiment Station, 27 Jun 1984**

| Furrow Width | Rep 1    |       |       | Rep 2    |       |       | Rep 3    |       |       | Mean     |       |       |
|--------------|----------|-------|-------|----------|-------|-------|----------|-------|-------|----------|-------|-------|
|              | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total |
| Control      | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  |
| 2 inch       | 0.04     | 1.33  | 1.38  | 0.08     | 0.50  | 0.58  | 0.08     | 0.25  | 0.33  | 0.07     | 0.69  | 0.76  |
| 3 inch       | 0.17     | 0.42  | 0.58  | 0.21     | 1.00  | 1.21  | 0.29     | 0.13  | 0.42  | 0.22     | 0.51  | 0.74  |
| 4 inch       | 0.00     | 0.59  | 0.58  | 0.08     | 0.38  | 0.46  | 0.17     | 0.67  | 0.83  | 0.08     | 0.54  | 0.63  |

**Table 22. Alfalfa Plant Count per Foot of Row for the Alfalfa Interseeding Furrow Width Techniques Trial  
At the Dickinson Experiment Station, 27 Jun 1984**

| Furrow Width | Rep 1    |       |       | Rep 2    |       |       | Rep 3    |       |       | Mean     |       |       |
|--------------|----------|-------|-------|----------|-------|-------|----------|-------|-------|----------|-------|-------|
|              | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total | Seedling | Adult | Total |
| Control      | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  | 0.00     | 0.00  | 0.00  |
| 2 inch       | 0.01     | 0.41  | 0.42  | 0.02     | 0.15  | 0.18  | 0.02     | 0.08  | 0.10  | 0.02     | 0.21  | 0.23  |
| 3 inch       | 0.05     | 0.13  | 0.18  | 0.06     | 0.30  | 0.37  | 0.09     | 0.04  | 0.13  | 0.07     | 0.16  | 0.23  |
| 4 inch       | 0.00     | 0.18  | 0.18  | 0.02     | 0.12  | 0.14  | 0.06     | 0.20  | 0.25  | 0.02     | 0.16  | 0.19  |

**Table 23. Points Analysis of the 0 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                     | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii           | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Bouteloua gracilis          | 11.27       | 35.73                | 56.00             | 24.93                      | 60.66            |
| Calamovilfa longifolia      | 1.73        | 5.50                 | 16.00             | 7.12                       | 12.62            |
| Koeleria pyramidata         | 1.13        | 3.59                 | 9.33              | 4.15                       | 7.74             |
| Muhlenbergia cuspidate      | 0.47        | 1.48                 | 4.67              | 2.08                       | 3.56             |
| Panicum oligosanthos        | 0.13        | 0.42                 | 0.67              | 0.30                       | 0.72             |
| Stipa comata                | 3.47        | 10.99                | 26.67             | 11.87                      | 22.86            |
| Carex filifolia             | 3.60        | 11.42                | 29.33             | 13.06                      | 24.48            |
| Carex heliophila            | 3.20        | 10.15                | 22.67             | 10.09                      | 20.24            |
| Achillea millefolium        | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Antennaria parvifolia       | 0.47        | 1.48                 | 2.67              | 1.19                       | 2.67             |
| Artemisia dracunculus       | 0.40        | 1.27                 | 4.00              | 1.78                       | 3.05             |
| Artemisia frigida           | 0.27        | 0.85                 | 2.67              | 1.19                       | 2.04             |
| Aster ericoides             | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Echinacea angustifolia      | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Glycyrrhiza lepidota        | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Grindelia squarrosa         | 0.20        | 0.63                 | 2.00              | 0.89                       | 1.52             |
| Haplopappus spinulosus      | 0.27        | 0.85                 | 2.67              | 1.19                       | 2.04             |
| Hedeoma hispida             | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Liatris punctata            | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Lygodesmia juncea           | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Opuntia fragilis            | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Petalostemon purpureum      | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Phlox hoodii                | 0.53        | 1.69                 | 4.67              | 2.08                       | 3.77             |
| Psoralea argophylla         | 0.13        | 0.42                 | 1.33              | 0.59                       | 1.01             |
| Psoralea esculenta          | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Solidago missouriensis      | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Solidago rigida             | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Taraxacum officinale        | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Rosa arkansana              | 0.33        | 1.06                 | 3.33              | 1.48                       | 2.54             |
| Symphoricarpos occidentalis | 0.07        | 0.21                 | 0.67              | 0.30                       | 0.51             |
| Lichen spp.                 | 2.07        | 6.55                 | 17.33             | 7.72                       | 14.27            |
| Furrow                      | 0.00        |                      | 0.00              |                            |                  |
| Litter                      | 65.33       |                      | 100.00            |                            |                  |
| Rock                        | 0.67        |                      | 4.00              |                            |                  |
| Sod                         | 0.00        |                      | 0.00              |                            |                  |
| Soil                        | 2.47        |                      | 11.33             |                            |                  |

**Table 24. Points Analysis of the 2 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.07               | 0.23                        | 0.67                     | 0.36                              | 0.59                    |
| Bouteloua gracilis     | 16.07              | 55.53                       | 72.00                    | 39.13                             | 94.66                   |
| Koeleria pyramidata    | 0.87               | 3.00                        | 7.33                     | 3.99                              | 6.99                    |
| Muhlenbergia cuspidata | 0.40               | 1.38                        | 3.33                     | 1.81                              | 3.19                    |
| Stipa comata           | 2.40               | 8.29                        | 22.00                    | 11.96                             | 20.25                   |
| Stipa viridula         | 0.27               | 0.92                        | 2.67                     | 1.45                              | 2.37                    |
| Carex filifolia        | 2.87               | 9.91                        | 21.33                    | 11.59                             | 21.50                   |
| Carex heliophila       | 2.67               | 9.22                        | 24.67                    | 13.41                             | 22.63                   |
| Achillea millefolium   | 0.13               | 0.46                        | 1.33                     | 0.72                              | 1.18                    |
| Antennaria parvifolia  | 0.13               | 0.46                        | 1.33                     | 0.72                              | 1.18                    |
| Artemisia dracunculus  | 0.27               | 0.92                        | 2.67                     | 1.45                              | 2.37                    |
| Artemisia frigida      | 0.27               | 0.92                        | 2.67                     | 1.45                              | 2.37                    |
| Artemisia ludoviciana  | 0.07               | 0.23                        | 0.67                     | 0.36                              | 0.59                    |
| Echinacea angustifolia | 0.07               | 0.23                        | 0.67                     | 0.36                              | 0.59                    |
| Gaura coccinea         | 0.07               | 0.23                        | 0.67                     | 0.36                              | 0.59                    |
| Liatis punctata        | 0.07               | 0.23                        | 0.67                     | 0.36                              | 0.59                    |
| Phlox hoodii           | 0.60               | 2.07                        | 4.00                     | 2.17                              | 4.24                    |
| Rosa arkansana         | 0.20               | 0.69                        | 2.00                     | 1.09                              | 1.78                    |
| Lichen spp.            | 1.47               | 5.07                        | 13.33                    | 7.25                              | 12.32                   |
| Furrow                 | 11.53              |                             | 52.00                    |                                   |                         |
| Litter                 | 48.07              |                             | 100.00                   |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 11.00              |                             | 39.33                    |                                   |                         |
| Soil                   | 0.47               |                             | 2.67                     |                                   |                         |

**Table 25. Points Analysis of the 3 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>         | <b>Basal Cover</b> | <b>Relative Basal Cover</b> | <b>Percent Frequency</b> | <b>Relative Percent Frequency</b> | <b>Importance Value</b> |
|------------------------|--------------------|-----------------------------|--------------------------|-----------------------------------|-------------------------|
| Agropyron smithii      | 0.73               | 2.44                        | 6.67                     | 3.60                              | 6.04                    |
| Andropogon scoparius   | 0.07               | 0.22                        | 0.67                     | 0.36                              | 0.58                    |
| Bouteloua gracilis     | 13.07              | 43.56                       | 50.67                    | 27.34                             | 70.90                   |
| Calamovilfa longifolia | 0.20               | 0.67                        | 2.00                     | 1.08                              | 1.75                    |
| Koeleria pyramidata    | 1.47               | 4.89                        | 12.00                    | 6.47                              | 11.36                   |
| Muhlenbergia cuspidata | 0.67               | 2.22                        | 5.33                     | 2.88                              | 5.10                    |
| Stipa comata           | 4.80               | 16.00                       | 34.67                    | 18.71                             | 34.71                   |
| Stipa viridula         | 0.27               | 0.89                        | 2.00                     | 1.08                              | 1.97                    |
| Carex filifolia        | 2.67               | 8.89                        | 19.33                    | 10.43                             | 19.32                   |
| Carex heliophila       | 2.80               | 9.33                        | 22.67                    | 12.23                             | 21.56                   |
| Achillea millefolium   | 0.07               | 0.22                        | 0.67                     | 0.36                              | 0.58                    |
| Antennaria parvifolia  | 0.07               | 0.22                        | 0.67                     | 0.36                              | 0.58                    |
| Artemisia dracunculus  | 0.27               | 0.89                        | 2.67                     | 1.44                              | 2.33                    |
| Artemisia frigida      | 0.13               | 0.44                        | 1.33                     | 0.72                              | 1.16                    |
| Chrysopsis villosa     | 0.07               | 0.22                        | 0.67                     | 0.36                              | 0.58                    |
| Echinacea angustifolia | 0.27               | 0.89                        | 2.00                     | 1.08                              | 1.97                    |
| Glycyrrhiza lepidota   | 0.07               | 0.22                        | 0.67                     | 0.36                              | 0.58                    |
| Liatris punctata       | 0.07               | 0.22                        | 0.67                     | 0.36                              | 0.58                    |
| Petalostemon purpureum | 0.13               | 0.44                        | 1.33                     | 0.72                              | 1.16                    |
| Phlox hoodii           | 0.60               | 2.00                        | 4.00                     | 2.16                              | 4.16                    |
| Psoralea argophylla    | 0.13               | 0.44                        | 1.33                     | 0.72                              | 1.16                    |
| Rosa arkansana         | 0.33               | 1.11                        | 3.33                     | 1.80                              | 2.91                    |
| Lichen spp.            | 1.07               | 3.56                        | 10.00                    | 5.40                              | 8.96                    |
| Furrow                 | 12.73              |                             | 51.33                    |                                   |                         |
| Litter                 | 42.80              |                             | 98.67                    |                                   |                         |
| Rock                   | 0.00               |                             | 0.00                     |                                   |                         |
| Sod                    | 14.13              |                             | 38.67                    |                                   |                         |
| Soil                   | 0.33               |                             | 2.00                     |                                   |                         |

**Table 26. Points Analysis of the 4 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                     | Basal Cover | Relative Basal Cover | Percent Frequency | Relative Percent Frequency | Importance Value |
|-----------------------------|-------------|----------------------|-------------------|----------------------------|------------------|
| Agropyron smithii           | 0.47        | 1.79                 | 4.67              | 2.52                       | 4.31             |
| Bouteloua gracilis          | 9.20        | 35.38                | 40.00             | 21.58                      | 56.96            |
| Calamovilfa longifolia      | 0.13        | 0.51                 | 1.33              | 0.72                       | 1.23             |
| Koeleria pyramidata         | 1.20        | 4.62                 | 12.00             | 6.47                       | 11.09            |
| Muhlenbergia cuspidata      | 0.27        | 1.03                 | 2.67              | 1.44                       | 2.47             |
| Stipa comata                | 4.07        | 15.64                | 30.00             | 16.19                      | 31.83            |
| Stipa viridula              | 0.67        | 2.56                 | 6.67              | 3.60                       | 6.16             |
| Carex filifolia             | 1.73        | 6.67                 | 15.33             | 8.27                       | 14.94            |
| Carex heliophila            | 3.47        | 13.33                | 31.33             | 16.91                      | 30.24            |
| Antennaria parvifolia       | 0.60        | 2.31                 | 5.33              | 2.88                       | 5.19             |
| Artemisia dracunculus       | 0.33        | 1.28                 | 2.67              | 1.44                       | 2.72             |
| Artemisia frigida           | 0.40        | 1.54                 | 3.33              | 1.80                       | 3.34             |
| Artemisia ludoviciana       | 0.07        | 0.26                 | 0.67              | 0.36                       | 0.62             |
| Aster ericoides             | 0.20        | 0.77                 | 2.00              | 1.08                       | 1.85             |
| Erysimum asperum            | 0.07        | 0.26                 | 0.67              | 0.36                       | 0.62             |
| Oxytropis lambertii         | 0.13        | 0.51                 | 1.33              | 0.72                       | 1.23             |
| Phlox hoodii                | 0.27        | 1.03                 | 2.67              | 1.44                       | 2.47             |
| Psoralea argophylla         | 0.07        | 0.26                 | 0.67              | 0.36                       | 0.62             |
| Psoralea esculenta          | 0.07        | 0.26                 | 0.67              | 0.36                       | 0.62             |
| Sphaeralcea coccinea        | 0.20        | 0.77                 | 2.00              | 1.08                       | 1.85             |
| Rosa arkansana              | 0.27        | 1.03                 | 2.67              | 1.44                       | 2.47             |
| Symphoricarpos occidentalis | 0.07        | 0.26                 | 0.67              | 0.36                       | 0.62             |
| Lichen spp.                 | 2.07        | 7.95                 | 16.00             | 8.63                       | 16.58            |
| Furrow                      | 14.13       |                      | 56.67             |                            |                  |
| Litter                      | 40.40       |                      | 99.33             |                            |                  |
| Rock                        | 0.00        |                      | 0.00              |                            |                  |
| Sod                         | 19.27       |                      | 49.33             |                            |                  |
| Soil                        | 0.20        |                      | 1.33              |                            |                  |

**Table 27. Mean Percentage of Basal Cover for the Alfalfa Interseeding Furrow Width Trial  
At the Dickinson Experiment Station, 1984**

| <b>Furrow Width</b> | <b>Grass</b> | <b>Sedge</b> | <b>Forbs</b> | <b>Shrubs</b> | <b>Club<br/>Moss</b> | <b>Lichen</b> | <b>Furrow</b> | <b>Litter</b> | <b>Rock</b> | <b>Sod</b> | <b>Soil</b> |
|---------------------|--------------|--------------|--------------|---------------|----------------------|---------------|---------------|---------------|-------------|------------|-------------|
| 0 inch              | 18.40        | 6.80         | 3.88         | 0.40          | 0.00                 | 2.07          | 0.00          | 65.33         | 0.67        | 0.00       | 2.47        |
| 2 inch              | 20.08        | 5.54         | 1.68         | 0.20          | 0.00                 | 1.47          | 11.53         | 48.07         | 0.00        | 11.00      | 0.47        |
| 3 inch              | 21.28        | 5.47         | 1.88         | 0.33          | 0.00                 | 1.07          | 12.73         | 42.80         | 0.00        | 14.13      | 0.33        |
| 4 inch              | 16.01        | 5.20         | 2.41         | 0.34          | 0.00                 | 2.07          | 14.13         | 40.40         | 0.00        | 19.27      | 0.20        |

**Table 28. Density Analysis per 0.1 Sq. Meter of the 0 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>                     | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|------------------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| <i>Achillea millefolium</i>        | 0.15           | 3.34                                    | 5.33                         | 2.61                                      | 5.95                        |
| <i>Antennaria parvifolia</i>       | 0.01           | 0.30                                    | 1.33                         | 0.65                                      | 0.95                        |
| <i>Artemisia dracunculus</i>       | 0.24           | 5.47                                    | 17.33                        | 8.50                                      | 13.97                       |
| <i>Artemisia frigida</i>           | 0.05           | 1.22                                    | 4.00                         | 1.96                                      | 3.18                        |
| <i>Artemisia ludoviciana</i>       | 0.13           | 3.04                                    | 4.00                         | 1.96                                      | 5.00                        |
| <i>Aster ericoides</i>             | 1.28           | 29.18                                   | 28.00                        | 13.73                                     | 42.91                       |
| <i>Chrysopsis villosa</i>          | 0.04           | 0.91                                    | 4.00                         | 1.96                                      | 2.87                        |
| <i>Echinacea angustifolia</i>      | 0.17           | 3.95                                    | 10.67                        | 5.23                                      | 9.18                        |
| <i>Erysimum asperum</i>            | 0.13           | 3.04                                    | 10.67                        | 5.23                                      | 8.27                        |
| <i>Gaura coccinea</i>              | 0.17           | 3.95                                    | 9.33                         | 4.58                                      | 8.53                        |
| <i>Glycyrrhiza lepidota</i>        | 0.01           | 0.30                                    | 1.33                         | 0.65                                      | 0.95                        |
| <i>Grindelia squarrosa</i>         | 0.56           | 12.77                                   | 17.33                        | 8.50                                      | 21.27                       |
| <i>Gutierrezia sarothrae</i>       | 0.03           | 0.61                                    | 2.67                         | 1.31                                      | 1.92                        |
| <i>Haplopappus spinulosus</i>      | 0.04           | 0.91                                    | 4.00                         | 1.96                                      | 2.87                        |
| <i>Hedeoma hispida</i>             | 0.08           | 1.82                                    | 2.67                         | 1.31                                      | 3.13                        |
| <i>Helianthus rigidus</i>          | 0.29           | 6.69                                    | 13.33                        | 6.54                                      | 13.23                       |
| <i>Liatis punctata</i>             | 0.19           | 4.26                                    | 10.67                        | 5.23                                      | 9.49                        |
| <i>Linum rigidum</i>               | 0.03           | 0.61                                    | 2.67                         | 1.31                                      | 1.92                        |
| <i>Lygodesmia juncea</i>           | 0.01           | 0.30                                    | 1.33                         | 0.65                                      | 0.95                        |
| <i>Oxytropis lambertii</i>         | 0.04           | 0.91                                    | 4.00                         | 1.96                                      | 2.87                        |
| <i>Petalostemon purpureum</i>      | 0.27           | 6.08                                    | 14.67                        | 7.19                                      | 13.27                       |
| <i>Phlox hoodii</i>                | 0.09           | 2.13                                    | 4.00                         | 1.96                                      | 4.09                        |
| <i>Psoralea argophylla</i>         | 0.04           | 0.91                                    | 4.00                         | 1.96                                      | 2.87                        |
| <i>Psoralea esculenta</i>          | 0.05           | 1.22                                    | 5.33                         | 2.61                                      | 3.83                        |
| <i>Solidago missouriensis</i>      | 0.01           | 0.30                                    | 1.33                         | 0.65                                      | 0.95                        |
| <i>Solidago rigida</i>             | 0.03           | 0.61                                    | 1.33                         | 0.65                                      | 1.26                        |
| <i>Sphaeralcea coccinea</i>        | 0.03           | 0.61                                    | 2.67                         | 1.31                                      | 1.92                        |
| <i>Rosa arkansana</i>              | 0.19           | 4.26                                    | 14.67                        | 7.19                                      | 11.45                       |
| <i>Symphoricarpos occidentalis</i> | 0.01           | 0.30                                    | 1.33                         | 0.65                                      | 0.95                        |

**Table 29. Density Analysis per 0.1 Sq. Meter of the 2 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                       | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-------------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| <i>Antennaria parvifolia</i>  | 0.03    | 0.93                           | 1.33                 | 0.70                             | 1.63                |
| <i>Artemisia dracunculus</i>  | 0.28    | 9.81                           | 22.67                | 11.89                            | 21.70               |
| <i>Artemisia frigida</i>      | 0.08    | 2.80                           | 8.00                 | 4.20                             | 7.00                |
| <i>Artemisia ludoviciana</i>  | 0.04    | 1.40                           | 2.67                 | 1.40                             | 2.80                |
| <i>Aster ericoides</i>        | 0.51    | 17.76                          | 18.67                | 9.79                             | 27.55               |
| <i>Chrysopsis villosa</i>     | 0.12    | 4.21                           | 9.33                 | 4.90                             | 9.11                |
| <i>Echinacea angustifolia</i> | 0.17    | 6.07                           | 13.33                | 6.99                             | 13.06               |
| <i>Erysimum asperum</i>       | 0.09    | 3.27                           | 8.00                 | 4.20                             | 7.47                |
| <i>Euphorbia geyeri</i>       | 0.01    | 0.47                           | 1.33                 | 0.70                             | 1.17                |
| <i>Gaura coccinea</i>         | 0.13    | 4.67                           | 12.00                | 6.29                             | 10.96               |
| <i>Grindelia squarrosa</i>    | 0.27    | 9.35                           | 13.33                | 6.99                             | 16.34               |
| <i>Haplopappus spinulosus</i> | 0.03    | 0.93                           | 2.67                 | 1.40                             | 2.33                |
| <i>Hedeoma hispida</i>        | 0.01    | 0.47                           | 1.33                 | 0.70                             | 1.17                |
| <i>Liatris punctata</i>       | 0.17    | 6.07                           | 10.67                | 5.59                             | 11.66               |
| <i>Linum rigidum</i>          | 0.01    | 0.47                           | 1.33                 | 0.70                             | 1.17                |
| <i>Lotus americanus</i>       | 0.03    | 0.93                           | 2.67                 | 1.40                             | 2.33                |
| <i>Lygodesmia juncea</i>      | 0.05    | 1.87                           | 5.33                 | 2.80                             | 4.67                |
| <i>Oxytropis lambertii</i>    | 0.04    | 1.40                           | 2.67                 | 1.40                             | 2.80                |
| <i>Petalostemon purpureum</i> | 0.04    | 1.40                           | 2.67                 | 1.40                             | 2.80                |
| <i>Phlox hoodii</i>           | 0.29    | 10.28                          | 16.00                | 8.39                             | 18.67               |
| <i>Psoralea argophylla</i>    | 0.07    | 2.34                           | 6.67                 | 3.50                             | 5.84                |
| <i>Ratibida columnifera</i>   | 0.01    | 0.47                           | 1.33                 | 0.70                             | 1.17                |
| <i>Solidago missouriensis</i> | 0.01    | 0.47                           | 1.33                 | 0.70                             | 1.17                |
| <i>Sphaeralcea coccinea</i>   | 0.04    | 1.40                           | 2.67                 | 1.40                             | 2.80                |
| <i>Vicia americana</i>        | 0.01    | 0.47                           | 1.33                 | 0.70                             | 1.17                |
| <i>Rosa arkansana</i>         | 0.29    | 10.28                          | 21.33                | 11.19                            | 21.47               |

**Table 30. Density Analysis per 0.1 Sq. Meter of the 3 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Species</b>              | <b>Density</b> | <b>Relative<br/>Percent<br/>Density</b> | <b>Percent<br/>Frequency</b> | <b>Relative<br/>Percent<br/>Frequency</b> | <b>Importance<br/>Value</b> |
|-----------------------------|----------------|-----------------------------------------|------------------------------|-------------------------------------------|-----------------------------|
| Achillea millefolium        | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Artemisia dracunculus       | 0.07           | 2.75                                    | 6.67                         | 3.79                                      | 6.54                        |
| Artemisia frigida           | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Artemisia ludoviciana       | 0.03           | 1.10                                    | 1.33                         | 0.76                                      | 1.86                        |
| Aster ericoides             | 0.16           | 6.59                                    | 8.00                         | 4.55                                      | 11.14                       |
| Aster oblongifolius         | 0.01           | 0.55                                    | 1.33                         | 0.76                                      | 1.31                        |
| Astragalus crassicaupus     | 0.01           | 0.55                                    | 1.33                         | 0.76                                      | 1.31                        |
| Chrysopsis villosa          | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Commandra umbellata         | 0.01           | 0.55                                    | 1.33                         | 0.76                                      | 1.31                        |
| Echinacea angustifolia      | 0.17           | 7.14                                    | 16.00                        | 9.09                                      | 16.23                       |
| Erysimum asperum            | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Gaura coccinea              | 0.08           | 3.30                                    | 6.67                         | 3.79                                      | 7.09                        |
| Gutierrezia sarothrae       | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Haplopappus spinulosus      | 0.03           | 1.10                                    | 1.33                         | 0.76                                      | 1.86                        |
| Hedeoma hispida             | 0.11           | 4.40                                    | 8.00                         | 4.55                                      | 8.95                        |
| Helianthus rigidus          | 0.44           | 18.13                                   | 20.00                        | 11.36                                     | 29.49                       |
| Liatis punctata             | 0.17           | 7.14                                    | 10.67                        | 6.06                                      | 13.20                       |
| Linum rigidum               | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Lotus americanus            | 0.07           | 2.75                                    | 6.67                         | 3.79                                      | 6.54                        |
| Lygodesmia juncea           | 0.09           | 3.85                                    | 8.00                         | 4.55                                      | 8.40                        |
| Opuntia fragilis            | 0.01           | 0.55                                    | 1.33                         | 0.76                                      | 1.31                        |
| Petalostemon purpureum      | 0.13           | 5.49                                    | 12.00                        | 6.82                                      | 12.31                       |
| Phlox hoodii                | 0.13           | 5.49                                    | 8.00                         | 4.55                                      | 10.04                       |
| Psoralea argophylla         | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Psoralea esculenta          | 0.07           | 2.75                                    | 6.67                         | 3.79                                      | 6.54                        |
| Ratibida columnifera        | 0.03           | 1.10                                    | 2.67                         | 1.52                                      | 2.62                        |
| Solidago missouriensis      | 0.08           | 3.30                                    | 4.00                         | 2.27                                      | 5.57                        |
| Sphaeralcea coccinea        | 0.12           | 4.95                                    | 10.67                        | 6.06                                      | 11.01                       |
| Rosa arkansana              | 0.20           | 8.24                                    | 13.33                        | 7.58                                      | 15.82                       |
| Symphoricarpos occidentalis | 0.01           | 0.55                                    | 1.33                         | 0.76                                      | 1.31                        |

**Table 31. Density Analysis per 0.1 Sq. Meter of the 4 Inch Furrow Width Treatment for the Alfalfa Interseeding Techniques Trial at the Dickinson Experiment Station, 1984**

| Species                     | Density | Relative<br>Percent<br>Density | Percent<br>Frequency | Relative<br>Percent<br>Frequency | Importance<br>Value |
|-----------------------------|---------|--------------------------------|----------------------|----------------------------------|---------------------|
| Achillea millefolium        | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Antennaria parvifolia       | 0.12    | 3.69                           | 8.00                 | 4.17                             | 7.86                |
| Artemisia dracunculus       | 0.21    | 6.56                           | 13.33                | 6.94                             | 13.50               |
| Artemisia frigida           | 0.12    | 3.69                           | 10.67                | 5.56                             | 9.25                |
| Artemisia ludoviciana       | 0.09    | 2.87                           | 4.00                 | 2.08                             | 4.95                |
| Aster ericoides             | 0.81    | 25.00                          | 21.33                | 11.11                            | 36.11               |
| Chrysopsis villosa          | 0.04    | 1.23                           | 4.00                 | 2.08                             | 3.31                |
| Commandra umbellata         | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Echinacea angustifolia      | 0.35    | 10.66                          | 25.33                | 13.19                            | 23.85               |
| Erysimum asperum            | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Gaura coccinea              | 0.04    | 1.23                           | 2.67                 | 1.39                             | 2.62                |
| Grindelia squarrosa         | 0.04    | 1.23                           | 2.67                 | 1.39                             | 2.62                |
| Haplopappus spinulosus      | 0.03    | 0.82                           | 2.67                 | 1.39                             | 2.21                |
| Hedeoma hispida             | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Helianthus rigidus          | 0.03    | 0.82                           | 1.33                 | 0.69                             | 1.51                |
| Liatris punctata            | 0.12    | 3.69                           | 8.00                 | 4.17                             | 7.86                |
| Linum rigidum               | 0.08    | 2.46                           | 8.00                 | 4.17                             | 6.63                |
| Lotus americanus            | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Lygodesmia juncea           | 0.03    | 0.82                           | 1.33                 | 0.69                             | 1.51                |
| Medicago falcata            | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Opuntia fragilis            | 0.04    | 1.23                           | 2.67                 | 1.39                             | 2.62                |
| Oxytropis lambertii         | 0.05    | 1.64                           | 4.00                 | 2.08                             | 3.72                |
| Petalostemon purpureum      | 0.09    | 2.87                           | 8.00                 | 4.17                             | 7.04                |
| Phlox hoodii                | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |
| Psoralea argophylla         | 0.05    | 1.64                           | 4.00                 | 2.08                             | 3.72                |
| Psoralea esculenta          | 0.05    | 1.64                           | 5.33                 | 2.78                             | 4.42                |
| Ratibida columnifera        | 0.03    | 0.82                           | 2.67                 | 1.39                             | 2.21                |
| Solidago missouriensis      | 0.16    | 4.92                           | 9.33                 | 4.86                             | 9.78                |
| Solidago rigida             | 0.05    | 1.64                           | 1.33                 | 0.69                             | 2.33                |
| Sphaeralcea coccinea        | 0.21    | 6.56                           | 14.67                | 7.64                             | 14.20               |
| Rosa arkansana              | 0.29    | 9.02                           | 16.00                | 8.33                             | 17.35               |
| Symphoricarpos occidentalis | 0.01    | 0.41                           | 1.33                 | 0.69                             | 1.10                |

**Table 32. Mean Density per 0.1 Sq. Meter for the Alfalfa Interseeding Furrow Width Techniques Trial at the Dickinson Experiment Station, 1984**

| <b>Furrow Width</b> | <b>Forbs</b> | <b>Shrubs</b> |
|---------------------|--------------|---------------|
| 0 inch              | 4.17         | 0.20          |
| 2 inch              | 2.54         | 0.29          |
| 3 inch              | 2.23         | 0.21          |
| 4 inch              | 2.91         | 0.30          |

**Table 33. Area in Square Feet and Percentage per Acre of Seed Bed Prepared by an Interseeder  
For Six Row Spacings and Four Furrow Widths**

| Row Spacing         |                   | Area of Seed Bed per Acre<br>In Square Feet |                       |                       |                        | Percentage of Seed Bed per Acre |                       |                       |                        |
|---------------------|-------------------|---------------------------------------------|-----------------------|-----------------------|------------------------|---------------------------------|-----------------------|-----------------------|------------------------|
| Spacings<br>In Feet | # Rows<br>Per Rod | Furrow<br>w<br>2 Inch                       | Furrow<br>w<br>3 Inch | Furrow<br>w<br>4 Inch | Furrow<br>w<br>12 Inch | Furrow<br>w<br>2 Inch           | Furrow<br>w<br>3 Inch | Furrow<br>w<br>4 Inch | Furrow<br>w<br>12 Inch |
| 2                   | 8.25              | 3703                                        | 5445                  | 7187                  | 21780                  | 8.50                            | 12.50                 | 16.50                 | 50.00                  |
| 3                   | 5.50              | 2468                                        | 3630                  | 4792                  | 14520                  | 5.67                            | 8.34                  | 11.00                 | 33.34                  |
| 4                   | 4.13              | 1854                                        | 2726                  | 3598                  | 10904                  | 4.26                            | 6.25                  | 8.26                  | 25.00                  |
| 5                   | 3.30              | 1481                                        | 2178                  | 2875                  | 8712                   | 3.40                            | 5.00                  | 6.60                  | 20.00                  |
| 8                   | 2.06              | 925                                         | 1362                  | 1795                  | 5446                   | 2.12                            | 3.13                  | 4.12                  | 12.50                  |
| 10                  | 1.65              | 741                                         | 1089                  | 1437                  | 4356                   | 1.70                            | 2.50                  | 3.30                  | 10.00                  |

## INTERSEEDED ALFALFA VARIETY RESPONSE TO GRAZING TRIAL

This trial is designed to evaluate the response to grazing pressure at three different time periods of seven pasture type alfalfa varieties and one hay type alfalfa variety which is used as a control. The purpose of this trial is to help determine which alfalfa variety or varieties are suitable for interseeding into rangeland for pasture use. This trial will also test if season of use causes a difference in growth and herbage production from the different varieties.

These plots were established on 13 acres located on the S $\frac{1}{2}$ , SE $\frac{1}{4}$ , SW $\frac{1}{4}$  Sec. 23, and SW $\frac{1}{4}$ , SW $\frac{1}{4}$ , SE $\frac{1}{4}$  Sec. 23, T. 140 N., R. 97 W. at the Dickinson Experiment Station. The 48 x 390 foot plots were arranged in a randomized block design with three replications. Each plot was split equally into three grazing treatments of 30 days each for June, July and August. The soils were vebar fine sandy loam, morton silt loam and regent silty clay loam. The range sites were sandy, silty and clayey. The alfalfa varieties that were included were Anik, Drylander, Kane, Prowler, Rangelander, Spredor II, Travois and Vernal. Each variety was seeded on 27 and 28 April 1983 at the rate of 0.50 lbs PLS/row/acre, using three foot row spacing and three inch twisted chisel plow shovels as the furrow openers.

The data that were collected from these plots were: above ground herbage production and alfalfa seedling counts. The above ground herbage production was sampled by clipping the vegetation to ground level in three  $\frac{1}{4}$  m<sup>2</sup> quadrats for each plot on 5 July 1984. The herbage was separated into graminoids, forbs, and shrubs. The samples were oven dried at 80°C. The average herbage production for each category and the total production for each plot were determined. The reported data are means of the three replications for each treatment.

The alfalfa seedling counts were made by counting the number of seedlings along three randomly placed meter sticks for each row of each plot. The mean number of seedlings per meter of row was determined for each treatment. Seedling counts were conducted on 12 July 1984.

### Interseeded Alfalfa Variety Response to Grazing Trial

|                            |                                                                                                                             |                   |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------|
| <b>Location:</b>           | Dickinson Experiment Station<br>S½, SE¼, SW¼ Sec. 23, T. 140 N., R. 97 W. and<br>SW¼, SW¼, SE¼ Sec. 23, T. 140 N., R. 97 W. |                   |
| <b>Replications:</b>       | Three                                                                                                                       | Split Plot Design |
| <b>Study Size:</b>         | 392' x 1480'                                                                                                                | 13.32 acres       |
| <b>Plot Size:</b>          | 48' x 390'                                                                                                                  | 0.43 acres        |
| <b>Drainage:</b>           |                                                                                                                             | 3.16 acres        |
| <b>Soils:</b>              | Vebar, Morton and Regent                                                                                                    |                   |
| <b>Range Sites:</b>        | Sandy, Silty and Clayey                                                                                                     |                   |
| <b>Seedling Date:</b>      | 27-28 Apr 1983                                                                                                              |                   |
| <b>Seeding Rate:</b>       | 0.50 lbs. PLS/row/acre                                                                                                      |                   |
| <b>Row Spacing:</b>        | 3'                                                                                                                          |                   |
| <b>Chisel Plow Shovel:</b> | 3" twisted                                                                                                                  |                   |
| <b>Alfalfa Varieties:</b>  | Anik, Drylander, Kane, Prowler, Rangeland, Spredor II, Travois and Vernal.                                                  |                   |
| <b>Split Treatments:</b>   | Three 30 day grazing periods<br>June, July and August                                                                       |                   |

**Figure 3:** Interseeded Alfalfa Variety Response to Grazing

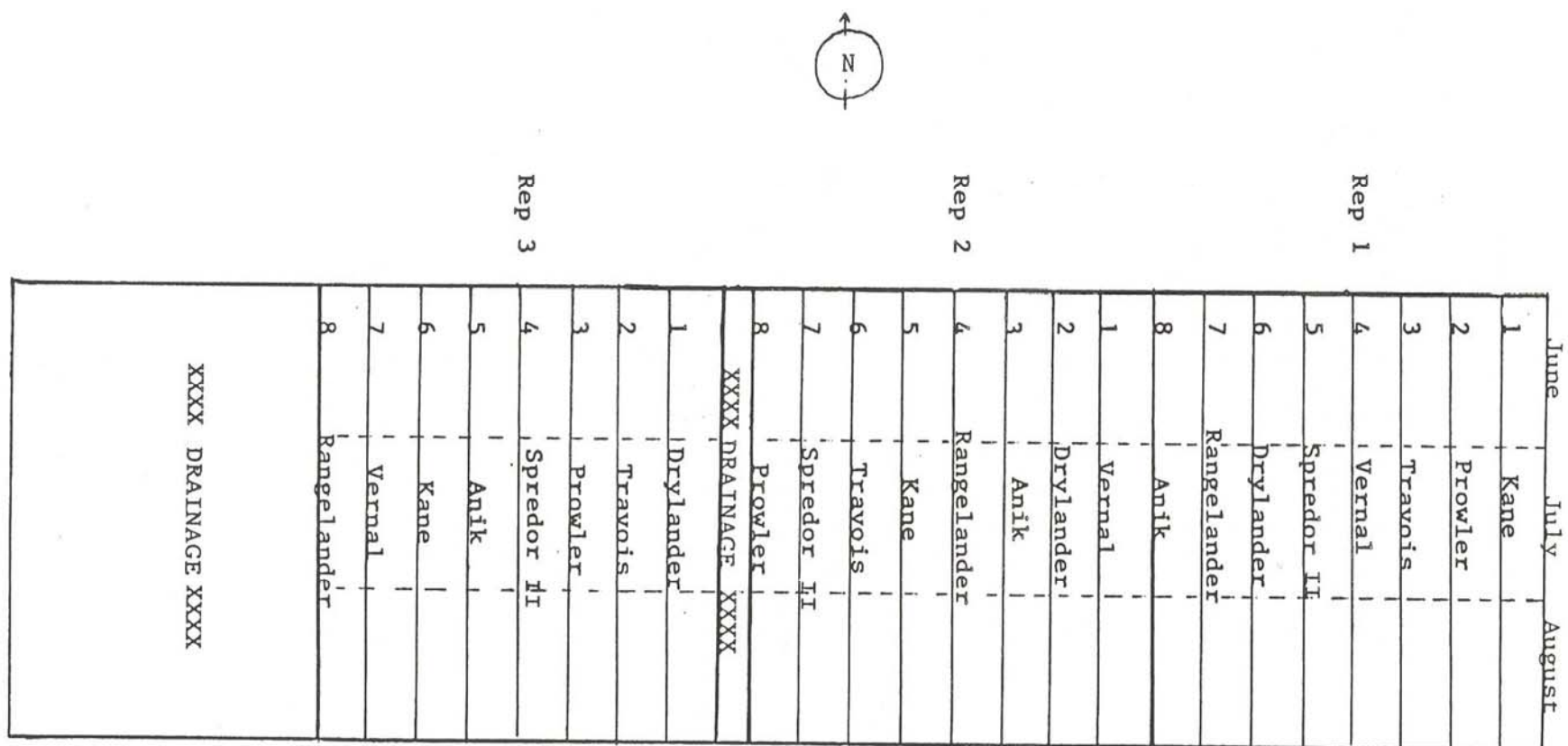


Figure 3 . Interseeded alfalfa variety response to grazing, seeded 27-28 Apr 1983.

**Table 34. Mean Above Ground Herbage Production by Category in Lbs/Acre for each 30 Day Grazing Treatment for each Variety in the Interseeded Alfalfa Variety Response to Grazing Trial at Dickinson Experiment Station, 1984**

| Clip Categories |  | Anik               |            |            |  | Drylander         |            |            |  | Kane           |            |            |  | Prowler       |            |            |
|-----------------|--|--------------------|------------|------------|--|-------------------|------------|------------|--|----------------|------------|------------|--|---------------|------------|------------|
|                 |  | Jun                | Jul        | Aug        |  | Jun               | Jul        | Aug        |  | Jun            | Jul        | Aug        |  | Jun           | Jul        | Aug        |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
| Total Grass     |  | 1103.7             | 1472.4     | 1829.2     |  | 1346.3            | 1347.5     | 2019.5     |  | 1615.1         | 1610.4     | 1421.3     |  | 1393.9        | 1367.7     | 1410.6     |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
| Forbs           |  | 140.3              | 272.4      | 197.4      |  | 299.7             | 171.3      | 252.1      |  | 118.9          | 122.5      | 233.1      |  | 120.1         | 138.0      | 204.6      |
| Shrubs          |  | 0.0                | 0.0        | 0.0        |  | 0.0               | 147.5      | 0.0        |  | 0.0            | 0.0        | 0.0        |  | 0.0           | 0.0        | 0.0        |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
| <b>Total</b>    |  | 1244.0             | 1744.8     | 2026.6     |  | 1646.0            | 1666.3     | 2271.6     |  | 1734.0         | 1732.9     | 1654.4     |  | 1514.0        | 1505.7     | 1615.1     |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
|                 |  | <b>Rangelander</b> |            |            |  | <b>Spredor II</b> |            |            |  | <b>Travois</b> |            |            |  | <b>Vernal</b> |            |            |
|                 |  | <b>Jun</b>         | <b>Jul</b> | <b>Aug</b> |  | <b>Jun</b>        | <b>Jul</b> | <b>Aug</b> |  | <b>Jun</b>     | <b>Jul</b> | <b>Aug</b> |  | <b>Jun</b>    | <b>Jul</b> | <b>Aug</b> |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
| Total Grass     |  | 975.3              | 2678.4     | 1540.2     |  | 1377.2            | 1428.4     | 1650.8     |  | 1257.1         | 1795.9     | 1650.8     |  | 937.2         | 1070.4     | 1585.4     |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
| Forbs           |  | 122.5              | 168.9      | 128.5      |  | 171.3             | 178.4      | 384.2      |  | 86.8           | 212.9      | 383.0      |  | 178.4         | 467.4      | 121.3      |
| Shrubs          |  | 0.0                | 0.0        | 0.0        |  | 0.0               | 0.0        | 0.0        |  | 0.0            | 0.0        | 0.0        |  | 0.0           | 0.0        | 0.0        |
|                 |  |                    |            |            |  |                   |            |            |  |                |            |            |  |               |            |            |
| <b>Total</b>    |  | 1097.8             | 2847.3     | 1668.6     |  | 1548.5            | 1606.8     | 2035.0     |  | 1343.9         | 2008.8     | 2033.8     |  | 1115.6        | 1537.8     | 1706.7     |

**Table 35. Mean Above Ground Herbage Production by Category in Lbs/Acre for each Variety in the Interseeded Alfalfa Variety Response to Grazing Trial at Dickinson Experiment Station, 1984**

| <b>Clip Categories</b> | <b>Anik</b> | <b>Drylander</b> | <b>Kane</b> | <b>Prowler</b> | <b>Rangelander</b> | <b>Spredor II</b> | <b>Travois</b> | <b>Vernal</b> |
|------------------------|-------------|------------------|-------------|----------------|--------------------|-------------------|----------------|---------------|
|                        |             |                  |             |                |                    |                   |                |               |
| Total Grass            | 1468.4      | 1571.1           | 1548.9      | 1390.7         | 1731.3             | 1485.5            | 1567.9         | 1197.7        |
|                        |             |                  |             |                |                    |                   |                |               |
| Forbs                  | 203.4       | 241.0            | 158.2       | 154.2          | 140.0              | 244.6             | 227.6          | 255.7         |
| Shrubs                 | 0.0         | 49.2             | 0.0         | 0.0            | 0.0                | 0.0               | 0.0            | 0.0           |
|                        |             |                  |             |                |                    |                   |                |               |
| <b>Total</b>           | 1671.8      | 1861.3           | 1707.1      | 1544.9         | 1871.2             | 1730.1            | 1795.5         | 1453.4        |

**Table 36. Alfalfa Variety Plant Counts per Meter of Row for the Alfalfa Variety Response to Grazing Trial at the Dickinson Experiment Station, 12 Jul 1984**

|             | Grazing Treatment |       |       |  |      |          |       |  |       |      |          |  | Mean  |       |      |
|-------------|-------------------|-------|-------|--|------|----------|-------|--|-------|------|----------|--|-------|-------|------|
|             | Jun               |       |       |  | Jul  |          |       |  | Aug   |      |          |  |       |       |      |
| Variety     | Seedling          | Adult | Total |  |      | Seedling | Adult |  | Total |      | Seedling |  | Adult | Total |      |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Anik        | 0.00              | 0.21  | 0.21  |  | 0.00 | 0.13     | 0.13  |  | 0.23  | 0.08 | 0.31     |  | 0.08  | 0.14  | 0.22 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Drylander   | 0.10              | 0.10  | 0.21  |  | 0.00 | 0.21     | 0.21  |  | 0.58  | 0.15 | 0.73     |  | 0.23  | 0.15  | 0.38 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Kane        | 0.10              | 0.52  | 0.63  |  | 0.17 | 0.35     | 0.52  |  | 0.19  | 0.38 | 0.56     |  | 0.15  | 0.42  | 0.57 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Prowler     | 0.02              | 0.33  | 0.35  |  | 0.27 | 1.25     | 1.52  |  | 0.21  | 0.35 | 0.56     |  | 0.17  | 0.65  | 0.81 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Rangelander | 0.02              | 0.63  | 0.65  |  | 0.06 | 0.46     | 0.52  |  | 0.31  | 0.94 | 1.25     |  | 0.13  | 0.67  | 0.81 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Spredor II  | 0.04              | 0.98  | 1.02  |  | 0.21 | 0.79     | 1.00  |  | 0.21  | 0.40 | 0.60     |  | 0.15  | 0.72  | 0.88 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Travois     | 0.73              | 2.50  | 3.23  |  | 0.52 | 0.73     | 1.25  |  | 0.75  | 1.02 | 1.77     |  | 0.67  | 1.42  | 2.08 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Vernal      | 0.00              | 0.38  | 0.38  |  | 0.04 | 0.15     | 0.19  |  | 0.40  | 0.35 | 0.75     |  | 0.15  | 0.29  | 0.44 |

**Table 37. Alfalfa Variety Plant Counts per Foot of Row for the Alfalfa Variety Response to Grazing Trial at the Dickinson Experiment Station, 12 Jul 1984**

|             | Grazing Treatment |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
|-------------|-------------------|-------|-------|--|------|----------|-------|--|-------|------|----------|--|-------|-------|------|
|             | Jun               |       |       |  | Jul  |          |       |  | Aug   |      |          |  |       |       |      |
| Variety     | Seedling          | Adult | Total |  |      | Seedling | Adult |  | Total |      | Seedling |  | Adult | Total |      |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Anik        | 0.00              | 0.06  | 0.06  |  | 0.00 | 0.04     | 0.04  |  | 0.07  | 0.02 | 0.09     |  | 0.02  | 0.04  | 0.07 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Drylander   | 0.03              | 0.03  | 0.06  |  | 0.00 | 0.06     | 0.06  |  | 0.18  | 0.05 | 0.22     |  | 0.07  | 0.05  | 0.12 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Kane        | 0.03              | 0.16  | 0.19  |  | 0.05 | 0.11     | 0.16  |  | 0.06  | 0.12 | 0.17     |  | 0.05  | 0.13  | 0.17 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Prowler     | 0.01              | 0.10  | 0.11  |  | 0.08 | 0.38     | 0.46  |  | 0.06  | 0.11 | 0.17     |  | 0.05  | 0.20  | 0.25 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Rangelander | 0.01              | 0.19  | 0.20  |  | 0.02 | 0.14     | 0.16  |  | 0.09  | 0.29 | 0.38     |  | 0.04  | 0.20  | 0.25 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Spredor II  | 0.01              | 0.30  | 0.31  |  | 0.06 | 0.24     | 0.30  |  | 0.06  | 0.12 | 0.18     |  | 0.05  | 0.22  | 0.27 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Travois     | 0.22              | 0.76  | 0.98  |  | 0.16 | 0.22     | 0.38  |  | 0.23  | 0.31 | 0.54     |  | 0.20  | 0.43  | 0.63 |
|             |                   |       |       |  |      |          |       |  |       |      |          |  |       |       |      |
| Vernal      | 0.00              | 0.12  | 0.12  |  | 0.01 | 0.05     | 0.06  |  | 0.12  | 0.11 | 0.23     |  | 0.05  | 0.09  | 0.13 |

**Table 38. Alfalfa Variety Plant Counts per Meter of Row for the Alfalfa Variety Response to Grazing Trial at the Dickinson Experiment Station, 12 Jul 1984**

|                |  | <b>Grazing Treatment</b> |  |            |  |            |  |             |
|----------------|--|--------------------------|--|------------|--|------------|--|-------------|
| <b>Variety</b> |  | <b>Jun</b>               |  | <b>Jul</b> |  | <b>Aug</b> |  | <b>Mean</b> |
| Anik           |  | 0.21                     |  | 0.13       |  | 0.31       |  | 0.22        |
| Drylander      |  | 0.10                     |  | 0.21       |  | 0.73       |  | 0.35        |
| Kane           |  | 0.63                     |  | 0.52       |  | 0.56       |  | 0.57        |
| Prowler        |  | 0.35                     |  | 1.52       |  | 0.56       |  | 0.81        |
| Rangelander    |  | 0.65                     |  | 0.52       |  | 1.25       |  | 0.81        |
| Spredor II     |  | 1.02                     |  | 1.00       |  | 0.60       |  | 0.88        |
| Travois        |  | 3.23                     |  | 1.25       |  | 1.77       |  | 2.08        |
| Vernal         |  | 0.38                     |  | 0.19       |  | 0.75       |  | 0.44        |

**Plant Species List of the Alfalfa Interseeding Trial  
At the Dickinson Experiment Station, 1984**

**Graminoids:**

|       |                           |                      |
|-------|---------------------------|----------------------|
| An sc | Andropogon scorpiarius    | Little bluestem      |
| Ag sm | Agropyron smithii         | Western wheatgrass   |
| Ag tr | Agropyron trachycaulum    | Slender wheatgrass   |
| Ar lo | Aristida longiseta        | Red threeawn         |
| Bo gr | Bouteloua gracilis        | Blue grama           |
| Bu da | Buchloe dactyloides       | Buffalo grass        |
| Ca mo | Calamagrostis montanensis | Plains reedgrass     |
| Ca lo | Calamovilfa longifolia    | Prairie sandreed     |
| Ko py | Koeleria pyramidata       | Prairie junegrass    |
| Mu cu | Muhlenbergia cuspidata    | Plains muhly         |
| Mu sq | Munroa squarrosa          | False buffalo grass  |
| Pa ol | Panicum oligosanthos      | Scribner panic grass |
| Po pr | Poa pratensis             | Kentucky bluegrass   |
| St co | Stipa comata              | Needleandthread      |
| St vi | Stipa viridula            | Green needlegrass    |
| Ca el | Carex eleocharis          | Needleleaf sedge     |
| Ca fi | Carex filifolia           | Threadleaved sedge   |
| Ca he | Carex heliophila          | Yellow sedge         |

**Forbs:**

|       |                        |                  |
|-------|------------------------|------------------|
| Ac mi | Achillea millefolium   | Yarrow           |
| Al st | Allium textile         | White wild onion |
| Am re | Amaranthus retroflexus | Rough pigweed    |
| An oc | Androsace occidentalis | Fairy candelabra |
| An ne | Antennaria neglecta    | Pussytoes        |
| An pa | Antennaria parvifolia  | Pussytoes        |
| Ar ho | Arabis holboellii      | Slim rockcress   |
| Ar dr | Artemisia dracunculus  | Green sage       |
| Ar fr | Artemisia frigida      | Fringed sage     |
| Ar lu | Artemisia ludoviciana  | White sage       |

**Forbs (Continued):**

|       |                                |                     |
|-------|--------------------------------|---------------------|
| As er | <i>Aster ericoides</i>         | White prairie aster |
| As la | <i>Aster laevis</i>            | Smooth blue aster   |
| As ob | <i>Aster oblongifolius</i>     | Aromatic aster      |
| As pt | <i>Aster ptarmicoides</i>      | White upland aster  |
| As ca | <i>Astragalus canadensis</i>   | Little rattlepod    |
| As cr | <i>Astragalus crassicaulus</i> | Ground plum         |
| As tr | <i>Astragalus triphyllus</i>   | Tufted milkvetch    |
| Ce ar | <i>Cerastium arvense</i>       | Prairie chickweed   |
| Ch al | <i>Chenopodium album</i>       | Lamb's quarters     |
| Ch vi | <i>Chrysopsis villosa</i>      | Golden aster        |
| Ci un | <i>Cirsium undulatum</i>       | Prairie thistle     |
| Co um | <i>Commandra umbellata</i>     | Bastard toadflax    |
| Co ar | <i>Convolvulus arvensis</i>    | Field bindweed      |
| Co se | <i>Convolvulus sepium</i>      | Large bindweed      |
| Co ca | <i>Conyza canadensis</i>       | Horseweed           |
| Ec an | <i>Echinacea angustifolia</i>  | Purple coneflower   |
| Er as | <i>Erysimum asperum</i>        | Western wallflower  |
| Eu di | <i>Euphorbia dictyosperma</i>  | Spurge              |
| Eu ge | <i>Euphorbia geyeri</i>        | Geyer's spurge      |
| Ga bo | <i>Galium boreale</i>          | Northern bedstraw   |
| Ga co | <i>Gaura coccinea</i>          | Gaura               |
| Gl le | <i>Glycyrrhiza lepidota</i>    | Wild licorice       |
| Gr sq | <i>Grindelia squarrosa</i>     | Gunweed             |
| Gu sa | <i>Gutierrezia sarothrae</i>   | Broomweed           |
| Ha sp | <i>Haplopappus spinulosus</i>  | Spiny ironweed      |
| He hi | <i>Hedeoma hispida</i>         | Rough pennyroyal    |
| He an | <i>Helianthus annuus</i>       | Common sunflower    |
| He ri | <i>Helianthus rigidus</i>      | Stiff sunflower     |
| Ko sc | <i>Kochia scoparia</i>         | Kochia              |
| La ob | <i>Lactuca oblongifolia</i>    | Blue wild lettuce   |
| La se | <i>Lactuca serriola</i>        | Prickly lettuce     |
| Le de | <i>Lepidium densiflorum</i>    | Peppergrass         |
| Li pu | <i>Liatris punctata</i>        | Blazing star        |

**Forbs (Continued):**

|       |                                |                             |
|-------|--------------------------------|-----------------------------|
| Li ri | <i>Linum rigidum</i>           | Stiffstem flax              |
| Li in | <i>Lithospermum incisum</i>    | Narrow-leaved puccoon       |
| Lo am | <i>Lotus americanus</i>        | Prairie bird's foot trefoil |
| Ly ju | <i>Lygodesmia juncea</i>       | Skeleton weed               |
| Me fa | <i>Medicago falcata</i>        | Travois alfalfa             |
| Me of | <i>Melilotus officinalis</i>   | Yellow sweetclover          |
| Mu di | <i>Musineon divaricatum</i>    | Wild parsley                |
| Ne pa | <i>Neslia paniculata</i>       | Ball mustard                |
| Oe bi | <i>Oenothera biennis</i>       | Common evening primrose     |
| Op fr | <i>Opuntia fragilis</i>        | Brittle prickly pear        |
| Ox la | <i>Oxytropis lambertii</i>     | Purple loco                 |
| Pe al | <i>Penstemon albidus</i>       | White beardtongue           |
| Pe pu | <i>Petalostemon purpureum</i>  | Purple prairie aster        |
| Ph ho | <i>Phlox hoodii</i>            | Moss phlox                  |
| Pl pu | <i>Plantago purshii</i>        | Woolly plantain             |
| Po al | <i>Polygala alba</i>           | White milkwort              |
| Po co | <i>Polygonum convolvulus</i>   | Wild buckwheat              |
| Po pe | <i>Potentilla pensylvanica</i> | Potentilla                  |
| Ps ar | <i>Psoralea argophylla</i>     | Silverleaf scurfpea         |
| Ps es | <i>Psoralea esculenta</i>      | Indian breadroot            |
| Ra co | <i>Ratibida columnifera</i>    | Long headed coneflower      |
| Sa ka | <i>Salsola kali</i>            | Russian thistle             |
| So mi | <i>Solidago missouriensis</i>  | Early goldenrod             |
| So mo | <i>Solidago mollis</i>         | Soft goldenrod              |
| So ri | <i>Solidago rigida</i>         | Stiff goldenrod             |
| Sp co | <i>Sphaeralcea coccinea</i>    | Scarlet globemallow         |
| Ta of | <i>Taraxacum officinale</i>    | Dandelion                   |
| Tr du | <i>Tragopogon dubius</i>       | Large goatsbeard            |
| Ve fa | <i>Vernonia fasciculata</i>    | Ironweed                    |
| Vi am | <i>Vicia americana</i>         | Wild vetch                  |
| Vi pe | <i>Viola pedatifida</i>        | Prairie violet              |

**Shrubs:**

|       |                             |                   |
|-------|-----------------------------|-------------------|
| Ar uv | Arctostaphylos uva-ursi     | Bearberry         |
| Rh tr | Rhus trilobata              | Skunk bush        |
| Ro ar | Rosa arkansana              | Prairie wild rose |
| Sy oc | Symphoricarpos occidentalis | Wolfberry         |

**Lycopods:**

|       |                   |           |
|-------|-------------------|-----------|
| Se de | Selaginella densa | Club moss |
|-------|-------------------|-----------|

**Eumycota:**

|         |                    |         |
|---------|--------------------|---------|
| Li spp. | Species of lichens | Lichens |
|---------|--------------------|---------|

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## ALFALFA INTERSEEDED PASTURE GRAZING TRIAL - 1984

### DICKINSON EXPERIMENT STATION

L. Manske

The alfalfa interseeded pasture grazing trial was seeded in May of 1977. A pasture type alfalfa (Travois) was interseeded into 10 acres of mixed grass prairie using a mechanical sod control method. The seeding rate was 4 pounds per acre. An 18 acre pasture with no treatment was used as the control. The number of cow-calf pairs grazed in the pastures varied from year to year (10 in 1978, 1979, and 1982, 8 in 1981 and 1984, and 7 in 1980) but the number remained constant on both pastures. The alfalfa interseeded pasture was not grazed in 1982 and data was not collected on either pasture in 1983. Stocking rates varied by pasture size and length of grazing period.

The soils of the pastures were fine sandy loams. These soils were predominantly sandy range sites.

The species composition was mixed grass prairie dominated with blue grama (Bouteloua gracilis), sun sedge (Carex heliophila), prairie junegrass (Koeleria pyramidata), western wheatgrass (Agropyron smithii), and needleandthread (Stipa comata).

Herbage production was determined by clipping the vegetation to ground level inside one-third meter square quadrats both inside and outside exclosure cages. The herbage samples were then oven dried at 175°F (80°C) and weighted to give oven dried above ground herbage production.

Cow and calf performance was determined by individual weight gains or losses. Cattle were weighted on and off each pasture. These data were converted into mean weight gain in pounds per day per head and mean weight gain in pounds per day per acre for the calves and cows.

Herbage production for the alfalfa interseeded and control pastures are included in Table 1. The mean total herbage production was 1246 and 3694 pounds per acre for the untreated control and alfalfa interseeded pastures respectively. Interseeding alfalfa increased the mean total herbage production by 196.4% above the untreated control. The alfalfa comprised 71% of the total.

Animal performance for the alfalfa interseeded and control pastures are included in Table 2. Calf daily gains per head were good on both the alfalfa interseeded and control pastures with 2.27 and 2.01 pounds respectively. The calf daily gains per head were 13% greater on the alfalfa interseeded pasture. The calf daily gains per acre were 1.81 and 0.89 pounds on the alfalfa interseeded and control pastures respectively. This gain per acre was 103% greater on the alfalfa interseeded pasture.

Cow performance on the alfalfa interseeded pasture was good with a daily gain per head of 1.11 pounds and a daily gain per acre of 0.89 pounds. The mean daily gain per head was 0.16 pounds and the mean daily gain per acre was 0.07 pounds for the cows on the control pasture. Generally cows lose weight on native range pastures in western North Dakota after 15 August. Five of the 8 cows on the control pasture lost an average of 0.51 pounds per day for the 36 day grazing period. The other 3 cows gained weight at the rate of 1.27 pounds per day. All of the eight cows on the alfalfa interseeded pasture gained weight for the same grazing period.

The stocking rates for the alfalfa interseeded and control pastures were 0.94 and 0.52 AUM's per acre respectively. The stocking rate was 81% greater on the alfalfa interseeded pasture. The mean stocking rate from 1978 to 1984 has been increased by 41% on the alfalfa interseeded pasture over the control pasture.

Interseeding of alfalfa into native range pastures shows considerable promise as a management tool for western North Dakota. The alfalfa interseeded pasture has greater herbage production, greater calf and cow gains per head and per acre, and higher stocking rates than the control native range pasture.

**Table 1. Mean Herbage Production and Utilization on the Alfalfa Interseeding Study, Dickinson Experiment Station, 1984**

| Pasture               | Herbage Production<br>(lbs/acre) |                    |                  | % Utilization |
|-----------------------|----------------------------------|--------------------|------------------|---------------|
|                       | 12 Jul<br>Pre grazed             | 24 Aug<br>Ungrazed | 24 Aug<br>Grazed |               |
|                       |                                  |                    |                  |               |
| Native Range Control: |                                  |                    |                  |               |
| Cool Short            | 225.28                           | 200.43             | 52.69            | 73.71         |
| Warm Short            | 89.77                            | 118.57             | 77.17            | 34.92         |
| Cool Mid              | 85.54                            | 61.63              | 18.35            | 70.23         |
| Western Wheatgrass    | 40.09                            | 35.29              | 10.82            | 69.34         |
| Warm Mid              | 0.00                             | 0.00               | 0.00             | 0.00          |
| Warm Tall             | 66.11                            | 170.32             | 63.52            | 62.71         |
| Introduced Grass      | 0.00                             | 0.00               | 0.00             | 0.00          |
| Sedge                 | 320.70                           | 576.83             | 251.25           | 56.44         |
|                       |                                  |                    |                  |               |
| Total Grass           | 827.49                           | 1163.07            | 473.80           | 59.26         |
|                       |                                  |                    |                  |               |
| Forbs                 | 156.11                           | 83.28              | 108.69           | -30.51        |
| Shrubs                | 0.00                             | 0.00               | 0.00             | 0.00          |
| Alfalfa               | 0.00                             | 0.00               | 0.00             | 0.00          |
|                       |                                  |                    |                  |               |
| TOTAL                 | 983.60                           | 1246.35            | 582.49           | 53.26         |
|                       |                                  |                    |                  |               |
| Alfalfa Interseeded:  |                                  |                    |                  |               |
| Cool Short            | 269.88                           | 100.69             | 25.41            | 74.76         |
| Warm Short            | 79.05                            | 139.27             | 64.93            | 53.38         |
| Cool Mid              | 154.13                           | 120.92             | 40.94            | 66.14         |
| Western Wheatgrass    | 201.57                           | 143.50             | 59.28            | 58.69         |
| Warm Mid              | 0.00                             | 4.71               | 0.94             | 80.04         |
| Warm Tall             | 0.00                             | 6.59               | 4.71             | 28.53         |
| Introduced Grass      | 259.72                           | 0.00               | 0.00             | 0.00          |
| Sedge                 | 257.74                           | 283.71             | 196.20           | 30.85         |
|                       |                                  |                    |                  |               |
| Total Grass           | 1222.09                          | 799.39             | 392.41           | 50.91         |
|                       |                                  |                    |                  |               |
| Forbs                 | 176.15                           | 266.30             | 160.91           | 39.58         |
| Shrubs                | 0.00                             | 0.00               | 0.00             | 0.00          |
| Alfalfa               | 2282.11                          | 2628.22            | 1974.22          | 24.88         |
|                       |                                  |                    |                  |               |
| TOTAL                 | 3680.35                          | 3693.91            | 2527.54          | 31.58         |

**Table 2. Mean Weight Gains for Calves and Cows on the Alfalfa Interseeding Study, Dickinson Experiment Station, 1984**

| <b>Pasture</b>               | <b>Mean Initial Weight</b> | <b>Mean Final Weight</b> | <b>Mean Gain Per Head</b> | <b>Mean Gain Per Day Per Head</b> | <b>Mean Gain Per Day Per Acre</b> |
|------------------------------|----------------------------|--------------------------|---------------------------|-----------------------------------|-----------------------------------|
|                              |                            |                          |                           |                                   |                                   |
| <b>Native Range Control:</b> |                            |                          |                           |                                   |                                   |
|                              |                            |                          |                           |                                   |                                   |
| Calf                         | 263                        | 336                      | 72.38                     | 2.01                              | 0.89                              |
|                              |                            |                          |                           |                                   |                                   |
| Cow                          | 1044                       | 1049                     | 5.63                      | 0.16                              | 0.07                              |
|                              |                            |                          |                           |                                   |                                   |
| <b>Alfalfa Interseeded:</b>  |                            |                          |                           |                                   |                                   |
|                              |                            |                          |                           |                                   |                                   |
| Calf                         | 265                        | 347                      | 81.50                     | 2.27                              | 1.81                              |
|                              |                            |                          |                           |                                   |                                   |
| Cow                          | 1093                       | 1133                     | 40.00                     | 1.11                              | 0.89                              |

**Table 3. The Rotation Dates and Stocking Pressure Data for the Control, and the Alfalfa Interseeded Treatments on Native Range at Dickinson Experiment Station, 1978-1984**

| <b>Treatment Year</b>        | <b>Pasture Size Acres</b> | <b>Dates Pasture Grazed</b>    | <b>Days In Period</b> | <b>No. of Head</b>                  | <b>No. Of AUM's</b> | <b>Stocking Rate AUM/Acre</b> |
|------------------------------|---------------------------|--------------------------------|-----------------------|-------------------------------------|---------------------|-------------------------------|
| <b>Native Range Control:</b> |                           |                                |                       |                                     |                     |                               |
| 1978                         | 18                        | 19 Jun-14 Aug                  | 56                    | 10 cow-calf<br>1 bull               | 20.20               | 1.12                          |
| 1979                         | 18                        | 22 Jun-20 Jul                  | 28                    | 10 cow-calf<br>1 bull               | 10.10               | 0.56                          |
| 1980                         | 18                        | 7 Jul-23 Jul                   | 16                    | 7 cow-calf<br>1 bull                | 4.20                | 0.23                          |
| 1981                         | 18                        | 24 Jun-28 Jul                  | 35                    | 8 cow-calf<br>1 bull                | 10.33               | 0.57                          |
| 1982                         | 18                        | 21 Jun-20 Aug<br>21 Jun- 4 Aug | 60<br>44              | 10 cow-calf<br>1 bull               | 21.11               | 1.17                          |
| 1983                         | 18                        | 12 Jul- 3 Aug                  | 22                    | 5 cow-4 calf<br>21 heifer<br>1 bull | 15.69               | 0.87                          |
| 1984                         | 18                        | 19 Jul-24 Aug                  | 36                    | 8 cow-calf                          | 9.44                | 0.52                          |
| <b>Alfalfa Interseeded:</b>  |                           |                                |                       |                                     |                     |                               |
| 1978                         | 10                        | 19 Jun- 7 Aug                  | 49                    | 10 cow-calf<br>1 bull               | 17.67               | 1.77                          |
| 1979                         | 10                        | 22 Jun-20 Jul                  | 28                    | 10 cow-calf<br>1 bull               | 10.10               | 1.01                          |
| 1980                         | 10                        | 7 Jul-16 Jul                   | 9                     | 7 cow-calf<br>1 bull                | 2.36                | 0.24                          |
| 1981                         | 10                        | 24 Jun-21 Jul                  | 28                    | 8 cow-calf<br>1 bull                | 8.26                | 0.83                          |
| 1982                         | 10                        |                                | 0                     | 0                                   | 0.0                 | 0.0                           |
| 1983                         | 10                        | 12 Jul- 3 Aug                  | 22                    | 14 cow-11 calf<br>1 bull            | 10.82               | 1.08                          |
| 1984                         | 10                        | 19 Jul-24 Aug                  | 36                    | 8 cow-calf                          | 9.44                | 0.94                          |

## ALFALFA VARIETY TRIAL, 1980 - 1984

Dickinson Experiment Station  
L. Manske and H. Goetz

An alfalfa variety trial was seeded at the Dickinson Experiment Station in May 1979. The 10 x 25 foot plots were arranged in a randomized block design with four replications. The trial was designed to evaluate the performance of the varieties in western North Dakota on the basis of dry weight herbage production and compared to a standard variety (Vernal). Four pasture type, sixteen dryland hay type and one hay and pasture type varieties were included in the trial. One cutting in late June or early July has been made annually since 1980.

The annual above ground dry weight herbage production for each variety and the percentage of production compared to a standard variety (Vernal) are shown in Table 1. The five highest producing varieties for 1980 were Norseman, Ranger, Kane, Iroquois, and Rangeland with 445, 403, 402, 401 and 400 pounds of herbage production per acre respectively. The five highest producing varieties for 1981 were Anik, D-111, Baker, Kane, and Rangeland with 1978, 1747, 1662, 1655, and 1642 pounds of herbage per acre. The five highest producing varieties for 1982 were Kane, Spredor II, Norseman, Travois, and Rangeland with 6139, 5260, 5210, 5077 and 4981 pounds of herbage production per acre respectively. The five highest producing varieties for 1983 were 520, Kane, 524, Baker and D-111 with 6342, 6135, 5896, 5865 and 5442 pounds per acre of herbage production respectively. The five highest producing varieties for 1984 were Norseman, Ladak-65, Rangeland, Polar I and Thor with 4899, 4884, 4755, 4607 and 4554 pounds per acre of herbage production respectively.

The production data from this trial has shown that there was very little difference between most of the alfalfa varieties that were included. The five year (1980-1984) mean annual production for all the varieties was 3150 pounds per acre. The five varieties with the greatest five year mean annual production were Kane (3752 lbs/acre), Ladak 65 (3369 lbs/acre), Rangeland (3358 lbs/acre), Norseman (3322 lbs/acre) and 520 (3273 lbs/acre). The two varieties with the lowest five year mean annual production were Agate (2636 lbs/acre) and Trek (2933 lbs/acre). The standard variety (Vernal) ranked thirteenth out of twenty one varieties with a five year mean annual production of 3112 lbs/acre.

The five year mean production for the pasture type varieties was 3341 lbs/acre. This was 7.4 percent greater than mean production for the hay type varieties which was 3115 lbs/acre (Table 2). The pasture type varieties have had a slightly greater production than the hay type varieties each year of the trial (Table 2).

The alfalfa varieties were separated into three winterhardy categories based on their reported adaptability to survive the winter period. These categories were: very winterhardy, winterhardy, and moderately winterhardy. All of the pasture type alfalfas were very winterhardy. Three of the dryland hay type varieties were very winterhardy, one variety was moderately winterhardy and twelve hay type varieties were winterhardy. One variety was a hay and pasture type. This hay and pasture type variety was very winterhardy. The five year mean production for the very winterhardy, the winterhardy and the moderately winterhardy categories were 3238, 3101 and 3042 pounds per acre respectively (Table 3). The very winterhardy category had the greatest herbage production in 1980, 1982 and the five year mean. The winterhardy category had the greatest herbage production in 1983. The moderately winterhardy

category had the greatest production in 1981 and 1984 but it has had the lowest production in 1980, 1982, 1983 and the five year mean (Table 3). Most of the varieties in the trial performed satisfactorily under the environmental conditions of western North Dakota during this trial. Twelve of the twenty one varieties had greater five year mean annual herbage production than the standard variety (Vernal). All of the varieties had five year mean production of over 3300 lbs/acre. Two of these varieties were pasture types and the other two were hay types. Three of the four were very winterhardy and one was winterhardy.

Most of the varieties have had very good herbage production during the 1982, 1983 and 1984 growing seasons. Fifteen varieties have three year mean annual herbage production of over 4500 lbs/acre, six varieties have over 4800 lbs/acre, and two varieties have over 5000 lbs/acre. The six varieties with the greatest three year (1982-1984) mean annual herbage production were Kane, Ladak 65, Rangeland, 520, Norseman, and Polar I with 5567, 5034, 4910, 4901, 4870 and 4860 pounds per acre respectively.

Plant density and mean dry weight per plant data were collected in 1983 and 1984 for each variety (Table 4). The five varieties with the greatest number of plants per square foot were Anik, Rangeland, Kane, Spredor II and Ramsey with 3.92, 3.87, 3.64, 3.53 and 3.45 plants per foot squared respectively. The five varieties with the lowest plant densities were Trek, Polar I, D-111, Thor and 520 with 2.59, 2.61, 2.71, 2.88 and 2.93 plants per foot squared respectively. The five varieties with the greatest mean weight per plant were Polar I, 520, Thor, D-111 and Trek with 0.72, 0.67, 0.66, 0.63 and 0.62 ounces per plant respectively. The four varieties with the lowest mean plant weight were Anik, Rangeland, Agate and Ramsey with 0.45, 0.46, 0.47 and 0.49 ounces per plant respectively. Generally the varieties with the higher plant densities had the lower mean plant dry weights and the varieties with the lower plant densities had the greatest mean plant weights.

Plant densities for the pasture type and dryland hay type varieties (Table 5) were 3.60 and 3.06 plants per foot squared respectively. The mean weight per plant for the pasture and hay type varieties were 0.50 and 0.58 ounces respectively. The pasture type alfalfa varieties had a slightly greater plant density per foot squared, a slightly lower mean weight per plant and a slightly greater herbage production per acre than the hay type alfalfa varieties. The plant densities for the very winterhardy, the winterhardy, and the moderately winterhardy categories were 3.52, 3.02 and 2.88 respectively (Table 6). The mean weight per plant for the very winterhardy, the winterhardy, and the moderately winterhardy categories were 0.51, 0.58 and 0.66 ounces respectively (Table 6). The very winterhardy varieties had the greatest plant density per foot squared, the lowest mean weight per plant and the greatest mean herbage production per acre. The moderately winterhardy varieties had the lowest plant density, the greatest mean plant weight and the lowest mean herbage production per acre. The winterhardy varieties were intermediate between the very winterhardy varieties and the moderately winterhardy varieties in plant density, mean plant weight and herbage production per acre. Most of the varieties in the trial performed very similarly. There was very little actual significant difference between the performance of any of the varieties. Only one variety (Kane) has had an annual mean herbage production of significant difference from the standard variety (Vernal). Vernal has performed satisfactorily in western North Dakota and any variety selected to be seeded should have tested performance as good or better than Vernal. These plots were established in 1979 and have been stressed by drought conditions. Western North Dakota is subjected to drought and harsh winter conditions on an irregular basis. These conditions should be considered when selecting alfalfa varieties.

**Table 1. Alfalfa Variety Trial at the Dickinson Experiment Station, 1980 – 1984<sup>1</sup>**

| Variety     | 1980<br>Clip-27 Jun                  |             | 1981<br>Clip-23 Jun                  |             | 1982<br>Clip-2 Jul                   |             | 1983<br>Clip-1 Jul                   |             | 1984<br>Clip-3 Jul                   |             | 1980 - 1984<br>Mean     |             |
|-------------|--------------------------------------|-------------|--------------------------------------|-------------|--------------------------------------|-------------|--------------------------------------|-------------|--------------------------------------|-------------|-------------------------|-------------|
|             | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre | %<br>Vernal |
| Agate       | 329 abcd                             | 88          | 1401 cdef                            | 89          | 3832 e                               | 86          | 3912 c                               | 81          | 3705 ab                              | 85          | 2636                    | 85          |
| Anik        | 171 f                                | 46          | 1978 bcde                            | 126         | 4563 bcde                            | 103         | 4459 bc                              | 92          | 3892 ab                              | 89          | 3013                    | 97          |
| Baker       | 233 def                              | 63          | 1662 bc                              | 106         | 4011 de                              | 91          | 5865 ab                              | 121         | 3966 ab                              | 91          | 3147                    | 101         |
| D-111       | 295 bcdef                            | 79          | 1747 ab                              | 111         | 3944 de                              | 89          | 5442 abc                             | 113         | 4316 ab                              | 99          | 3149                    | 101         |
| Iroquois    | 401 ab                               | 108         | 1422 bcdef                           | 90          | 4794 bcde                            | 108         | 3744 c                               | 77          | 4489 ab                              | 103         | 2970                    | 95          |
| Kane        | 402 ab                               | 108         | 1655 bcd                             | 105         | 6139 a                               | 139         | 6135 ab                              | 126         | 4428 ab                              | 102         | 3752                    | 121         |
| Ladak       | 320 abcd                             | 86          | 1351 cdef                            | 86          | 4796 bcde                            | 108         | 4414 bc                              | 91          | 4546 ab                              | 104         | 3085                    | 99          |
| Ladak-65    | 337 abcd                             | 91          | 1407 bcdef                           | 90          | 4785 bcde                            | 108         | 5433 abc                             | 112         | 4884 a                               | 112         | 3369                    | 108         |
| Norseman    | 445 a                                | 120         | 1556 bcde                            | 99          | 5210 b                               | 118         | 4495 bc                              | 93          | 4899 a                               | 113         | 3321                    | 107         |
| Nugget      | 374 abc                              | 101         | 1391 bcdef                           | 88          | 4558 bcde                            | 103         | 4338 bc                              | 90          | 4549 ab                              | 105         | 3042                    | 98          |
| Polar I     | 244 cdef                             | 66          | 1519 bcdef                           | 97          | 4695 bcde                            | 106         | 5277 abc                             | 109         | 4607 ab                              | 106         | 3268                    | 105         |
| Ramsey      | 307 bcd                              | 83          | 1195 f                               | 76          | 4804 bcde                            | 108         | 5187 abc                             | 107         | 4094 ab                              | 94          | 3117                    | 100         |
| Rangelander | 400 ab                               | 108         | 1642 bcd                             | 104         | 4981 bcd                             | 112         | 5010 abc                             | 104         | 4755 ab                              | 109         | 3358                    | 108         |
| Ranger      | 403 ab                               | 108         | 1239 ef                              | 79          | 4455 bcde                            | 101         | 5243 abc                             | 108         | 4540 ab                              | 104         | 3176                    | 102         |
| Spredor II  | 369 abc                              | 99          | 1289 cdef                            | 82          | 5260 b                               | 119         | 4575 abc                             | 95          | 4289 ab                              | 99          | 3156                    | 101         |
| Thor        | 284 bcdef                            | 76          | 1554 bcde                            | 99          | 4158 cde                             | 94          | 4662 abc                             | 96          | 4554 ab                              | 105         | 3042                    | 98          |
| Travois     | 372 abc                              | 100         | 1277 def                             | 81          | 5077 bc                              | 115         | 4659 abc                             | 96          | 4097 ab                              | 94          | 3096                    | 100         |
| Trek        | 335 abcd                             | 90          | 1362 cdef                            | 87          | 4282 bcde                            | 97          | 5124 abc                             | 106         | 3561 b                               | 82          | 2933                    | 94          |
| Vernal      | 372 abc                              | 100         | 1572 bcdef                           | 100         | 4425 bcde                            | 100         | 4838 abc                             | 100         | 4353 ab                              | 100         | 3112                    | 100         |
| 520         | 180 ef                               | 48          | 1485 bcdef                           | 94          | 4274 bcde                            | 96          | 6342 a                               | 131         | 4086 ab                              | 94          | 3273                    | 105         |
| 524         | 339 abcd                             | 91          | 1518 bcdef                           | 97          | 4121 cde                             | 93          | 5896 ab                              | 122         | 3820 ab                              | 88          | 3139                    | 101         |

<sup>1</sup>Means within columns followed by the same letter are not significantly different by Duncans multiple range test at P<0.05.

**Table 2. Mean Herbage Production (lbs. / acre) for the Pasture and Dryland Hay Type Alfalfa Varieties at the Dickinson Experiment Station, 1980-1984**

| <b>Type Alfalfa</b> | <b>1980</b> | <b>1981</b> | <b>1982</b> | <b>1983</b> | <b>1984</b> | <b>Mean</b> |
|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                     |             |             |             |             |             |             |
| Pasture             | 386         | 1466        | 5364        | 5095        | 4392        | 3341        |
|                     |             |             |             |             |             |             |
| Hay                 | 345         | 1461        | 4447        | 5013        | 4311        | 3115        |
|                     |             |             |             |             |             |             |
| Hay and Pasture     | 171         | 1978        | 4563        | 4459        | 3892        | 3013        |

**Table 3. Mean Herbage Production (lbs. / acre) for the Alfalfa Variety in Three Winterhardy Categories at the Dickinson Experiment Station, 1980-1984**

| <b>Winterhardy Category</b> | <b>1980</b> | <b>1981</b> | <b>1982</b> | <b>1983</b> | <b>1984</b> | <b>Mean</b> |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                             |             |             |             |             |             |             |
| Very Winterhardy            | 348         | 1493        | 5104        | 4867        | 4376        | 3238        |
|                             |             |             |             |             |             |             |
| Winterhardy                 | 320         | 1477        | 4348        | 5121        | 4240        | 3101        |
|                             |             |             |             |             |             |             |
| Moderately Winterhardy      | 284         | 1554        | 4158        | 4662        | 4554        | 3042        |

**Table 4. The Density of Plants and the Mean Dry Weight per Plant at the Dickinson Experiment Station, 1983-1984**

|                  | 1983                               |                                  |  | 1984                               |                                  |  | Mean                               |                                  |
|------------------|------------------------------------|----------------------------------|--|------------------------------------|----------------------------------|--|------------------------------------|----------------------------------|
| <b>Varieties</b> | <b># of<br/>Plt. /<br/>Ft. sq.</b> | <b>Wt. /<br/>Plt.<br/>In oz.</b> |  | <b># of<br/>Plt. /<br/>Ft. sq.</b> | <b>Wt. /<br/>Plt.<br/>In oz.</b> |  | <b># of<br/>Plt. /<br/>Ft. sq.</b> | <b>Wt. /<br/>Plt.<br/>In oz.</b> |
| Agate            | 3.81                               | 0.43                             |  | 2.65                               | 0.51                             |  | 3.23                               | 0.47                             |
| Anik             | 4.90                               | 0.41                             |  | 2.93                               | 0.48                             |  | 3.92                               | 0.45                             |
| Baker            | 3.63                               | 0.59                             |  | 2.65                               | 0.55                             |  | 3.14                               | 0.57                             |
| D-111            | 3.04                               | 0.59                             |  | 2.37                               | 0.66                             |  | 2.71                               | 0.63                             |
| Iroquois         | 3.28                               | 0.57                             |  | 2.79                               | 0.59                             |  | 3.04                               | 0.58                             |
| Kane             | 4.21                               | 0.48                             |  | 3.07                               | 0.53                             |  | 3.64                               | 0.51                             |
| Ladak            | 3.26                               | 0.57                             |  | 2.70                               | 0.62                             |  | 2.98                               | 0.60                             |
| Ladak 65         | 3.88                               | 0.50                             |  | 2.93                               | 0.61                             |  | 3.41                               | 0.56                             |
| Norseman         | 4.12                               | 0.40                             |  | 2.65                               | 0.67                             |  | 3.39                               | 0.54                             |
| Nugget           | 3.07                               | 0.55                             |  | 3.02                               | 0.55                             |  | 3.05                               | 0.55                             |
| Polar I          | 3.07                               | 0.65                             |  | 2.14                               | 0.79                             |  | 2.61                               | 0.72                             |
| Ramsey           | 3.91                               | 0.48                             |  | 2.98                               | 0.50                             |  | 3.45                               | 0.49                             |
| Rangelander      | 4.21                               | 0.42                             |  | 3.53                               | 0.49                             |  | 3.87                               | 0.46                             |
| Ranger           | 3.35                               | 0.53                             |  | 3.07                               | 0.54                             |  | 3.21                               | 0.54                             |
| Spredor II       | 4.03                               | 0.47                             |  | 3.02                               | 0.52                             |  | 3.53                               | 0.50                             |
| Thor             | 3.75                               | 0.48                             |  | 2.00                               | 0.83                             |  | 2.88                               | 0.66                             |
| Travois          | 4.16                               | 0.46                             |  | 2.56                               | 0.58                             |  | 3.36                               | 0.52                             |
| Trek             | 2.95                               | 0.65                             |  | 2.23                               | 0.58                             |  | 2.59                               | 0.62                             |
| Vernal           | 3.35                               | 0.55                             |  | 2.98                               | 0.53                             |  | 3.17                               | 0.54                             |
| 520              | 3.10                               | 0.80                             |  | 2.75                               | 0.54                             |  | 2.93                               | 0.67                             |
| 524              | 3.63                               | 0.55                             |  | 2.65                               | 0.53                             |  | 3.14                               | 0.54                             |

**Table 5. Mean Density of Plants and the Mean Dry Weight per Plant for the Pasture and Dryland Hay Type Alfalfa Varieties at the Dickinson Experiment Station, 1983-1984**

|                 | 1983                     |                        |  | 1984                     |                        |  | Mean                     |                        |
|-----------------|--------------------------|------------------------|--|--------------------------|------------------------|--|--------------------------|------------------------|
| Type Alfalfa    | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |
| Pasture         | 4.15                     | 0.46                   |  | 3.05                     | 0.53                   |  | 3.60                     | 0.50                   |
| Hay             | 3.45                     | 0.56                   |  | 2.66                     | 0.60                   |  | 3.06                     | 0.58                   |
| Hay and Pasture | 4.90                     | 0.41                   |  | 2.93                     | 0.48                   |  | 3.92                     | 0.45                   |

**Table 6. Mean Density of Plants and the Mean Dry Weight per Plant for the Alfalfa Varieties in Three Winterhardy Categories at the Dickinson Experiment Station, 1983 – 1984**

|                        | 1983                     |                        |  | 1984                     |                        |  | Mean                     |                        |
|------------------------|--------------------------|------------------------|--|--------------------------|------------------------|--|--------------------------|------------------------|
| Winterhardy Category   | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |
| Very Winterhardy       | 4.10                     | 0.46                   |  | 2.93                     | 0.55                   |  | 3.52                     | 0.51                   |
| Winterhardy            | 3.35                     | 0.58                   |  | 2.69                     | 0.58                   |  | 3.02                     | 0.58                   |
| Moderately Winterhardy | 3.75                     | 0.48                   |  | 2.00                     | 0.83                   |  | 2.88                     | 0.66                   |

## ALFALFA VARIETY TRIAL, 1982 - 1984

Hettinger Experiment Station

L. Manske and H. Goetz

An alfalfa variety trial was seeded at the Hettinger Experiment Station in May 1981. The 10 x 25 foot plots were arranged in a randomized block design with three replications. The alleys between the replications were five feet wide. The trial was designed to evaluate the performance of the varieties in southwestern North Dakota on the basis of dry weight herbage production and compared to a standard variety (Vernal). Six pasture type, nineteen dryland hay type and two hay and pasture type varieties were included in the trial. One cutting in late June or early July has been made annually since 1982.

The annual above ground dry weight herbage production for each variety and the percentage of production compared to a standard variety (Vernal) are shown in Table 1. The five highest producing varieties for 1982 were Prowler, Travois, Spredor II, Nugget, and Iroquois with 5244, 5191, 4986, 4790 and 4782 pounds of herbage production per acre respectively. The five highest producing varieties for 1983 were Nugget, Drylander, Prowler, Ladak 65 and Spredor II with 6071, 5528, 5212, 5114 and 5079 pounds per acre of herbage production respectively. The five highest producing varieties for 1984 were Spredor II, Drylander, Norseman, Vernal and Travois and D-111 with 4564, 4267, 3848, 3619 and 3509 pounds per acre of herbage production respectively.

The production data from this trial has shown that there was very little difference between most of the alfalfa varieties that were included. The three year (1982-1984) mean annual production for all the varieties was 4047 pounds per acre. The five varieties with the greatest three year mean annual production were Spredor II (4876 lbs/acre), Drylander (4800 lbs/acre), Nugget (4611 lbs/acre), Prowler (4545 lbs/acre) and Ladak 65 (4284 lbs/acre). The standard variety (Vernal) ranked twentieth out of twenty seven varieties with a three year mean annual production of 3841 lbs/acre.

The three year mean production for the pasture type varieties was 4368 lbs/acre. This was 10.2 percent greater than mean production for the hay type varieties which was 3964 lbs/acre (Table 2). The pasture type varieties have had a slightly greater production than the hay type varieties each year of the trial (Table 2).

The alfalfa varieties were separated into three winterhardy categories based on their reported adaptability to survive the winter period. These categories were: very winterhardy, winterhardy, and moderately winterhardy. All of the pasture type alfalfas were very winterhardy. Two of the dryland hay type varieties were very winterhardy, five varieties were moderately winterhardy and twelve hay type varieties were winterhardy. Two varieties were hay and pasture type varieties. One of these hay and pasture type varieties was winterhardy and the other was moderately winterhardy. The three year mean production for the very winterhardy, the winterhardy and the moderately winterhardy categories were 4255, 4050 and 3765 pounds per acre respectively (Table 3). The very winterhardy category had the greatest mean herbage production for each year of this trial. The moderately winterhardy category had the lowest mean herbage production in each year.

All of the varieties in the trial performed satisfactorily under the environmental conditions of southwestern North Dakota during this trial. All of the varieties had three year mean herbage production of greater than 3500 lbs/acre. Four varieties had three year mean production of over 4500 lbs/acre.

Plant density and mean dry weight per plant data were collected in 1983 and 1984 for each variety (Table 4). The five varieties with the greatest number of plants per square foot were Magnum, Ladak 65, 520, 532 and Ranger with 4.99, 4.34, 4.25 and 4.19 plants per foot squared respectively. The five varieties with the lowest plant densities were Polar I, Drylander, Trek, D-111 and Kane with 3.04, 3.38, 3.44, 3.50 and 3.51 plants per foot squared respectively. The five varieties with the greatest mean weight per plant were Drylander, Polar I, Spredor II, D-111 and Perry with 0.65, 0.47, .046, 0.43 and 0.43 ounces per plant respectively. The four varieties with the lowest mean plant weight were Magnum, AS-67, 532 and 520 with 0.25, 0.28, 0.31 and 0.33 ounces per plant respectively. Generally the varieties with the higher plant densities had the lower mean plant dry weights and the varieties with the lower plant densities had the greater mean plant weights.

Plant densities for the pasture type and dryland hay type varieties (Table 5) were 3.71 and 3.84 plants per foot squared respectively. The mean weight per plant for the pasture and hay type varieties were 0.45 and 0.37 ounces respectively. The pasture type alfalfa varieties had a slightly lower plant density per foot squared, a slightly greater mean weight per plant and a slightly greater herbage production per acre than the hay type alfalfa varieties.

The plant densities for the very winterhardy, the winterhardy, and the moderately winterhardy categories were 3.71, 3.77 and 4.08 respectively (Table 6). The mean weight per plant for the very winterhardy, the winterhardy, and the moderately winterhardy categories were 0.43, 0.39 and 0.33 ounces respectively (Table 6). The very winterhardy varieties had the lowest plant density per foot squared, the greatest mean weight per plant and the greatest herbage production per acre. The moderately winterhardy varieties had the greatest plant density, the lowest mean plant weight and the lowest herbage production per acre. The winterhardy varieties were intermediate between the very winterhardy varieties and the moderately winterhardy varieties in plant density, mean plant weight and herbage production per acre.

Most of the varieties in the trial performed very similarly. There was very little actual significant difference between the performance of any of the varieties. Only three varieties have had annual mean herbage production of significant difference from the standard variety (Vernal). Vernal has performed satisfactorily in western North Dakota and any variety selected to be seeded should have tested performance as good or better than Vernal. These plots were established in 1981 and have not been severely stressed by drought conditions nor harsh winter conditions. Southwestern North Dakota is subjected to drought and harsh winter conditions on an irregular basis. These conditions should be considered when selecting alfalfa varieties.

**Table 1. Alfalfa Variety Adaptation Trial, Hettinger Experiment Station, 1982-1984**

| Variety     | 1982<br>Clip-7 Jul                   |             | 1983<br>Clip-28 Jun                  |             | 1984<br>Clip-2 Jul                   |             | 1982 – 1984<br>Mean     |        |
|-------------|--------------------------------------|-------------|--------------------------------------|-------------|--------------------------------------|-------------|-------------------------|--------|
|             | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre <sup>1</sup> | %<br>Vernal | Total<br>Lbs. /<br>Acre | Vernal |
| Agate       | 3908 bcd                             | 104         | 4593 bc                              | 111         | 3164 bcd                             | 87          | 3888                    | 101    |
| AS-67       | 3923 bcd                             | 104         | 4222 bc                              | 102         | 2577 cd                              | 71          | 3574                    | 93     |
| Baker       | 4550 abcd                            | 121         | 4025 bc                              | 98          | 2994 bcd                             | 83          | 3856                    | 100    |
| D-111       | 3999 abcd                            | 106         | 4608 bc                              | 111         | 3509 abcd                            | 97          | 4039                    | 105    |
| Drylander   | 4604 abcd                            | 122         | 5528 ab                              | 134         | 4267 ab                              | 118         | 4800                    | 125    |
| Futura      | 4752 abcd                            | 126         | 3323 c                               | 80          | 3146 bcd                             | 87          | 3740                    | 97     |
| Iroquois    | 4782 abcd                            | 127         | 4474 bc                              | 108         | 3460 abcd                            | 96          | 4239                    | 110    |
| Kane        | 3644 d                               | 97          | 4246 bc                              | 103         | 3210 bcd                             | 89          | 3700                    | 96     |
| Ladak 65    | 4469 abcd                            | 119         | 5114 ab                              | 124         | 3270 abcd                            | 90          | 4284                    | 112    |
| Magnum      | 4507 abcd                            | 120         | 4265 bc                              | 104         | 2422 d                               | 67          | 3731                    | 97     |
| Norseman    | 4406 abcd                            | 117         | 4069 bc                              | 98          | 3848 abc                             | 106         | 4108                    | 107    |
| Nugget      | 4790 abcd                            | 127         | 6071 a                               | 147         | 2971 bcd                             | 82          | 4611                    | 120    |
| Perry       | 4478 abcd                            | 119         | 4313 bc                              | 104         | 3373 abcd                            | 93          | 4055                    | 106    |
| Polar I     | 4603 abcd                            | 122         | 4447 bc                              | 107         | 3154 bcd                             | 87          | 4068                    | 106    |
| Polar II    | 4016 abcd                            | 107         | 4036 bc                              | 98          | 3493 abcd                            | 97          | 3848                    | 100    |
| Prowler     | 5244 a                               | 139         | 5212 ab                              | 126         | 3178 bcd                             | 88          | 4545                    | 118    |
| Ramsey      | 4027 abcd                            | 107         | 4476 bc                              | 108         | 2680 cd                              | 74          | 3728                    | 97     |
| Rangelander | 4184 abcd                            | 111         | 4374 bc                              | 106         | 3489 abcd                            | 96          | 4016                    | 105    |
| Ranger      | 4298 abcd                            | 114         | 4092 bc                              | 99          | 3261 abcd                            | 90          | 3884                    | 101    |
| Spredor II  | 4986 abc                             | 132         | 5079 ab                              | 123         | 4564 a                               | 126         | 4876                    | 127    |
| Thor        | 4015 abcd                            | 107         | 4657 abc                             | 113         | 3320 abcd                            | 92          | 3997                    | 104    |
| Travois     | 5191 ab                              | 138         | 4109 bc                              | 99          | 3509 abcd                            | 97          | 4270                    | 111    |
| Trek        | 4162 abcd                            | 110         | 4013 bc                              | 97          | 2980 bcd                             | 82          | 3718                    | 97     |
| Vernal      | 3768 cd                              | 100         | 4137 bc                              | 100         | 3619 abcd                            | 100         | 3841                    | 100    |
| 520         | 4512 abcd                            | 120         | 4208 bc                              | 102         | 3385 abcd                            | 94          | 4035                    | 105    |
| 524         | 4440 abcd                            | 118         | 4568 bc                              | 110         | 3373 abcd                            | 93          | 4127                    | 107    |
| 532         | 3832 cd                              | 102         | 4165 bc                              | 101         | 3095 bcd                             | 86          | 3697                    | 96     |

<sup>1</sup>Means within columns followed by the same letter are not significantly different by Duncan's multiple range test at P<0.05.

**Table 2. Mean Herbage Production (Lbs. / Acre) For the Pasture and Dryland Hay Type Alfalfa Varieties at the Hettinger Experiment Station, 1982-1984**

| <b>Type Alfalfa</b> | <b>1982</b> | <b>1983</b> | <b>1984</b> | <b>Mean</b> |
|---------------------|-------------|-------------|-------------|-------------|
| Pasture             | 4642        | 4758        | 3703        | 4368        |
| Hay                 | 4312        | 4389        | 3191        | 3964        |
| Hay and Pasture     | 4155        | 4239        | 3234        | 3876        |

**Table 3. Mean Herbage Production (Lbs. / Acre) For the Alfalfa Varieties in Three Winterhardy Categories at the Hettinger Experiment Station, 1982-1984**

| <b>Winterhardy Category</b> | <b>1982</b> | <b>1983</b> | <b>1984</b> | <b>Mean</b> |
|-----------------------------|-------------|-------------|-------------|-------------|
| Very Winterhardy            | 4536        | 4636        | 3593        | 4255        |
| Winterhardy                 | 4366        | 4513        | 3270        | 4050        |
| Moderately Winterhardy      | 4174        | 4111        | 3009        | 3765        |

**Table 4. The Density of Plants and the Mean Dry Weight per Plant, 1983-1984**

| Varieties   | 1983                      |                         |  | 1984                      |                         |  | Mean                      |                         |
|-------------|---------------------------|-------------------------|--|---------------------------|-------------------------|--|---------------------------|-------------------------|
|             | # of<br>Plt. /<br>Ft. sq. | Wt. /<br>Plt.<br>In oz. |  | # of<br>Plt. /<br>Ft. sq. | Wt. /<br>Plt.<br>In oz. |  | # of<br>Plt. /<br>Ft. sq. | Wt. /<br>Plt.<br>In oz. |
| Agate       | 4.03                      | 0.44                    |  | 3.28                      | 0.35                    |  | 3.66                      | 0.40                    |
| AS-67       | 4.40                      | 0.32                    |  | 3.91                      | 0.24                    |  | 4.16                      | 0.28                    |
| Baker       | 3.97                      | 0.39                    |  | 3.91                      | 0.28                    |  | 3.94                      | 0.34                    |
| D-111       | 3.47                      | 0.50                    |  | 3.53                      | 0.36                    |  | 3.50                      | 0.43                    |
| Drylander   | 3.16                      | 0.75                    |  | 3.60                      | 0.55                    |  | 3.38                      | 0.65                    |
| Futura      | 3.66                      | 0.34                    |  | 3.41                      | 0.33                    |  | 3.54                      | 0.34                    |
| Iroquois    | 4.16                      | 0.40                    |  | 3.60                      | 0.35                    |  | 3.88                      | 0.38                    |
| Kane        | 3.23                      | 0.49                    |  | 3.78                      | 0.31                    |  | 3.51                      | 0.40                    |
| Ladak 65    | 4.28                      | 0.44                    |  | 4.40                      | 0.27                    |  | 4.34                      | 0.36                    |
| Magnum      | 5.14                      | 0.32                    |  | 4.84                      | 0.18                    |  | 4.99                      | 0.25                    |
| Norseman    | 3.04                      | 0.49                    |  | 4.03                      | 0.35                    |  | 3.54                      | 0.42                    |
| Nugget      | 4.77                      | 0.47                    |  | 3.16                      | 0.34                    |  | 3.97                      | 0.41                    |
| Perry       | 2.91                      | 0.58                    |  | 4.46                      | 0.28                    |  | 3.69                      | 0.43                    |
| Polar I     | 2.91                      | 0.57                    |  | 3.16                      | 0.36                    |  | 3.04                      | 0.47                    |
| Polar II    | 4.09                      | 0.38                    |  | 3.78                      | 0.34                    |  | 3.94                      | 0.36                    |
| Prowler     | 4.16                      | 0.46                    |  | 3.41                      | 0.34                    |  | 3.79                      | 0.40                    |
| Ramsey      | 3.97                      | 0.42                    |  | 3.84                      | 0.25                    |  | 3.91                      | 0.34                    |
| Rangelander | 4.34                      | 0.37                    |  | 2.73                      | 0.47                    |  | 3.54                      | 0.42                    |
| Ranger      | 4.46                      | 0.37                    |  | 3.91                      | 0.30                    |  | 4.19                      | 0.34                    |
| Spredor II  | 3.91                      | 0.48                    |  | 3.78                      | 0.44                    |  | 3.85                      | 0.46                    |
| Thor        | 3.53                      | 0.51                    |  | 3.66                      | 0.33                    |  | 3.60                      | 0.42                    |
| Travois     | 4.34                      | 0.36                    |  | 3.97                      | 0.32                    |  | 4.16                      | 0.34                    |
| Trek        | 3.16                      | 0.48                    |  | 3.72                      | 0.29                    |  | 3.44                      | 0.39                    |
| Vernal      | 3.28                      | 0.48                    |  | 3.81                      | 0.34                    |  | 3.55                      | 0.41                    |
| 520         | 4.59                      | 0.33                    |  | 3.91                      | 0.32                    |  | 4.25                      | 0.33                    |
| 524         | 3.53                      | 0.48                    |  | 3.53                      | 0.35                    |  | 3.53                      | 0.42                    |
| 532         | 4.46                      | 0.34                    |  | 4.03                      | 0.28                    |  | 4.25                      | 0.31                    |

**Table 5. Mean Density of Plants and the Mean Dry Weight per Plant for the Pasture and Dryland Hay Type Alfalfa Varieties at the Hettinger Experiment Station, 1983-1984**

| Type Alfalfa    | 1983                     |                        |  | 1984                     |                        |  | Mean                     |                        |
|-----------------|--------------------------|------------------------|--|--------------------------|------------------------|--|--------------------------|------------------------|
|                 | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |
| Pasture         | 3.86                     | 0.49                   |  | 3.55                     | 0.41                   |  | 3.71                     | 0.45                   |
|                 |                          |                        |  |                          |                        |  |                          |                        |
| Hay             | 3.92                     | 0.43                   |  | 3.76                     | 0.31                   |  | 3.84                     | 0.37                   |
|                 |                          |                        |  |                          |                        |  |                          |                        |
| Hay and Pasture | 3.69                     | 0.46                   |  | 4.25                     | 0.28                   |  | 3.97                     | 0.37                   |

**Table 6. Mean Density of Plants and the Mean Dry Weight per Plant for the Alfalfa Varieties In Three Winterhardy Categories at the Hettinger Experiment Station, 1983-1984**

| Winterhardy Category   | 1983                     |                       |  | 1984                     |                        |  | Mean                     |                        |
|------------------------|--------------------------|-----------------------|--|--------------------------|------------------------|--|--------------------------|------------------------|
|                        | Mean # of Plt. / Ft. sq. | Mean Wt./ Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |  | Mean # of Plt. / Ft. sq. | Mean Wt. / Plt. In oz. |
| Very Winterhardy       | 3.77                     | 0.48                  |  | 3.64                     | 0.38                   |  | 3.71                     | 0.43                   |
|                        |                          |                       |  |                          |                        |  |                          |                        |
| Winterhardy            | 3.81                     | 0.46                  |  | 3.72                     | 0.32                   |  | 3.77                     | 0.39                   |
|                        |                          |                       |  |                          |                        |  |                          |                        |
| Moderately Winterhardy | 4.21                     | 0.37                  |  | 3.94                     | 0.28                   |  | 4.08                     | 0.33                   |

## BROMEGRASS VARIETY TRIAL

### Dickinson Experiment Station – 1984

L. Manske and H. Goetz

A bromegrass variety trial was seeded at the Dickinson Experiment Station in the spring of 1979. The 10x25 foot plots were arranged in a randomized block design with four replications. Eleven varieties of smooth bromegrass (*Bromus inermis*) and one selection of meadow bromegrass (*Bromus biebersteinii*) were included in the trial. The trial was designed to evaluate the performance of the varieties in western North Dakota on the basis of dry weight above ground herbage production.

The annual dry weight above ground herbage production for each variety is shown in Table 1. The four highest producing bromegrass varieties in 1984 were Barton, Lancaster, Meadow brome, and Baylor with 1784, 1765, 1580, and 1541 pounds of herbage production per acre respectively. The four varieties with the greatest five year (1980-1984) mean annual herbage production were Baylor, Lancaster, Meadow brome and Rebound with 2175, 2030, 2018 and 2000 pounds per acre respectively. The two varieties with the lowest five year mean herbage production were Mandan 404 and Manchar with 1569 and 1658 pounds per acre respectively.

The bromegrass varieties in this trial have performed satisfactorily under the environmental conditions of western North Dakota. Ten varieties of smooth bromegrass and the selection of meadow bromegrass have had five year mean annual herbage production of over 1600 lbs/acre, seven varieties have had production of over 1800 lbs/acre and four varieties have had mean annual production of over 2000 lbs/acre. The top producing bromegrass varieties show good potential for use as tamegrass pastures and hayland in western North Dakota.

**Table 1. Bromegrass Variety Trial - 1984<sup>1</sup>**

| Annual Herbage Production in Lbs / Acre |                |                |                |                |               |      |  |  |  |
|-----------------------------------------|----------------|----------------|----------------|----------------|---------------|------|--|--|--|
| Variety                                 | 1980<br>23 Jun | 1981<br>30 Jun | 1982<br>28 Jun | 1983<br>23 Jun | 1984<br>5 Jul | Mean |  |  |  |
| Barton SB                               | 1441 a         | 2511 ab        | 2364 bc        | 1294 ab        | 1784 a        | 1879 |  |  |  |
| Baylor SB                               | 1441 a         | 2557 ab        | 3792 a         | 1546 ab        | 1541 abc      | 2175 |  |  |  |
| Beacon SB                               | 1473 a         | 2364 ab        | 1902 c         | 1172 b         | 1488 abc      | 1680 |  |  |  |
| Blair SB                                | 1443 a         | 2427 ab        | 2224 bc        | 1407 ab        | 1400 abc      | 1780 |  |  |  |
| Fox SB                                  | 1372 a         | 2357 ab        | 2576 abc       | 1604 ab        | 1567 abc      | 1895 |  |  |  |
| Lancaster SB                            | 1395 a         | 2975 a         | 2752 abc       | 1264 b         | 1765 ab       | 2030 |  |  |  |
| Lincoln SB                              | 1483 a         | 2385 ab        | 2384 bc        | 1135 b         | 1334 c        | 1744 |  |  |  |
| Lyon SB                                 | 1411 a         | 2692 ab        | 2342 bc        | 1314 ab        | 1360 bc       | 1824 |  |  |  |
| Manchar SB                              | 1337 a         | 2356 ab        | 1995 bc        | 1310 ab        | 1292 c        | 1658 |  |  |  |
| Mandan 404 SB                           | 1290 a         | 2071 b         | 2105 bc        | 1134 b         | 1245 c        | 1569 |  |  |  |
| Rebound SB                              | 1557 a         | 2440 ab        | 3239 ab        | 1491 ab        | 1274 c        | 2000 |  |  |  |
| Meadow brome                            | 1275 a         | 2194 ab        | 3249 ab        | 1792 a         | 1580 abc      | 2018 |  |  |  |

SB - Smooth bromegrass-*Bromus inermis*

Meadow bromegrass-*Bromus biebersteinii*

<sup>1</sup>Means within columns followed by the same letter are not significantly different by Duncans multiple range test at P<0.05.

## Leafy Spurge Control with Tebuthiuron – 1984

### Dickinson Experiment Station

Llewellyn Manske

A study that tests the effects of tebuthiuron (Graslan) on leafy spurge (Euphorbia esula) was started in 1983 at the Dickinson Experiment Station. Leafy spurge is a major problem weed in uncultivated rangelands in North Dakota. It greatly reduces herbage production and beef production which causes substantial economic losses. The leafy spurge plant is extremely difficult to control and has numerous mechanisms to survive control attempts.

Tebuthiuron is a herbicide that is primarily intended for use on shrubs in rangeland. The chemical is absorbed by the roots and translocated to the leaves. Photosynthesis is restricted. The leaves senesce prematurely and fall off and a new set of leaves develop. This process continues until the plant depletes its stored carbohydrates. The process may take one to four years before the plant dies completely depending on the species and the environmental conditions. In theory, this appears to be a desirable method to control leafy spurge.

One set of test plots for this study was established in 1983 on 0.1 acres located on the NE $\frac{1}{4}$ , NE $\frac{1}{4}$ , SW $\frac{1}{4}$  sec. 22, T. 141 N., R. 104 W. on the property of Dale Maus, five miles north of Camels Hump Butte. The 10 x 53 foot plots were arranged in a randomized block design with two replications. The size of the leafy spurge patch was not sufficient for additional treatments or replications. The soil was vebar fine sandy loam. The range site was sandy. The site has a slight slope of about 3% with an east aspect and the south half of the plots has a slight slope of about 5% with a north aspect. The vegetation on the site was predominantly leafy spurge with an understory of Kentucky bluegrass (Poa pratensis) and a few scattered plants of smooth brome grass (Bromus inermis).

A second set of plots was established in 1984 on 0.12 acres located on NE $\frac{1}{4}$ , SE $\frac{1}{4}$ , NE $\frac{1}{4}$  sec. 4, T. 140 N., R. 103 W. on the property of Cecil Adams, northeast of Camels Hump Butte in the Knutson Creek drainage. The 30 x 22 foot plots were arranged in a randomized block design with two replications. The soil was Havrelon silt loam. The range site was overflow. The vegetation on the site was predominantly leafy spurge with a few scattered plants of silver sage (Artemisia cana) and western wild rose (Rosa woodsii) and a very sparse understory of Kentucky bluegrass.

The herbicide, tebuthiuron, was furnished by the Elanco Products Company. The chemical was incorporated into solid clay pellets with 20% active ingredients. Three rates of the 20% concentration were used in this trial each year. The three rates were: 1, 2 and 3 pounds of active ingredient per acre. A control of no chemical treatment was included in each replication. No additional herbicide was added to the 1983 applied treatment plots in 1984. The herbicide was broadcast applied with a whirly-bird hand spreader on 12 July 1983 and 4 June 1984. The recommended optimum period to apply herbicides to leafy spurge is from mid-June until seed dispersal during hot, dry weather in July (Lym and Messersmith, 1983).

The data that were collected on the 1983 applied and the 1984 applied treatment plots in 1984 were: above ground herbage production, leafy spurge stem densities and mean weight per leafy spurge stem. The sample dates in 1984 were 5 June, 19 June, 6 July, 8 August, 6 September, 8 October, and 8 November. The above ground herbage production was sampled by clipping the vegetation to ground level in two  $\frac{1}{4}$  m<sup>2</sup> quadrats for each plot. The herbage was separated into four categories, leafy spurge, grass, forbs, and shrubs. The samples were oven dried at 80°C. The average herbage production for each category and the total production for each plot were determined. The leafy spurge stem densities were conducted by counting all of the current years leafy spurge stems that were rooted within two  $\frac{1}{4}$  m<sup>2</sup> quadrats per plot. These data were converted to stems per foot square. The mean dry weight per leafy spurge stem data was collected by counting the number of stems clipped during collection of the above ground herbage samples per  $\frac{1}{4}$  m<sup>2</sup> and calculating the mean weight per stem from the leafy spurge herbage production data.

A new set of plots will be established for each of the next two years. No retreatment will be applied to the four sets of plots. The herbage production data, the leafy spurge stem density data and the mean dry weight per leafy spurge stem data will be collected from these plots for a total of six years in order to follow the effects of tebuthiuron on leafy spurge.

Tebuthiuron does have an effect on leafy spurge. The herbicide causes a reduction in herbage weight, stem density and mean weight per stem of leafy spurge.

The first set of plots were treated with 1, 2, and 3 lbs ai per acre in 1983. The reduction in herbage weight of leafy spurge at 422 days after treatment was 78%, 93% and 95% for the 1, 2, and 3 lbs ai/acre rates respectively. The control treatment had a reduction of 68% in herbage weight of leafy spurge during the same time period. The density of leafy spurge stems was reduced by 66%, 94%, and 99.6% for the 1, 2, and 3 lbs ai/acre rates respectively while the control stem densities were reduced by 40% in 422 days. The mean weight per stem was reduced by 66%, 74%, and 67% for the 1, 2, and 3 lbs ai/acre rates respectively in 422 days while the control weight per stem was reduced by 57%. The grass component was also effected by the Tebuthiuron at these rates. Very little grass growth occurred on these plots after treatment. The reduction in herbage weight of grass at 422 days after treatment was 52%, 66%, and 78% for the 1, 2, and 3 lbs ai/acre rates respectively. The control had no change in grass herbage production at 422 days after treatment.

The second set of plots were treated with 1, 2, and 3 lbs ai per acre in 1984. The reduction in herbage weight of leafy spurge at 93 days after treatment was 37%, 52%, and 69% for the 1, 2, and 3 lbs ai/acre rates respectively. The control treatment had a reduction of 5% in herbage weight of leafy spurge during the same time period. The density of leafy spurge stems was reduced by 47%, 43%, and 62% for the 1, 2, and 3 lbs ai/acre rates respectively while the control stem densities were reduced by 32% in 93 days. The mean weight per stem was reduced by 14% and 28% for the 2 and 3 lbs ai/acre rates respectively in 93 days. The mean weight per stem was increased by 5% and 24% for the 1 lb ai/acre rate and the control respectively in 93 days. There was very little grass on this set of plots. The small amount of grass that was present at the start of the trial was semidormant at 93 days after treatment. Some regrowth did occur.

At 125 days after treatment the grass herbage production was 103 lbs, 29 lbs, 18 lbs, and 0 lbs per acre for the control, 1, 2, and 3 lbs ai/acre rates respectively.

The data from these two sets of plots do show encouraging trends on the detrimental effects of tebuthiuron on leafy spurge.

### **Literature Cited**

Lym, Rodney G. and Calvin G. Messersmith. 1983. "Control of Leafy Spurge with Herbicides". North Dakota Farm Research Bimonthly Bulletin Vol. 40(5):16-19.

### Leafy Spurge Control by Tebuthiuron Applied in 1983

|                          |                                                                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Location:</b>         | NE <sup>1</sup> / <sub>4</sub> , NE <sup>1</sup> / <sub>4</sub> , SW <sup>1</sup> / <sub>4</sub> Sec. 22, T. 141 N., R. 104 W.<br>Property of Dale Maus |
| <b>Replications:</b>     | Two      Randomized Block Design                                                                                                                        |
| <b>Study Size:</b>       | 53' x 80'      0.1 acres                                                                                                                                |
| <b>Plot Size:</b>        | 10' x 53'      0.012 acres                                                                                                                              |
| <b>Perimeter border:</b> | 2'                                                                                                                                                      |
| <b>Soil:</b>             | Vebar fine sand loam                                                                                                                                    |
| <b>Range Site:</b>       | Sandy                                                                                                                                                   |
| <b>Herbicide:</b>        | Tebuthiuron<br>20% concentrated pellets                                                                                                                 |
| <b>Application Date:</b> | 12 July 1983                                                                                                                                            |
| <b>Treatments:</b>       | 0 lbs ai/acre<br>1 lbs ai/acre<br>2 lbs ai/acre<br>3 lbs ai/acre                                                                                        |

**Figure 1:** Control of Leafy Spurge with Tebuthiuron

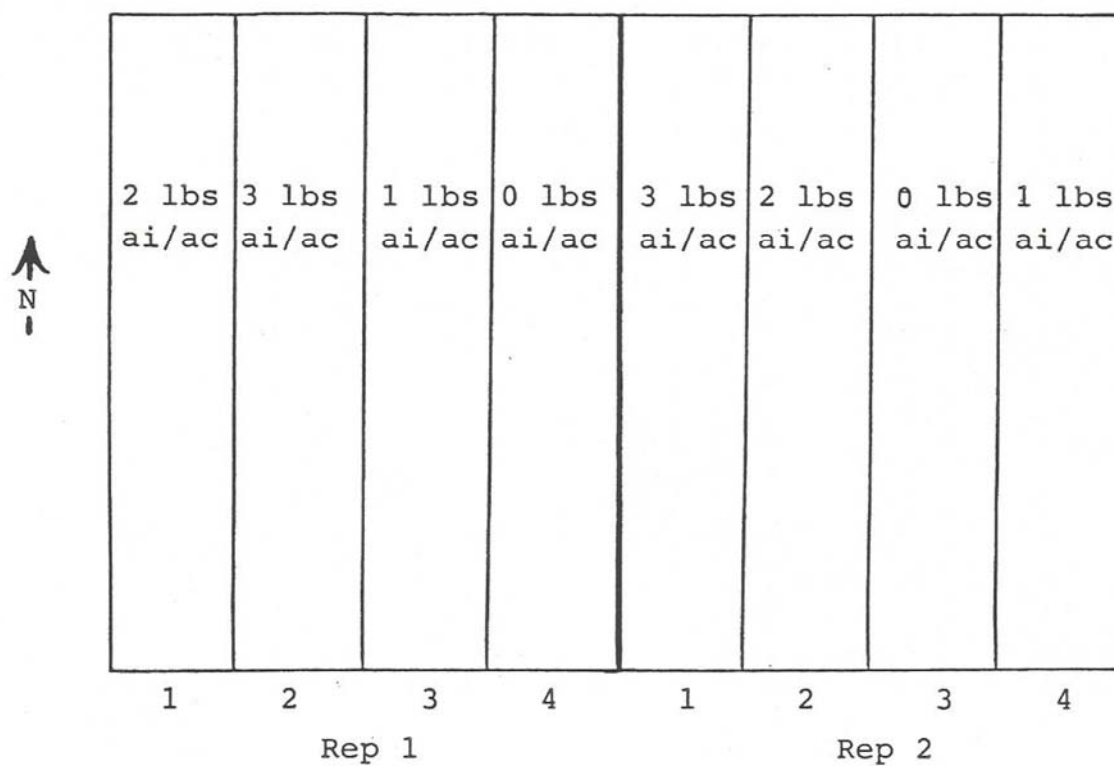


Figure 1. Control of Leafy Spurge with Tebuthiuron randomized block plot design with two replications. Rates are 0,1,2 and 3 pounds of active ingredient per acre using 20 percent concentration pellets. Located at NE $\frac{1}{4}$  NE $\frac{1}{4}$  SW $\frac{1}{4}$  sec. 22, T.141 N., R.104 W. Plots are 10 feet by 53 feet.

## Leafy Spurge Control by Tebuthiuron Applied in 1984

|                          |                                                                       |            |
|--------------------------|-----------------------------------------------------------------------|------------|
| <b>Location:</b>         | NE¼, SE¼, NE¼ Sec. 4, T. 140 N., R. 103 W.<br>Property of Cecil Adams |            |
| <b>Replications:</b>     | Two    Randomized Block Design                                        |            |
| <b>Study Size:</b>       | 44' x 120'                                                            | 0.12 acres |
| <b>Plot Size:</b>        | 22' x 30'                                                             | 0.02 acres |
| <b>Perimeter Border:</b> | 2'                                                                    |            |
| <b>Soil:</b>             | Havrelon silt loam                                                    |            |
| <b>Range Site:</b>       | Overflow                                                              |            |
| <b>Herbicide:</b>        | Tebuthiuron<br>20% concentrated pellets                               |            |
| <b>Application Date:</b> | 4 June 1984                                                           |            |
| <b>Treatments:</b>       | 0 lbs ai/acre<br>1 lbs ai/acre<br>2 lbs ai/acre<br>3 lbs ai/acre      |            |

**Figure 2:** Plot Diagram for the 1984 Applied Tebuthiuron Leafy Spurge Control Trial



|       | 1             | 2             | 3             | 4             |
|-------|---------------|---------------|---------------|---------------|
| Rep 1 | 2 lbs ai/acre | 0 lbs ai/acre | 3 lbs ai/acre | 1 lbs ai/acre |
| Rep 2 | 1 lbs ai/acre | 3 lbs ai/acre | 2 lbs ai/acre | 0 lbs ai/acre |

Figure 2. Plot diagram for the 1984 applied Tebuthiuron leafy spurge control trial at the Dickinson Experiment Station, 1984.

**Table 1. Mean Above Ground Herbage Production in Lbs/Acre for the 1983 Applied  
Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| <b>Herbicide Rate<br/>In Lbs Ai / Acre</b> | <b>5 Jun</b> | <b>19 Jun</b> | <b>6 Jul</b> | <b>8 Aug</b> | <b>6 Sep</b> | <b>8 Oct</b> |
|--------------------------------------------|--------------|---------------|--------------|--------------|--------------|--------------|
| <b>0 Lbs:</b>                              |              |               |              |              |              |              |
| Spurge                                     | 692.2        | 1193.5        | 1301.4       | 452.3        | 438.9        | 454.9        |
| Grass                                      | 946.4        | 992.8         | 828.7        | 1063.3       | 1002.6       | 917.0        |
| Forbs                                      | 0.0          | 1.8           | 17.8         | 14.3         | 0.0          | 0.0          |
| Shrubs                                     | 0.0          | 1.8           | 8.9          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>                               | 1638.6       | 2189.9        | 2156.9       | 1529.8       | 1441.5       | 1371.9       |
| <b>1 Lbs:</b>                              |              |               |              |              |              |              |
| Spurge                                     | 360.4        | 548.6         | 576.2        | 251.5        | 223.0        | 109.7        |
| Grass                                      | 614.6        | 986.6         | 762.3        | 1244.3       | 565.5        | 383.6        |
| Forbs                                      | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                                     | 0.0          | 7.1           | 21.4         | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>                               | 915.0        | 1542.3        | 1359.9       | 1495.9       | 788.5        | 493.3        |
| <b>2 Lbs:</b>                              |              |               |              |              |              |              |
| Spurge                                     | 567.3        | 396.7         | 426.3        | 388.9        | 116.0        | 126.7        |
| Grass                                      | 435.3        | 255.1         | 246.2        | 517.2        | 311.3        | 190.0        |
| Forbs                                      | 0.0          | 5.4           | 8.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                                     | 17.8         | 44.6          | 22.3         | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>                               | 1020.5       | 701.8         | 702.8        | 906.1        | 389.8        | 316.7        |
| <b>3 Lbs:</b>                              |              |               |              |              |              |              |
| Spurge                                     | 449.6        | 264.9         | 137.4        | 95.5         | 66.9         | 62.4         |
| Grass                                      | 346.1        | 612.0         | 132.9        | 445.1        | 243.5        | 195.4        |
| Forbs                                      | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                                     | 0.0          | 0.0           | 9.8          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>                               | 795.7        | 876.9         | 280.1        | 540.6        | 310.4        | 257.8        |

**Table 2. Mean Leafy Spurge Densities in Stems per Foot Square for the 1983 Applied  
Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| <b>Herbicide Rate<br/>In Lbs Ai / Acre</b> | <b>5 Jun</b> | <b>19 Jun</b> | <b>6 Jul</b> | <b>8 Aug</b> | <b>6 Sep</b> | <b>8 Oct</b> | <b>8 Nov</b> |
|--------------------------------------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|
| <b>0 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 23.1         | 26.6          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 14.7         | 23.5          | 18.2         | 10.9         | 7.9          | 0.0          | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.9          | 0.1          |
| Dead                                       | 0.0          | 0.1           | 0.0          | 1.2          | 2.1          | 14.6         | 8.5          |
| Dead Regrowth                              | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| <b>1 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 23.1         | 3.3           | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 12.5         | 14.6          | 9.9          | 5.8          | 3.7          | 0.0          | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 3.4          | 0.2          |
| Dead                                       | 0.0          | 0.9           | 0.2          | 1.0          | 3.2          | 3.0          | 3.6          |
| Dead Regrowth                              | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          | 0.3          |
| <b>2 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 27.0         | 4.5           | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 17.1         | 15.7          | 10.7         | 4.0          | 1.1          | 0.0          | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 7.8          | 2.2          |
| Dead                                       | 0.0          | 0.7           | 1.8          | 3.3          | 3.7          | 5.8          | 0.7          |
| Dead Regrowth                              | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          | 0.7          |
| <b>3 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 12.0         | 26.6          | 0.2          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 15.8         | 23.5          | 3.7          | 0.8          | 0.1          | 0.0          | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 6.5          | 4.9          |
| Dead                                       | 0.0          | 0.1           | 2.0          | 1.2          | 2.4          | 2.1          | 0.2          |
| Dead Regrowth                              | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          | 1.4          |

**Table 3. Mean Dry Weight per Stem of Leafy Spurge in Grams for the 1983 Applied  
Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | Grams / Stem |        |       |       |       |       |
|------------------------------------|--------------|--------|-------|-------|-------|-------|
|                                    | 5 Jun        | 19 Jun | 6 Jul | 8 Aug | 6 Sep | 8 Oct |
| 0 lbs                              | 0.49         | 0.53   | 0.74  | 0.39  | 0.46  | 0.34  |
| 1 lbs                              | 0.30         | 0.36   | 0.59  | 0.39  | 0.34  | 0.25  |
| 2 lbs                              | 0.35         | 0.29   | 0.36  | 0.28  | 0.25  | 0.09  |
| 3 lbs                              | 0.30         | 0.16   | 0.25  | 0.56  | 0.28  | 0.08  |

**Table 4. Mean Percentage of Difference in Herbage Production from the Application Date  
for the 1983 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson  
Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun | 6 Jul  | 8 Aug  | 6 Sep  | 8 Oct  |
|------------------------------------|----------------------|--------|--------|--------|--------|--------|
|                                    | Days after Treatment |        |        |        |        |        |
|                                    | 329                  | 343    | 360    | 393    | 422    | 454    |
| <b>0 Lbs:</b>                      |                      |        |        |        |        |        |
| Spurge                             | -48.95               | -11.97 | - 4.01 | -66.64 | -67.63 | -66.45 |
| Grass                              | - 5.71               | - 1.09 | -17.44 | + 5.94 | - 0.11 | - 8.64 |
| <b>1 Lbs:</b>                      |                      |        |        |        |        |        |
| Spurge                             | -64.03               | -45.30 | -42.49 | -74.90 | -77.74 | -89.05 |
| Grass                              | -48.09               | -16.67 | -35.61 | + 5.10 | -52.23 | -67.60 |
| <b>2 Lbs:</b>                      |                      |        |        |        |        |        |
| Spurge                             | -66.42               | -76.52 | -74.77 | -76.98 | -93.13 | -92.50 |
| Grass                              | -52.49               | -72.16 | -73.13 | -43.56 | -66.03 | -79.26 |
| <b>3 Lbs:</b>                      |                      |        |        |        |        |        |
| Spurge                             | -64.95               | -79.35 | -89.29 | -92.55 | -94.78 | -95.14 |
| Grass                              | -68.17               | -43.72 | -87.78 | -59.07 | -77.61 | -82.03 |

**Table 5. Mean Percentage of Difference in Mature Leafy Spurge Stem Density from the Application Date for the 1983 Applied Tebuthiuron Leafy Spurge Control Trial At the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun | 6 Jul  | 8 Aug  | 6 Sep  | 8 Oct   | 8 Nov   |
|------------------------------------|----------------------|--------|--------|--------|--------|---------|---------|
|                                    | Days After Treatment |        |        |        |        |         |         |
|                                    | 329                  | 343    | 360    | 393    | 422    | 454     | 485     |
| 0 lbs                              | +12.06               | +79.43 | +39.01 | -17.02 | -39.72 | -100.00 | -100.00 |
| 1 lbs                              | +13.56               | +33.05 | - 9.32 | -47.46 | -66.10 | -100.00 | -100.00 |
| 2 lbs                              | - 8.46               | -15.92 | -42.79 | -78.61 | -94.03 | -100.00 | -100.00 |
| 3 lbs                              | -29.46               | + 4.98 | -83.40 | -96.27 | -99.59 | -100.00 | -100.00 |

**Table 6. Mean Percentage of Difference in Mean Dry Weight per Stem of Leafy Spurge from the Application Date for the 1983 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun | 6 Jul  | 8 Aug  | 6 Sep  | 8 Oct  |
|------------------------------------|----------------------|--------|--------|--------|--------|--------|
|                                    | Days After Treatment |        |        |        |        |        |
|                                    | 329                  | 343    | 360    | 393    | 422    | 454    |
| 0 lbs                              | -54.63               | -50.93 | -31.48 | -63.89 | -57.41 | -68.52 |
| 1 lbs                              | -69.70               | -63.64 | -40.40 | -60.61 | -65.66 | -74.75 |
| 2 lbs                              | -63.92               | -70.10 | -62.89 | -71.13 | -74.23 | -90.72 |
| 3 lbs                              | -64.71               | -81.18 | -70.59 | -34.12 | -67.06 | -90.59 |

**Table 7. Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge from the Application Date for the 1983 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun  | 6 Jul  | 8 Aug  | 6 Sep  | 8 Oct   | 8 Nov   |
|------------------------------------|----------------------|---------|--------|--------|--------|---------|---------|
|                                    | Days After Treatment |         |        |        |        |         |         |
|                                    | 329                  | 343     | 360    | 393    | 422    | 454     | 485     |
| <b>0 Lbs:</b>                      |                      |         |        |        |        |         |         |
| <b>Herbage Production:</b>         |                      |         |        |        |        |         |         |
| Leafy Spurge                       | -48.95               | -11.97  | - 4.01 | -66.64 | -67.63 | -66.45  |         |
| Grass                              | - 5.71               | - 1.09  | -17.44 | + 5.94 | - 0.11 | - 8.64  |         |
| Stem Density                       | +12.06               | +79.43  | +39.01 | -17.02 | -39.72 | -100.00 | -100.00 |
| Stem Weight                        | -54.63               | -50.93  | -31.48 | -63.89 | -57.41 | -68.52  |         |
|                                    |                      |         |        |        |        |         |         |
| <b>1 Lbs:</b>                      |                      |         |        |        |        |         |         |
| <b>Herbage Production::</b>        |                      |         |        |        |        |         |         |
| Leafy Spurge                       | - 64.03              | - 45.30 | -42.49 | -74.90 | -77.74 | -89.05  |         |
| Grass                              | - 48.09              | - 16.67 | -35.61 | + 5.10 | -52.23 | -67.60  |         |
| Stem Density                       | +13.56               | +33.05  | - 9.32 | -47.46 | -66.10 | -100.00 | -100.00 |
| Stem Weight                        | -69.70               | -63.64  | -40.40 | -60.61 | -65.66 | -74.75  |         |
|                                    |                      |         |        |        |        |         |         |
| <b>2 Lbs:</b>                      |                      |         |        |        |        |         |         |
| <b>Herbage Production:</b>         |                      |         |        |        |        |         |         |
| Leafy Spurge                       | -66.42               | -76.52  | -74.77 | -76.98 | -93.13 | -92.50  |         |
| Grass                              | -52.49               | -72.16  | -73.13 | -43.56 | -66.03 | -79.26  |         |
| Stem Density                       | - 8.46               | -15.92  | -42.79 | -78.61 | -94.03 | -100.00 | -100.00 |
| Stem Weight                        | -63.92               | -70.10  | -62.89 | -71.13 | -74.23 | -90.72  |         |
|                                    |                      |         |        |        |        |         |         |
| <b>3 Lbs:</b>                      |                      |         |        |        |        |         |         |
| <b>Herbage Production:</b>         |                      |         |        |        |        |         |         |
| Leafy Spurge                       | -64.95               | -79.35  | -89.29 | -92.55 | -94.78 | -95.14  |         |
| Grass                              | -68.17               | -43.72  | -87.78 | -59.07 | -77.61 | -82.03  |         |
| Stem Density                       | -29.46               | + 4.98  | -83.40 | -96.27 | -99.59 | -100.00 | -100.00 |
| Stem Weight                        | -64.71               | -81.18  | -70.59 | -34.12 | -67.06 | -90.59  |         |

**Table 8. Mean Above Ground Herbage Production in Lbs/Acre for the 1984 Applied  
Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| <b>Herbicide Rate<br/>In Lbs Ai / Acre</b> | <b>5 Jun</b>  | <b>19 Jun</b> | <b>6 Jul</b>  | <b>8 Aug</b>  | <b>6 Sep</b>  | <b>8 Oct</b>  |
|--------------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>0 Lbs:</b>                              |               |               |               |               |               |               |
| Spurge                                     | 2184.4        | 2575.2        | 2988.2        | 2052.5        | 2080.2        | 1764.4        |
| Grass                                      | 8.9           | 26.8          | 1.8           | 5.4           | 0.0           | 102.6         |
| Forbs                                      | 1.8           | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           |
| Shrubs                                     | 28.6          | 0.0           | 25.9          | 15.2          | 83.9          | 24.1          |
| <b>TOTAL</b>                               | <b>2223.6</b> | <b>2602.0</b> | <b>3015.9</b> | <b>2073.0</b> | <b>2164.0</b> | <b>1891.0</b> |
| <b>1 Lbs:</b>                              |               |               |               |               |               |               |
| Spurge                                     | 2337.9        | 2317.4        | 2401.3        | 1699.3        | 1464.7        | 1545.0        |
| Grass                                      | 48.2          | 9.8           | 19.6          | 17.8          | 0.0           | 29.4          |
| Forbs                                      | 5.4           | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           |
| Shrubs                                     | 32.1          | 45.5          | 0.0           | 0.0           | 0.0           | 0.0           |
| <b>TOTAL</b>                               | <b>2423.6</b> | <b>2372.7</b> | <b>2420.9</b> | <b>1717.1</b> | <b>1464.7</b> | <b>1574.4</b> |
| <b>2 Lbs:</b>                              |               |               |               |               |               |               |
| Spurge                                     | 2556.5        | 2750.0        | 2040.0        | 1496.8        | 1220.3        | 1343.4        |
| Grass                                      | 35.7          | 8.0           | 6.3           | 0.0           | 0.0           | 17.8          |
| Forbs                                      | 0.0           | 0.0           | 0.0           | 7.1           | 0.0           | 0.0           |
| Shrubs                                     | 108.8         | 8.0           | 0.9           | 0.0           | 0.0           | 0.0           |
| <b>TOTAL</b>                               | <b>2701.0</b> | <b>2766.1</b> | <b>2047.2</b> | <b>1503.9</b> | <b>1220.3</b> | <b>1361.2</b> |
| <b>3 Lbs:</b>                              |               |               |               |               |               |               |
| Spurge                                     | 2769.7        | 2413.8        | 1401.3        | 1290.7        | 854.5         | 1291.6        |
| Grass                                      | 8.9           | 58.0          | 32.1          | 232.8         | 0.0           | 0.0           |
| Forbs                                      | 4.5           | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           |
| Shrubs                                     | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           | 0.0           |
| <b>TOTAL</b>                               | <b>2783.0</b> | <b>2471.7</b> | <b>1433.4</b> | <b>1523.5</b> | <b>854.5</b>  | <b>1291.6</b> |

**Table 9. Mean Leafy Spurge Densities in Stems per Foot Square for the 1984 Applied  
Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| <b>Herbicide Rate<br/>In Lbs Ai / Acre</b> | <b>5 Jun</b> | <b>19 Jun</b> | <b>6 Jul</b> | <b>8 Aug</b> | <b>6 Sep</b> | <b>8 Oct</b> | <b>8 Nov</b> |
|--------------------------------------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|
| <b>0 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 72.1         | 59.7          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 54.5         | 39.3          | 43.7         | 33.7         | 36.9         | 7.2          | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                                       | 0.0          | 0.0           | 0.0          | 1.8          | 1.8          | 24.9         | 36.0         |
|                                            |              |               |              |              |              |              |              |
| <b>1 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 24.8         | 24.0          | 0.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 56.5         | 45.5          | 34.4         | 27.3         | 29.8         | 6.0          | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.3          | 0.0          |
| Dead                                       | 0.0          | 0.0           | 0.0          | 1.6          | 4.2          | 22.5         | 23.2         |
|                                            |              |               |              |              |              |              |              |
| <b>2 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 45.1         | 32.5          | 1.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 49.2         | 44.6          | 26.4         | 29.9         | 27.9         | 10.1         | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 2.0          | 0.0          |
| Dead                                       | 0.0          | 0.0           | 0.0          | 3.4          | 1.2          | 20.3         | 23.6         |
|                                            |              |               |              |              |              |              |              |
| <b>3 Lbs:</b>                              |              |               |              |              |              |              |              |
| Seedling                                   | 28.4         | 46.5          | 0.0          | 0.2          | 0.0          | 0.0          | 0.0          |
| Mature                                     | 62.3         | 48.8          | 28.0         | 32.3         | 23.5         | 13.2         | 0.0          |
| Regrowth                                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.3          | 0.0          |
| Dead                                       | 0.0          | 0.0           | 0.0          | 1.5          | 4.2          | 12.8         | 22.8         |

**Table 10. Mean Dry Weight per Stem of Leafy Spurge in Grams for the 1984 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station. 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | Grams / Stem |        |       |       |       |       |
|------------------------------------|--------------|--------|-------|-------|-------|-------|
|                                    | 5 Jun        | 19 Jun | 6 Jul | 8 Aug | 6 Sep | 8 Oct |
| 0 lbs                              | 0.45         | 0.68   | 0.71  | 0.61  | 0.56  | 0.58  |
| 1 lbs                              | 0.43         | 0.55   | 0.73  | 0.63  | 0.45  | 0.56  |
| 2 lbs                              | 0.51         | 0.64   | 0.81  | 0.47  | 0.44  | 0.45  |
| 3 lbs                              | 0.46         | 0.52   | 0.52  | 0.47  | 0.33  | 0.52  |

**Table 11. Mean Percentage of Difference in Herbage Production from the Application Date for the 1984 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun  | 6 Jul   | 8 Aug    | 6 Sep   | 8 Oct    |
|------------------------------------|----------------------|---------|---------|----------|---------|----------|
|                                    | Days After Treatment |         |         |          |         |          |
|                                    | 0                    | 14      | 31      | 64       | 93      | 125      |
| <b>0 Lbs:</b>                      |                      |         |         |          |         |          |
| Spurge                             |                      | +17.89  | +36.80  | - 6.04   | - 4.77  | -19.23   |
| Grass                              |                      | + 2.00  | -79.93  | -40.02   | -100.00 | +1050.00 |
| <b>1 Lbs:</b>                      |                      |         |         |          |         |          |
| Spurge                             |                      | - 0.88  | + 2.71  | -27.32   | -37.35  | -33.92   |
| Grass                              |                      | - 79.63 | -59.25  | -62.96   | -100.00 | -38.88   |
| <b>2 Lbs:</b>                      |                      |         |         |          |         |          |
| Spurge                             |                      | + 7.57  | -20.20  | -41.45   | -52.27  | -47.45   |
| Grass                              |                      | - 77.49 | -82.48  | -100.00  | -100.00 | -50.00   |
| <b>3 Lbs:</b>                      |                      |         |         |          |         |          |
| Spurge                             |                      | -12.85  | -49.40  | -53.40   | -69.15  | -53.37   |
| Grass                              |                      | +550.00 | +259.98 | +2509.98 | -100.00 | -100.00  |

**Table 12. Mean Percentage of Difference in Mature Leafy Spurge Stem Density from the Application Date for the 1984 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun | 6 Jul  | 8 Aug  | 6 Sep  | 8 Oct  | 8 Nov   |
|------------------------------------|----------------------|--------|--------|--------|--------|--------|---------|
|                                    | Days After Treatment |        |        |        |        |        |         |
|                                    | 0                    | 14     | 31     | 64     | 93     | 125    | 156     |
|                                    |                      |        |        |        |        |        |         |
| 0 lbs                              |                      | -27.94 | -19.93 | -38.16 | -32.37 | -86.88 | -100.00 |
|                                    |                      |        |        |        |        |        |         |
| 1 lbs                              |                      | -19.41 | -39.14 | -51.64 | -47.20 | -89.47 | -100.00 |
|                                    |                      |        |        |        |        |        |         |
| 2 lbs                              |                      | - 9.43 | -46.42 | -39.25 | -43.40 | -79.43 | -100.00 |
|                                    |                      |        |        |        |        |        |         |
| 3 lbs                              |                      | -21.76 | -55.14 | -48.14 | -62.30 | -78.84 | -100.00 |

**Table 13. Mean Percentage of Difference in Mean Dry Weight per Stem of Leafy Spurge from the Application Date for the 1984 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun | 6 Jul  | 8 Aug  | 6 Sep  | 8 Oct  |
|------------------------------------|----------------------|--------|--------|--------|--------|--------|
|                                    | Days After Treatment |        |        |        |        |        |
|                                    | 0                    | 14     | 31     | 64     | 93     | 125    |
|                                    |                      |        |        |        |        |        |
| 0 lbs                              |                      | +51.11 | +57.78 | +35.56 | +24.44 | +28.89 |
|                                    |                      |        |        |        |        |        |
| 1 lbs                              |                      | +27.91 | +69.77 | +46.52 | + 4.65 | +30.23 |
|                                    |                      |        |        |        |        |        |
| 2 lbs                              |                      | +30.20 | +58.82 | - 7.84 | -13.73 | -11.76 |
|                                    |                      |        |        |        |        |        |
| 3 lbs                              |                      | + 6.00 | + 6.00 | + 2.17 | -28.26 | + 6.00 |

**Table 14. Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge from the Application Date for the 1984 Applied Tebuthiuron Leafy Spurge Control Trial at the Dickinson Experiment Station, 1984**

| Herbicide Rate<br>In Lbs Ai / Acre | 5 Jun                | 19 Jun  | 6 Jul   | 8 Aug    | 6 Sep   | 8 Oct    | 8 Nov   |
|------------------------------------|----------------------|---------|---------|----------|---------|----------|---------|
|                                    | Days After Treatment |         |         |          |         |          |         |
|                                    | 0                    | 14      | 31      | 64       | 93      | 125      | 156     |
| <b>0 Lbs:</b>                      |                      |         |         |          |         |          |         |
| <b>Herbage Production:</b>         |                      |         |         |          |         |          |         |
| Leafy Spurge                       |                      | +17.89  | +36.80  | - 6.04   | - 4.77  | -19.23   |         |
| Grass                              |                      | + 2.00  | -79.93  | -40.02   | -100.00 | +1050.00 |         |
| Stem Density                       |                      | -27.94  | -19.93  | -38.16   | -32.37  | -86.88   | -100.00 |
| Stem Weight                        |                      | +51.11  | +57.78  | +35.56   | +24.44  | +28.89   |         |
|                                    |                      |         |         |          |         |          |         |
| <b>1 Lbs:</b>                      |                      |         |         |          |         |          |         |
| <b>Herbage Production:</b>         |                      |         |         |          |         |          |         |
| Leafy Spurge                       |                      | - 0.88  | + 2.71  | -27.32   | -37.35  | -33.92   |         |
| Grass                              |                      | -79.63  | -59.25  | -62.96   | -100.00 | -38.88   |         |
| Stem Density                       |                      | -19.41  | -39.14  | -51.64   | -47.20  | -89.47   | -100.00 |
| Stem Weight                        |                      | +27.91  | +69.77  | +46.52   | + 4.65  | +30.23   |         |
|                                    |                      |         |         |          |         |          |         |
| <b>2 Lbs:</b>                      |                      |         |         |          |         |          |         |
| <b>Herbage Production:</b>         |                      |         |         |          |         |          |         |
| Leafy Spurge                       |                      | + 7.57  | -20.20  | -41.45   | -52.27  | -47.45   |         |
| Grass                              |                      | -77.49  | -82.48  | -100.00  | -100.00 | -50.00   |         |
| Stem Density                       |                      | - 9.43  | -46.42  | -39.25   | -43.40  | -79.43   | -100.00 |
| Stem Weight                        |                      | +30.20  | +58.82  | - 7.84   | -13.73  | -11.76   |         |
|                                    |                      |         |         |          |         |          |         |
| <b>3 Lbs:</b>                      |                      |         |         |          |         |          |         |
| <b>Herbage Production:</b>         |                      |         |         |          |         |          |         |
| Leafy Spurge                       |                      | -12.85  | -49.40  | -53.40   | -69.15  | -53.37   |         |
| Grass                              |                      | +550.00 | +259.98 | +2509.98 | -100.00 | -100.00  |         |
| Stem Density                       |                      | -21.76  | -55.14  | -48.14   | -62.30  | -78.84   | -100.00 |
| Stem Weight                        |                      | + 6.00  | + 6.00  | + 2.17   | -28.26  | + 6.00   |         |

## Leafy Spurge Control with Chemical and Mechanical Treatments – 1984

### Dickinson Experiment Station

Llewellyn Manske and Phillip Sjursen

A study to test the effects of chemical and mechanical treatments on leafy spurge (Euphorbia esula) was started in 1984 at the Dickinson Experiment Station. The chemical Picloram (Tordon) at 2 lbs ai / acre (1 gallon of 22K liquid or 100 pounds of 2K granules) has been shown by many scientists to reduce leafy spurge and it is one technique that is accepted and recommended as a good treatment for leafy spurge control. It is not an inexpensive treatment. The mechanical treatment of mowing leafy spurge has been observed to reduce the density of leafy spurge at times. Observations also have been made that spraying picloram on leafy spurge regrowth two weeks after mowing increases the effects of the chemical. These observations of the effects of mowing of leafy spurge need to be tested to determine if mowing has a beneficial detrimental effect on leafy spurge. If this study shows that mowing of leafy spurge can be beneficial or additive to chemical treatments, a follow-up study will be needed to test if the rate of chemical applied can be reduced.

The test plots were established on 0.25 acres located on the NE $\frac{1}{4}$ , SE $\frac{1}{4}$ , NE $\frac{1}{4}$  Sec. 4, T. 140 N., R. 103 W. on the property of Cecil Adams. The 30 x 22 foot plots were arranged in a randomized block design with two replications. The soil was Havrelon silt loam. The range site was overflow. The vegetation on the site was predominantly leafy spurge with a few scattered plants of silver sage (Artemisia cana) and wolfberry (Symphoricarpos occidentalis) and a thin understory of Kentucky bluegrass (Poa pratensis), prairie sandreed (Calamovilfa longifolia) and needleandthread Stipa comata).

The treatments were: in early June, mowing, mowing plus Tordon, and Tordon; in early July, mowing, mowing plus Tordon and Tordon; and in mid August, Tordon. A control of no treatment was included in each replication. The early June, early July and mid August periods of treatment coincided with pre-flower, post flower (seed development) and early regrowth phenological stages of development for the leafy spurge plants respectively. The mowing treatment was conducted with a sickle bar mower and the herbage was raked off the plots. The chemical treatment was applied at a rate of 2 lbs ai / acre of picloram in the form of 2K granules with a hand held whirlybird spreader.

The data that were collected from these plots were: above ground herbage production, leafy spurge stem densities, and mean weight per leafy spurge stem. The sample dates were: 5 and 19 June, 6 July, 8 August, 6 September and 8 October 1984. Three plants from each plot were dug up on 8 November to determine general condition of the roots.

Data will be collected from these plots with no retreatment for one or two additional years in order to follow the effects of chemical and mechanical treatments on leafy spurge.

No definitive conclusions can be made from these data without knowing the relative survival rate of the leafy spurge plants on each treatment one year after treatment. Several encouraging trends do show up in the data however.

Mowing leafy spurge appeared to have a little effect on the top growth. We do not know yet if this effect is significant. The total herbage production of leafy spurge and the mean weight per stem was reduced considerably. The density of live stems greatly increased for a month after the June mow treatment and then it decreased. All of the stems were dead 125 days after the June mow. The control plots had 17% of the stems still alive on the same sample date which amounted to an 87% reduction in live stems. The July mow treatment had a 98% reduction in live stems 93 days after treatment. A few of the plants on the July mow plots had mature seeds at time of treatment. The mowing treatment should be applied prior to the seed development phenophase. The July mow appeared to stimulate a small amount of additional regrowth over the control. The roots in both mowing treatments were alive but no buds were present on the first 6 inches of root except for a few buds on the roots on one plot of the July mow treatment. The roots on the control plots had numerous healthy buds on the same amount of root. If mowing has detrimental effects on leafy spurge it would probably be more effective to use two annual mowing periods rather than a single application. The first mowing should be in June before the plants start seed development and the second mowing should be of the regrowth in July just prior to peak herbage production to eliminate any possibility of flowering and seed development.

Tordon at 2 lbs ai / acre was effective in killing the top growth of the leafy spurge for the June, July and August application dates. The June treatment had 100% of the stems dead 62 days after treatment. The July treatment had 99.7% stem kill after 93 days and the August treatment had 99.1% kill of the top growth after 62 days. The roots were dead or near dead with decaying on the June and July treatments in early November. The roots on the August Tordon treatment were still alive in early November but no healthy buds were present in the first six inches.

The combination of mowing plus Tordon treatment appeared to have a little more effect on the top growth than the Tordon alone treatment. Both the June and July combination treatments had 100% of the top growth dead 62 days after treatment and no fall regrowth occurred. The roots on these plots were dead and decaying in early November in the first six inches.

Mowing of leafy spurge did have some detrimental effects. It may or may not be significant. Mowing alone may be a better alternative to no treatment in areas of leafy spurge that can be reached with a mower and cost was a factor. Tordon at 2 lbs ai / acre was effective in top growth kill. At this rate, the chemical treatment was not inexpensive and may be a major deterrent of its use. The combination of mowing plus tordon appears to be additive to some degree. Mowing may not have a cost / benefit ratio that would warrant this added expense at the 2 lbs ai / acre rate of chemical. If the rate of chemical could be reduced and still have effective kill with the addition of mowing, the total cost may be reduced.

## Leafy Spurge Control by Chemical and Mechanical Treatment in 1984

|                           |                                                                                                                                                                                 |                         |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Location:</b>          | NE¼, SE¼, NE¼ Sec. 4, T. 140 N., R. 103 W.<br>Property of Cecil Adams                                                                                                           |                         |
| <b>Replications:</b>      | Two                                                                                                                                                                             | Randomized Block Design |
| <b>Study Size:</b>        | 62' x 178'                                                                                                                                                                      | 0.25 acres              |
| <b>Plot Size:</b>         | 22' x 30'                                                                                                                                                                       | 0.02 acres              |
| <b>Perimeter Border:</b>  | 2'                                                                                                                                                                              |                         |
| <b>Soil:</b>              | Havrelon silt loam                                                                                                                                                              |                         |
| <b>Range Site:</b>        | Overflow                                                                                                                                                                        |                         |
| <b>Application Rate:</b>  | 2 lbs ai / acre of Tordon 2K pellets                                                                                                                                            |                         |
| <b>Application Dates:</b> | Early June – 4 Jun 1984<br>Early July – 6 Jul 1984<br>Mid August – 8 Aug 1984                                                                                                   |                         |
| <b>Treatments:</b>        | Control<br>Early June Mow<br>Early June Mow + Tordon 2K<br>Early June Tordon 2K<br>Early July Mow<br>Early July Mow + Tordon 2K<br>Early July Tordon 2K<br>Mid August Tordon 2K |                         |

**Figure 1.**Plot Diagram for the Leafy Spurge Control by Chemical and Mechanical Treatment

N 

|       | 1                                   | 2                       | 3                       | 4                                   | 5                          | 6                 | 7                 | 8                          |
|-------|-------------------------------------|-------------------------|-------------------------|-------------------------------------|----------------------------|-------------------|-------------------|----------------------------|
| Rep 1 | Early July<br>Mow<br>+<br>Tordon 2K | Early July<br>Tordon 2K | Early July<br>Mow       | Early June<br>Mow<br>+<br>Tordon 2K | Early June<br>Tordon 2K    | Early June<br>Mow | Control           | Mid<br>August<br>Tordon 2K |
| Rep 2 | Early June<br>Mow<br>+<br>Tordon 2K | Control                 | Early June<br>Tordon 2K | Early July<br>Mow<br>+<br>Tordon 2K | Mid<br>August<br>Tordon 2K | Early July<br>Mow | Early June<br>Mow | Early July<br>Tordon 2K    |

Figure 1. Plot diagram for the leafy spurge control by chemical and mechanical treatment at the Dickinson Experiment Station, 1984.

**Table 1. Mean Above Ground Herbage Production in Lbs / Acre for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| <b>Treatments</b>        | <b>5 Jun</b> | <b>19 Jun</b> | <b>6 Jul</b> | <b>8 Aug</b> | <b>6 Sep</b> | <b>8 Oct</b> |
|--------------------------|--------------|---------------|--------------|--------------|--------------|--------------|
| <b>Control:</b>          |              |               |              |              |              |              |
| Spurge                   | 2234.5       | 3524.3        | 3957.8       | 3635.8       | 2709.0       | 2604.6       |
| Grass                    | 12.5         | 11.6          | 41.9         | 0.0          | 0.0          | 271.2        |
| Forbs                    | 13.4         | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 2260.3       | 3535.9        | 3999.7       | 3635.8       | 2709.0       | 2875.8       |
|                          |              |               |              |              |              |              |
| <b>Jun Mow:</b>          |              |               |              |              |              |              |
| Spurge                   | 2459.3       | 575.3         | 1475.4       | 1993.6       | 564.6        | 502.2        |
| Grass                    | 36.6         | 3.6           | 0.0          | 29.4         | 16.1         | 23.2         |
| Forbs                    | 7.1          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 2503.0       | 578.9         | 1475.4       | 2023.1       | 580.7        | 525.4        |
|                          |              |               |              |              |              |              |
| <b>Jun Mow + Tordon:</b> |              |               |              |              |              |              |
| Spurge                   | 1719.8       | 431.7         | 154.3        | 138.3        | 161.5        | 30.3         |
| Grass                    | 17.8         | 67.8          | 72.3         | 88.3         | 422.8        | 25.9         |
| Forbs                    | 6.3          | 0.0           | 24.1         | 3.6          | 0.0          | 0.0          |
| Shrubs                   | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 1743.9       | 499.5         | 250.7        | 230.1        | 584.3        | 56.2         |
|                          |              |               |              |              |              |              |
| <b>Jun Tordon:</b>       |              |               |              |              |              |              |
| Spurge                   | 1949.0       | 2462.8        | 885.8        | 925.0        | 580.7        | 796.6        |
| Grass                    | 63.3         | 10.7          | 69.6         | 30.3         | 0.0          | 0.9          |
| Forbs                    | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 9.8          | 2.7           | 26.8         | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 2022.2       | 2476.2        | 982.1        | 955.3        | 580.7        | 797.5        |

**Table 1. (Cont.) Mean Above Ground Herbage Production in Lbs / Acre for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| <b>Treatments</b>        | <b>5 Jun</b> | <b>19 Jun</b> | <b>6 Jul</b> | <b>8 Aug</b> | <b>6 Sep</b> | <b>8 Oct</b> |
|--------------------------|--------------|---------------|--------------|--------------|--------------|--------------|
| <b>Jul Mow:</b>          |              |               |              |              |              |              |
| Spurge                   | 2044.5       | 2705.4        | 3282.6       | 220.3        | 125.8        | 82.1         |
| Grass                    | 58.0         | 11.6          | 61.6         | 15.2         | 27.7         | 53.5         |
| Forbs                    | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 34.8         | 0.0           | 92.8         | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 2137.2       | 2717.0        | 3436.9       | 235.5        | 130.2        | 135.6        |
| <b>Jul Mow + Tordon:</b> |              |               |              |              |              |              |
| Spurge                   | 1621.7       | 2380.8        | 2337.0       | 161.5        | 24.0         | 24.1         |
| Grass                    | 100.8        | 138.3         | 173.9        | 32.1         | 144.5        | 192.7        |
| Forbs                    | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 201.6        | 15.2          | 50.0         | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 1924.1       | 2534.2        | 2560.9       | 193.6        | 167.7        | 216.8        |
| <b>Jul Tordon:</b>       |              |               |              |              |              |              |
| Spurge                   | 2326.3       | 3271.0        | 2769.7       | 1670.7       | 1261.3       | 1133.7       |
| Grass                    | 6.3          | 17.0          | 0.0          | 2.7          | 0.0          | 2.7          |
| Forbs                    | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 185.5        | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 2518.1       | 3287.9        | 2769.7       | 1673.4       | 1261.3       | 1136.4       |
| <b>Aug Tordon:</b>       |              |               |              |              |              |              |
| Spurge                   | 2154.2       | 2458.4        | 3172.0       | 2058.7       | 909.0        | 1179.2       |
| Grass                    | 77.6         | 75.8          | 80.3         | 23.2         | 37.5         | 53.5         |
| Forbs                    | 0.9          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Shrubs                   | 162.4        | 0.0           | 5.4          | 0.0          | 0.0          | 0.0          |
| <b>TOTAL</b>             | 2395.0       | 2534.2        | 3257.6       | 2081.9       | 946.4        | 1232.8       |

**Table 2. Mean Leafy Spurge Densities in Stems per Foot Square for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| <b>Treatments</b>        | <b>5 Jun</b> | <b>19 Jun</b> | <b>6 Jul</b> | <b>8 Aug</b> | <b>6 Sep</b> | <b>8 Oct</b> |
|--------------------------|--------------|---------------|--------------|--------------|--------------|--------------|
| <b>Control:</b>          |              |               |              |              |              |              |
| Seedling                 | 67.5         | 36.8          | 0.7          | 0.2          | 0.0          | 0.0          |
| Mature                   | 33.6         | 33.4          | 28.5         | 32.1         | 21.8         | 4.5          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.1          |
| Dead                     | 0.0          | 0.0           | 0.1          | 1.5          | 3.8          | 21.7         |
| <b>Jun Mow:</b>          |              |               |              |              |              |              |
| Seedling                 | 32.5         | 23.9          | 2.7          | 1.2          | 0.0          | 0.0          |
| Mature                   | 38.7         | 43.5          | 67.1         | 46.3         | 21.6         | 0.0          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                     | 0.0          | 0.0           | 0.0          | 0.0          | 6.0          | 32.4         |
| <b>Jun Mow + Tordon:</b> |              |               |              |              |              |              |
| Seedling                 | 32.5         | 43.0          | 0.1          | 0.0          | 0.0          | 0.0          |
| Mature                   | 25.6         | 29.0          | 5.1          | 0.0          | 0.0          | 0.0          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                     | 0.0          | 0.0           | 5.2          | 6.6          | 11.0         | 1.7          |
| <b>Jun Tordon:</b>       |              |               |              |              |              |              |
| Seedling                 | 52.0         | 18.7          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                   | 28.7         | 40.0          | 20.7         | 0.0          | 0.0          | 0.0          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                     | 0.0          | 0.0           | 0.7          | 20.4         | 12.1         | 7.4          |
| <b>Jul Mow:</b>          |              |               |              |              |              |              |
| Seedling                 | 60.4         | 39.0          | 8.1          | 0.0          | 0.0          | 0.0          |
| Mature                   | 31.1         | 34.6          | 30.0         | 17.4         | 2.3          | 0.7          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.7          |
| Dead                     | 0.0          | 0.0           | 0.0          | 3.8          | 13.8         | 8.9          |
| <b>Jul Mow + Tordon:</b> |              |               |              |              |              |              |
| Seedling                 | 34.1         | 81.8          | 6.6          | 0.0          | 0.0          | 0.0          |
| Mature                   | 25.5         | 37.9          | 26.9         | 13.3         | 0.0          | 0.0          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                     | 0.0          | 0.0           | 0.0          | 3.5          | 1.8          | 2.0          |
| <b>Jul Tordon:</b>       |              |               |              |              |              |              |
| Seedling                 | 26.5         | 22.0          | 0.0          | 0.0          | 0.0          | 0.0          |
| Mature                   | 38.8         | 38.0          | 31.3         | 25.4         | 2.6          | 0.1          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                     | 0.0          | 0.0           | 0.0          | 3.3          | 15.3         | 16.7         |
| <b>Aug Tordon:</b>       |              |               |              |              |              |              |
| Seedling                 | 24.6         | 25.3          | 1.3          | 0.0          | 0.0          | 0.0          |
| Mature                   | 40.8         | 35.0          | 31.3         | 32.5         | 11.0         | 0.3          |
| Regrowth                 | 0.0          | 0.0           | 0.0          | 0.0          | 0.0          | 0.0          |
| Dead                     | 0.0          | 0.0           | 0.0          | 3.6          | 11.0         | 25.6         |

**Table 3. Mean Dry Weight per Stem of Leafy Spurge in Grams for the Leafy Spurge Control by Chemical and Mechanical Treatment at the Dickinson Experiment Station, 1984**

| Treatment        | Grams / Stem |        |       |       |       |       |
|------------------|--------------|--------|-------|-------|-------|-------|
|                  | 5 Jun        | 19 Jun | 6 Jul | 8 Aug | 6 Sep | 8 Oct |
| Control          | 0.69         | 1.10   | 1.44  | 1.13  | 1.10  | 1.07  |
| Jun Mow          | 0.66         | 0.14   | 0.23  | 0.45  | 0.22  | 0.16  |
| Jun Mow + Tordon | 0.70         | 0.16   | 0.16  | 0.22  | 0.15  | 0.23  |
| Jun Tordon       | 0.71         | 0.64   | 0.43  | 0.47  | 0.50  | 1.11  |
| Jul Mow          | 0.68         | 0.80   | 1.14  | 0.11  | 0.08  | 0.09  |
| Jul Mow + Tordon | 0.66         | 0.75   | 0.91  | 0.11  | 0.14  | 0.13  |
| Jul Tordon       | 0.62         | 0.90   | 0.92  | 0.61  | 0.73  | 0.72  |
| Aug Tordon       | 0.55         | 0.73   | 1.06  | 0.59  | 0.43  | 0.54  |

**Table 4. Mean Percentage of Difference in Herbage Production from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| Treatment                | Days After Treatment |         |          |         |          |          |
|--------------------------|----------------------|---------|----------|---------|----------|----------|
|                          | 0                    | 14      | 31       | 62      | 93       | 125      |
| <b>Control:</b>          |                      |         |          |         |          |          |
| Spurge                   |                      | +57.72  | +77.13   | +62.71  | +21.24   | +16.57   |
| Grass                    |                      | - 7.13  | +235.71  | -100.00 | -100.00  | +2071.10 |
| <b>Jun Mow:</b>          |                      |         |          |         |          |          |
| Spurge                   |                      | -76.61  | -40.01   | -18.93  | -77.04   | -79.58   |
| Grass                    |                      | -90.24  | - 100.00 | -19.50  | -56.08   | -36.59   |
| <b>Jun Mow + Tordon:</b> |                      |         |          |         |          |          |
| Spurge                   |                      | -74.90  | -91.03   | -91.96  | -90.61   | -98.24   |
| Grass                    |                      | +279.99 | +304.99  | +395.01 | +2270.01 | +45.01   |
| <b>June Tordon:</b>      |                      |         |          |         |          |          |
| Spurge                   |                      | +26.36  | -54.55   | -52.54  | -70.21   | -59.13   |
| Grass                    |                      | -83.10  | + 9.87   | -52.11  | -100.00  | -98.59   |
| <b>Jul Mow:</b>          |                      |         |          |         |          |          |
| Spurge                   |                      |         | -93.29   | -96.17  | -97.50   |          |
| Grass                    |                      |         | -75.37   | -55.06  | -13.05   |          |
| <b>Jul Mow + Tordon:</b> |                      |         |          |         |          |          |
| Spurge                   |                      |         | -93.09   | -98.97  | -98.97   |          |
| Grass                    |                      |         | -81.54   | -16.92  | +10.77   |          |
| <b>Jul Tordon:</b>       |                      |         |          |         |          |          |
| Spurge                   |                      |         | -39.68   | -54.46  | -59.07   |          |
| Grass                    |                      |         | +100.00  | 0.00    | +100.00  |          |
| <b>Aug Tordon:</b>       |                      |         |          |         |          |          |
| Spurge                   |                      |         | -55.85   | -42.72  |          |          |
| Grass                    |                      |         | +61.58   | +130.79 |          |          |

**Table 5. Mean Percentage of Difference in Mature Leafy Spurge Stem Density from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| Treatment        | Days After Treatment |        |        |         |         |         |
|------------------|----------------------|--------|--------|---------|---------|---------|
|                  | 0                    | 14     | 31     | 62      | 93      | 125     |
| Control          |                      | - 0.83 | -15.19 | - 4.42  | - 35.08 | -86.74  |
| Jun Mow          |                      | +12.23 | +73.14 | + 19.42 | - 44.36 | -100.00 |
| Jun Mow + Tordon |                      | +13.45 | -80.00 | -100.00 | -100.00 | -100.00 |
| Jun Tordon       |                      | +39.16 | -27.83 | -100.00 | -100.00 | -100.00 |
| Jul Mow          |                      |        | -42.11 | - 92.26 | - 97.83 |         |
| Jul Mow + Tordon |                      |        | -50.52 | -100.00 | -100.00 |         |
| Jul Tordon       |                      |        | -18.99 | - 91.69 | - 99.70 |         |
| Aug Tordon       |                      |        | -66.29 | - 99.14 |         |         |

**Table 6. Mean Percentage of Difference in Mean Dry Weight per Stem from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| Treatment        | Days After Treatment |        |         |        |        |        |
|------------------|----------------------|--------|---------|--------|--------|--------|
|                  | 0                    | 14     | 31      | 62     | 93     | 125    |
| Control          |                      | +59.42 | +108.70 | +63.77 | +59.42 | +55.07 |
| Jun Mow          |                      | -78.79 | -65.15  | -31.82 | -66.67 | -75.76 |
| Jun Mow + Tordon |                      | -77.14 | -77.14  | -68.57 | -78.57 | -67.14 |
| Jun Tordon       |                      | - 9.86 | -39.44  | -33.80 | -29.58 | +56.34 |
| Jul Mow          |                      |        | -90.35  | -92.98 | -92.11 |        |
| Jul Mow + Tordon |                      |        | -87.91  | -84.62 | -85.71 |        |
| Jul Tordon       |                      |        | -33.70  | -20.65 | -21.74 |        |
| Aug Tordon       |                      |        | -27.12  | - 8.47 |        |        |

**Table 7. Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| Treatment                  | Days After Treatment |         |         |         |          |          |
|----------------------------|----------------------|---------|---------|---------|----------|----------|
|                            | 0                    | 14      | 31      | 62      | 93       | 125      |
| <b>Control:</b>            |                      |         |         |         |          |          |
| <b>Herbage Production:</b> |                      |         |         |         |          |          |
| Leafy Spurge               |                      | +57.72  | +77.13  | +62.71  | +21.24   | +16.57   |
| Grass                      |                      | - 7.13  | +235.71 | -100.00 | -100.00  | +2071.10 |
| Stem Density               |                      | - 0.83  | -15.19  | - 4.42  | -35.08   | -86.74   |
| Stem Weight                |                      | +59.42  | +108.70 | +63.77  | +59.42   | +55.07   |
|                            |                      |         |         |         |          |          |
| <b>Jun Mow:</b>            |                      |         |         |         |          |          |
| <b>Herbage Production:</b> |                      |         |         |         |          |          |
| Leafy Spurge               |                      | -76.61  | -40.01  | -18.93  | -77.04   | -79.58   |
| Grass                      |                      | -90.24  | -100.00 | -19.50  | -56.08   | -36.59   |
| Stem Density               |                      | +12.23  | +73.14  | +19.42  | -44.36   | -100.00  |
| Stem Weight                |                      | -78.79  | -65.15  | -31.82  | -66.67   | -75.76   |
|                            |                      |         |         |         |          |          |
| <b>Jun Mow + Tordon:</b>   |                      |         |         |         |          |          |
| <b>Herbage Production:</b> |                      |         |         |         |          |          |
| Leafy Spurge               |                      | -74.90  | -91.03  | -91.96  | -90.61   | -98.24   |
| Grass                      |                      | +279.99 | +304.99 | +395.01 | +2270.01 | +45.01   |
| Stem Density               |                      | +13.45  | -80.00  | -100.00 | - 100.00 | -100.00  |
| Stem Weight                |                      | -77.14  | -77.14  | -68.57  | -78.57   | -67.14   |
|                            |                      |         |         |         |          |          |
| <b>Jun Tordon:</b>         |                      |         |         |         |          |          |
| <b>Herbage Production:</b> |                      |         |         |         |          |          |
| Leafy Spurge               |                      | +26.36  | -54.55  | -52.54  | -70.21   | -59.13   |
| Grass                      |                      | -83.10  | +9.87   | -52.11  | -100.00  | -98.59   |
| Stem Density               |                      | +39.16  | -27.83  | -100.00 | -100.00  | -100.00  |
| Stem Weight                |                      | - 9.86  | -39.44  | -33.80  | -29.58   | +56.34   |

**Table 7. (Cont.) Mean Percentage of Difference in Herbage Production, Leafy Spurge Stem Density and Weight per Stem of Leafy Spurge from the Application Date for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 1984**

| <b>Treatment</b>           | <b>Days After Treatment</b> |           |           |           |           |            |
|----------------------------|-----------------------------|-----------|-----------|-----------|-----------|------------|
|                            | <b>0</b>                    | <b>14</b> | <b>31</b> | <b>62</b> | <b>93</b> | <b>125</b> |
| <b>Jul Mow:</b>            |                             |           |           |           |           |            |
| <b>Herbage Production:</b> |                             |           |           |           |           |            |
| Leafy Spurge               |                             |           | -93.29    | -96.17    | -97.50    |            |
| Grass                      |                             |           | -75.37    | -55.06    | -13.05    |            |
| Stem Density               |                             |           | -42.11    | -92.26    | -97.83    |            |
| Stem Weight                |                             |           | -90.35    | -92.98    | -92.11    |            |
|                            |                             |           |           |           |           |            |
| <b>Jul Mow + Tordon:</b>   |                             |           |           |           |           |            |
| <b>Herbage Production:</b> |                             |           |           |           |           |            |
| Leafy Spurge               |                             |           | -93.09    | -98.97    | -98.97    |            |
| Grass                      |                             |           | -81.54    | -16.92    | +10.77    |            |
| Stem Density               |                             |           | -50.52    | -100.00   | -100.00   |            |
| Stem Weight                |                             |           | -87.91    | -84.62    | -85.71    |            |
|                            |                             |           |           |           |           |            |
| <b>Jul Tordon:</b>         |                             |           |           |           |           |            |
| <b>Herbage Production:</b> |                             |           |           |           |           |            |
| Leafy Spurge               |                             |           | -39.68    | -54.46    | -59.07    |            |
| Grass                      |                             |           | +100.00   | 0.00      | +100.00   |            |
| Stem Density               |                             |           | -18.99    | -91.69    | -99.70    |            |
| Stem Weight                |                             |           | -33.70    | -20.65    | -21.74    |            |
|                            |                             |           |           |           |           |            |
| <b>Aug Tordon:</b>         |                             |           |           |           |           |            |
| <b>Herbage Production:</b> |                             |           |           |           |           |            |
| Leafy Spurge               |                             |           | -55.85    | -42.72    |           |            |
| Grass                      |                             |           | +61.58    | +130.79   |           |            |
| Stem Density               |                             |           | -66.29    | -99.14    |           |            |
| Stem Weight                |                             |           | -27.12    | - 8.47    |           |            |

**Table 8. General Condition of Roots for the Leafy Spurge Control by Chemical and Mechanical Treatments at the Dickinson Experiment Station, 8 November 1984**

| <b>Treatment</b> | <b>Rep 1</b>            | <b>Rep 2</b>          |
|------------------|-------------------------|-----------------------|
|                  |                         |                       |
| <b>Control</b>   | Alive, very tough, buds | Alive, tough, buds    |
|                  |                         |                       |
| <b>June:</b>     |                         |                       |
| Mow              | Alive, tough            | Alive, tough          |
|                  |                         |                       |
| Mow + Tordon     | Dead, very decayed      | Dead, decaying        |
|                  |                         |                       |
| Tordon           | Dead, very decayed      | Near dead, some decay |
|                  |                         |                       |
| <b>July:</b>     |                         |                       |
| Mow              | Alive, tough, few buds  | Alive, tough          |
|                  |                         |                       |
| Mow + Tordon     | Dead, decaying          | Dead, decaying        |
|                  |                         |                       |
| Tordon           | Near dead, some decay   | Dead, decaying        |
|                  |                         |                       |
| <b>August:</b>   |                         |                       |
| Tordon           | Alive                   | Alive, tough          |

## **Shrub Reduction by Chemical Control – 1984**

### **Dickinson Experiment Station**

Llewellyn Manske and Phillip Sjursen

Some shrub species have become problems in localized areas for ranchers and other land managers in North Dakota. The shrub stands generally occupy areas of higher than normal available soil moisture or areas with a water table within range of the roots for at least part of the growing season. Because of the available water, many areas that support dense stands of shrubs have a high potential to produce high yields in graminoid herbage if the shrub plants were reduced in size and number. Shrubs tend to increase in size and density under light grazing or no grazing pressure and decrease under heavy grazing. Houston (1961) found this to be true in Montana. This has been shown to be true in western North Dakota by Brand (1980) and in eastern North Dakota under rotation grazing systems by Manske (1980 and 1981). With increasing emphasis on land managers to use rotation grazing systems to improve range condition, the increase in shrubs on localized areas of grasslands will be a growing problem. Because of this existing problem and the potential for the problem to increase, there is a need for information on simple, economic methods for reducing shrub densities on rangeland.

Many shrub species provide cover and fall and winter food for wildlife. Some shrubs are important in late summer, fall and winter diets of livestock. Wildlife and livestock do not require nor do they generally use large and very dense stands of shrubs. A harmonious level of shrub density on rangeland that is compatible with livestock grazing and wildlife needs should be the desired goal.

A study to test the effects of chemical treatment on a few selected shrub species was started at the Dickinson Experiment Station in 1983. The trial was established on 0.50 acres located on the SW $\frac{1}{4}$ , SW $\frac{1}{4}$ , NW $\frac{1}{4}$  Sec. 12, T. 138 N., R. 101 W. at the Pyramid Park Experimental Area of the Dickinson Experiment Station. Each plot was 22 x 30 feet in size and arranged in a randomized block design. The chemical, Tebuthiuron (Graslan), was furnished by the Elanco products company in two concentrations, 20% and 40%, of active ingredient incorporated into dense clay pellets. Three rates, 0.25, 0.50 and 0.75 pounds of active ingredient per acre, for each concentration and a control of no herbicide were applied.

Each rate of each concentration was replicated at least twice with one rate, 0.50 lbs ai / acre and the control replicated four times. The size of the plots and the number of replications were limited by the available area of homogenous shrub densities. The herbicide was broadcast applied with a whirlybird hand spreader on 24 May 1983. No retreatment was made in 1984.

The soil was possibly Havrelon silt loam. Some additional work will be needed to confirm this preliminary soil classification. The range site was overflow. The site fits into the Sagebrush range type classification of Hanson and Whitman (1938). Silver sage (*Artemisia cana*) was the only shrub species that was included in this trial in 1983. Wolfberry (*Symphoricarpos occidentalis*) may be included at a future date.

Tebuthiuron is a herbicide designed to be effective on shrubs. The company claims that the chemical has very little effect on grass and grasslike plants at low rates. The grasses tend to increase on treated areas when the canopy cover of the shrubs is reduced. A simplified version of the theory on how the chemical works follows. The chemical is absorbed by the roots and translocated to the leaves. Photosynthesis is restricted. The leaves senesce prematurely and fall off and a new set of leaves develop. This process continues until the plant depletes its stored carbohydrates. This process may take one to four years before the plant dies completely depending on the species and the environmental conditions.

The data that were collected from these plots were: shrub density, plant height, crown diameter in two directions, north – south (N-S), and east – west (E-W) and plant species present list. Crown area and crown volume can be determined from the height and diameter measurements.

Shrub density, number of plants per unit area, was determined by counting every plant of silver sage in each plot which was 61.31 square meters. These data were converted to plants per meter square.

Each silver sagebrush plant of each plot was permanently identified by affixing a numbered tag. The individual plant height data were collected by measuring in centimeters from ground level to the apex of the tallest branch. The crown diameter data were collected by measuring the distance between the outside leaves in a north - south and an east – west direction. Two sets of height and crown diameter data were collected for each plant. One set of data included only living current years growth. The other set of data included the living portions plus the current years growth which had senesced. The difference between the two sets of data was the amount of senesced (dead) plant material. Crown area and crown volume was determined for the living portions and for the living plus dead portions of the plants. The formula used to determine crown area was:

$$c.a. = \left[ \frac{D_1 + D_2}{4} \right]^2 \pi$$

The formula used to determine crown volume was:

$$c.v. = 4 / 3 \pi H D_1 D_2$$

A plant species present list was made for each plot. Each species was separated into four categories of relative abundance which were Dominant, Abundant, Frequent and Scarce.

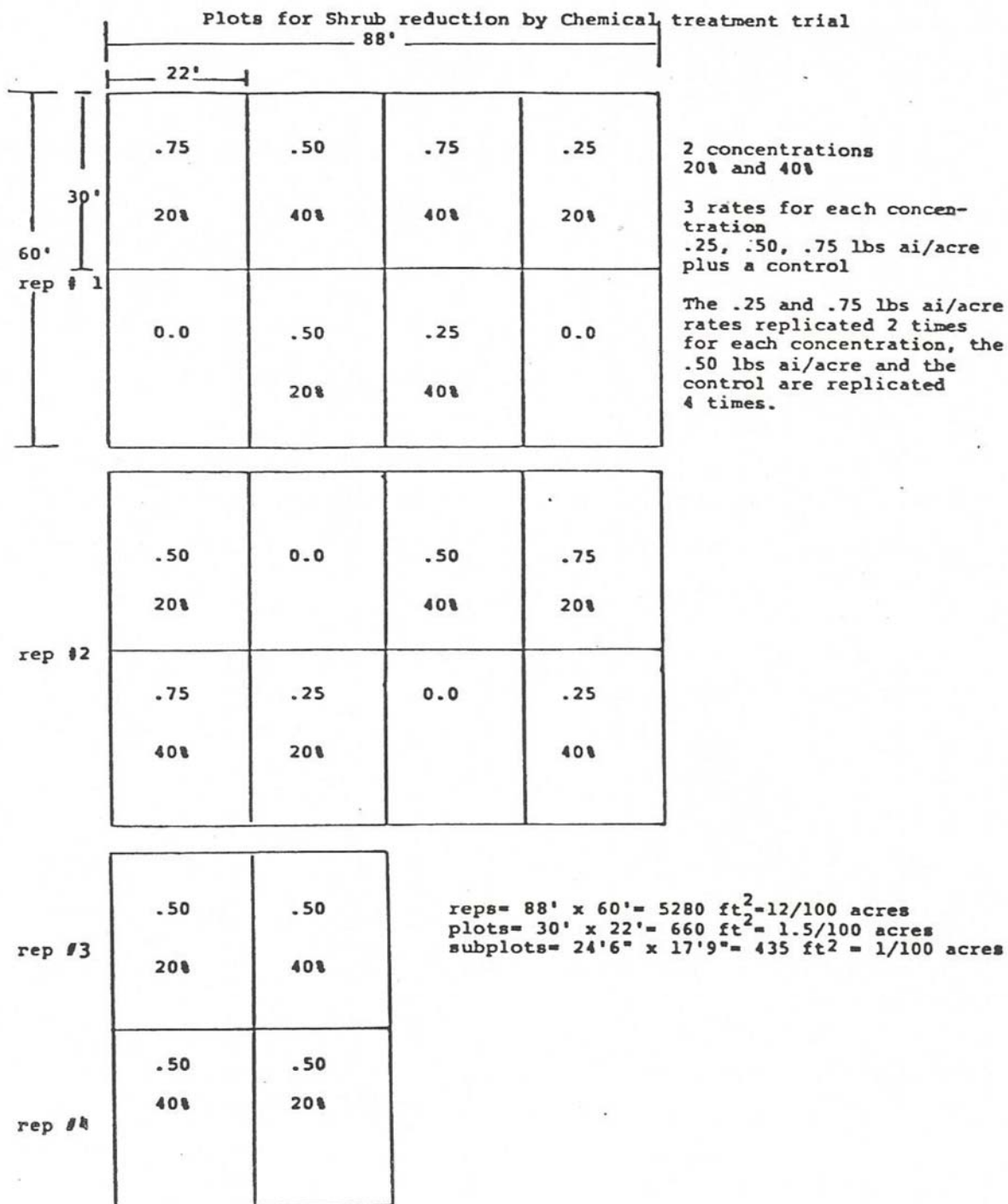
A few silver sage plants that were located on or near the boundary between two plots were unintentionally placed in the wrong plot during field measurements in 1983. Since each plant had been tagged with identification numbers and measured individually, it was a simple matter to place the data with the correct plot. All of the 1983 data was recalculated and have been included in this report along with the 1984 data.

Data to detect the effects of Tebuthiuron on silver sage was collected 94 days after treatment in 1983 and 413 days after treatment in 1984. Very little effect of the Tebuthiuron at the rates and concentrations tested was detected in 1983, 94 days after treatment. Very little difference was noticed between treatments.

In 1984, the effects of Tebuthiuron on silver sage were considerably greater than in 1983. The difference in the treatment effects were also greater in 1984. Based on percentage of reduction in total plant size per treatment the sequence from most effective to least effective rate and concentration was: .75, 20%; .50, 40%; .75, 40%; .50, 20%; .25, 40%; .25, 20%; and 0.0.

These plots will be monitored for two additional years to follow the effects of Tebuthiuron on silver sage at these rates.

**Figure 1:** Shrub Reduction Trial Plot Diagram.



**Table 1. Mean Height and Two Diameters in Centimeters of Silver Sage – 1983**

|         | Rate<br>Lbs. Ai / Acre | Conc.<br>% | Total #<br>Plants | Height     |            | Diameter<br>N-S |            | Diameter<br>E-W |            |
|---------|------------------------|------------|-------------------|------------|------------|-----------------|------------|-----------------|------------|
|         |                        |            |                   | Dead<br>Cm | Live<br>Cm | Dead<br>Cm      | Live<br>Cm | Dead<br>Cm      | Live<br>Cm |
| Rep 1 E | 0.0                    |            | 73                | 83.69      | 82.86      | 69.03           | 66.69      | 68.43           | 66.55      |
| Rep 1 W | 0.0                    |            | 61                | 75.38      | 74.70      | 63.61           | 60.65      | 61.58           | 60.86      |
| Rep 2 E | 0.0                    |            | 57                | 76.61      | 75.67      | 77.00           | 74.68      | 74.41           | 71.57      |
| Rep 2 W | 0.0                    |            | 87                | 72.91      | 72.60      | 58.94           | 55.21      | 54.49           | 51.29      |
| Mean    |                        |            | 69.5              | 77.04      | 76.39      | 66.32           | 63.41      | 63.79           | 61.56      |
|         |                        |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .25                    | 20         | 55                | 86.17      | 82.09      | 84.09           | 80.37      | 82.23           | 78.03      |
| Rep 2   | .25                    | 20         | 51                | 83.79      | 83.02      | 89.59           | 83.96      | 85.76           | 84.53      |
| Mean    |                        |            | 53.0              | 85.02      | 82.53      | 86.74           | 82.09      | 83.93           | 81.15      |
|         |                        |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .25                    | 40         | 69                | 74.07      | 72.80      | 62.39           | 58.68      | 63.28           | 58.22      |
| Rep 2   | .25                    | 40         | 77                | 71.47      | 70.88      | 64.61           | 60.07      | 64.82           | 60.85      |
| Mean    |                        |            | 73.0              | 72.70      | 71.79      | 63.56           | 59.41      | 64.09           | 59.61      |
|         |                        |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .50                    | 20         | 61                | 78.05      | 76.42      | 66.06           | 61.21      | 58.03           | 54.71      |
| Rep 2   | .50                    | 20         | 66                | 90.33      | 90.11      | 84.29           | 81.66      | 77.58           | 73.08      |
| Rep 3   | .50                    | 20         | 71                | 72.81      | 71.95      | 61.50           | 57.32      | 58.64           | 53.41      |
| Rep 4   | .50                    | 20         | 44                | 74.05      | 73.82      | 59.36           | 56.00      | 54.64           | 48.43      |
| Mean    |                        |            | 60.5              | 79.13      | 78.37      | 68.48           | 64.70      | 62.92           | 58.20      |
|         |                        |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .50                    | 40         | 67                | 79.40      | 77.20      | 65.13           | 60.58      | 72.99           | 66.19      |
| Rep 2   | .50                    | 40         | 64                | 86.01      | 84.80      | 83.23           | 77.84      | 78.94           | 74.83      |
| Rep 3   | .50                    | 40         | 49                | 68.68      | 68.30      | 66.14           | 62.20      | 55.51           | 52.90      |
| Rep 4   | .50                    | 40         | 48                | 83.65      | 82.58      | 87.96           | 85.75      | 78.81           | 73.77      |
| Mean    |                        |            | 57.0              | 79.84      | 78.55      | 75.23           | 71.07      | 72.13           | 67.36      |
|         |                        |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .75                    | 20         | 66                | 90.93      | 90.93      | 80.95           | 74.29      | 82.41           | 72.99      |
| Rep 2   | .75                    | 20         | 63                | 85.07      | 85.07      | 76.99           | 73.34      | 79.29           | 72.36      |
| Mean    |                        |            | 64.5              | 88.07      | 88.07      | 79.02           | 73.82      | 80.88           | 72.68      |
|         |                        |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .75                    | 40         | 51                | 82.00      | 79.15      | 74.72           | 69.57      | 79.74           | 76.19      |
| Rep 2   | .75                    | 40         | 55                | 84.42      | 83.65      | 85.38           | 81.09      | 75.81           | 71.07      |
| Mean    |                        |            | 53.0              | 83.25      | 81.49      | 80.25           | 75.55      | 77.70           | 73.53      |

**Table 2. Mean Percentage of Dead Material – 1983**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total #<br/>Plants</b> | <b>Height<br/>% Dead</b> | <b>Diameter<br/>N-S<br/>% Dead</b> | <b>Diameter<br/>E-W<br/>% Dead</b> |
|---------|-------------------------------|--------------------|---------------------------|--------------------------|------------------------------------|------------------------------------|
| Rep 1 E | 0.0                           |                    | 73                        | 0.99                     | 3.40                               | 2.74                               |
| Rep 1 W | 0.0                           |                    | 61                        | 0.89                     | 4.66                               | 1.16                               |
| Rep 2 E | 0.0                           |                    | 57                        | 1.23                     | 3.01                               | 3.82                               |
| Rep 2 W | 0.0                           |                    | 87                        | 0.43                     | 6.32                               | 5.87                               |
| Mean    |                               |                    | 69.5                      | 0.85                     | 4.39                               | 3.50                               |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .25                           | 20                 | 55                        | 4.74                     | 4.43                               | 5.11                               |
| Rep 2   | .25                           | 20                 | 51                        | 0.92                     | 6.29                               | 1.43                               |
| Mean    |                               |                    | 53.0                      | 2.93                     | 5.35                               | 3.30                               |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .25                           | 40                 | 69                        | 1.71                     | 5.95                               | 7.99                               |
| Rep 2   | .25                           | 40                 | 77                        | 0.83                     | 7.02                               | 6.12                               |
| Mean    |                               |                    | 73.0                      | 1.25                     | 6.53                               | 7.00                               |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .50                           | 20                 | 61                        | 2.09                     | 7.34                               | 5.71                               |
| Rep 2   | .50                           | 20                 | 66                        | 0.24                     | 3.13                               | 5.80                               |
| Rep 3   | .50                           | 20                 | 71                        | 1.18                     | 6.80                               | 8.91                               |
| Rep 4   | .50                           | 20                 | 44                        | 0.31                     | 5.67                               | 11.36                              |
| Mean    |                               |                    | 60.5                      | 0.97                     | 5.52                               | 7.51                               |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .50                           | 40                 | 67                        | 2.77                     | 6.99                               | 9.31                               |
| Rep 2   | .50                           | 40                 | 64                        | 1.40                     | 6.48                               | 5.20                               |
| Rep 3   | .50                           | 40                 | 49                        | 0.56                     | 5.96                               | 4.71                               |
| Rep 4   | .50                           | 40                 | 48                        | 1.27                     | 2.51                               | 6.40                               |
| Mean    |                               |                    | 57.0                      | 1.62                     | 5.53                               | 6.62                               |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .75                           | 20                 | 66                        | 0.00                     | 8.23                               | 11.43                              |
| Rep 2   | .75                           | 20                 | 63                        | 0.00                     | 4.74                               | 8.73                               |
| Mean    |                               |                    | 64.5                      | 0.00                     | 6.57                               | 10.14                              |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .75                           | 40                 | 51                        | 3.47                     | 6.90                               | 4.46                               |
| Rep 2   | .75                           | 40                 | 55                        | 0.90                     | 5.02                               | 6.25                               |
| Mean    |                               |                    | 53.0                      | 2.12                     | 5.86                               | 5.37                               |

**Table 3. Plant Density of Silver Sage – 1983**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total<br/># of<br/>Plants</b> | <b>Density<br/># / m<sup>2</sup></b> | <b>#<br/>Plants<br/>With<br/>Dead</b> | <b>Plants<br/>% with<br/>Dead</b> | <b>#<br/>Plants<br/>Totally<br/>Dead</b> | <b>Plants %<br/>Totally<br/>Dead</b> |
|---------|-------------------------------|--------------------|----------------------------------|--------------------------------------|---------------------------------------|-----------------------------------|------------------------------------------|--------------------------------------|
| Rep 1 E | 0.0                           |                    | 73                               | 1.19                                 | 22                                    | 30.14                             | 0                                        | 0.0                                  |
| Rep 1 W | 0.0                           |                    | 61                               | 0.99                                 | 15                                    | 24.59                             | 0                                        | 0.0                                  |
| Rep 2 E | 0.0                           |                    | 57                               | 0.93                                 | 17                                    | 29.82                             | 0                                        | 0.0                                  |
| Rep 2 W | 0.0                           |                    | 87                               | 1.42                                 | 28                                    | 32.18                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 69.5                             | 1.13                                 | 20.5                                  | 29.50                             | 0                                        | 0.0                                  |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .25                           | 20                 | 55                               | 0.90                                 | 17                                    | 30.91                             | 0                                        | 0.0                                  |
| Rep 2   | .25                           | 20                 | 51                               | 0.83                                 | 17                                    | 33.33                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 53.0                             | 0.87                                 | 17.0                                  | 32.08                             | 0                                        | 0.0                                  |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .25                           | 40                 | 69                               | 1.12                                 | 31                                    | 44.93                             | 0                                        | 0.0                                  |
| Rep 2   | .25                           | 40                 | 77                               | 1.26                                 | 20                                    | 25.97                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 73.0                             | 1.19                                 | 25.5                                  | 34.93                             | 0                                        | 0.0                                  |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .50                           | 20                 | 61                               | 0.99                                 | 17                                    | 27.87                             | 0                                        | 0.0                                  |
| Rep 2   | .50                           | 20                 | 66                               | 1.08                                 | 19                                    | 28.79                             | 0                                        | 0.0                                  |
| Rep 3   | .50                           | 20                 | 71                               | 1.16                                 | 24                                    | 33.80                             | 0                                        | 0.0                                  |
| Rep 4   | .50                           | 20                 | 44                               | 0.72                                 | 15                                    | 34.09                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 60.5                             | 0.99                                 | 18.8                                  | 30.99                             | 0                                        | 0.0                                  |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .50                           | 40                 | 67                               | 1.09                                 | 24                                    | 35.82                             | 0                                        | 0.0                                  |
| Rep 2   | .50                           | 40                 | 64                               | 1.04                                 | 30                                    | 46.88                             | 0                                        | 0.0                                  |
| Rep 3   | .50                           | 40                 | 49                               | 0.80                                 | 16                                    | 32.65                             | 0                                        | 0.0                                  |
| Rep 4   | .50                           | 40                 | 48                               | 0.78                                 | 16                                    | 33.33                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 57.0                             | 0.93                                 | 21.5                                  | 37.72                             | 0                                        | 0.0                                  |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .75                           | 20                 | 66                               | 1.08                                 | 24                                    | 36.36                             | 0                                        | 0.0                                  |
| Rep 2   | .75                           | 20                 | 63                               | 1.03                                 | 22                                    | 34.92                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 64.5                             | 1.06                                 | 23.0                                  | 35.66                             | 0                                        | 0.0                                  |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .75                           | 40                 | 51                               | 0.83                                 | 11                                    | 21.57                             | 0                                        | 0.0                                  |
| Rep 2   | .75                           | 40                 | 55                               | 0.90                                 | 14                                    | 25.45                             | 0                                        | 0.0                                  |
| Mean    |                               |                    | 53.0                             | 0.87                                 | 12.5                                  | 23.58                             | 0                                        | 0.0                                  |

**Table 4. Mean Crown Area and Percent Dead Area – 1983**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total #<br/>Plants</b> | <b>Crown Area<br/>Dead<br/>Cm<sup>2</sup></b> | <b>Crown Area<br/>Live<br/>Cm<sup>2</sup></b> | <b>%<br/>Dead</b> |
|---------|-------------------------------|--------------------|---------------------------|-----------------------------------------------|-----------------------------------------------|-------------------|
| Rep 1 E | 0.0                           |                    | 73                        | 3710.24                                       | 3485.69                                       | 6.05              |
| Rep 1 W | 0.0                           |                    | 61                        | 3077.30                                       | 2899.03                                       | 5.79              |
| Rep 2 E | 0.0                           |                    | 57                        | 4501.34                                       | 4199.58                                       | 6.70              |
| Rep 2 W | 0.0                           |                    | 87                        | 2526.25                                       | 2227.24                                       | 11.84             |
| Mean    |                               |                    | 69.5                      | 3323.84                                       | 3066.28                                       | 7.75              |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .25                           | 20                 | 55                        | 5431.13                                       | 4925.95                                       | 9.30              |
| Rep 2   | .25                           | 20                 | 51                        | 6037.48                                       | 5574.03                                       | 7.68              |
| Mean    |                               |                    | 53.0                      | 5718.86                                       | 5232.77                                       | 8.50              |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .25                           | 40                 | 69                        | 3100.99                                       | 2683.24                                       | 13.47             |
| Rep 2   | .25                           | 40                 | 77                        | 3289.40                                       | 2871.18                                       | 12.71             |
| Mean    |                               |                    | 73.0                      | 3199.66                                       | 2781.56                                       | 13.07             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .50                           | 20                 | 61                        | 3023.30                                       | 2638.65                                       | 12.72             |
| Rep 2   | .50                           | 20                 | 66                        | 5145.10                                       | 4701.63                                       | 8.62              |
| Rep 3   | .50                           | 20                 | 71                        | 2834.01                                       | 2407.63                                       | 15.04             |
| Rep 4   | .50                           | 20                 | 44                        | 2551.76                                       | 2141.39                                       | 16.08             |
| Mean    |                               |                    | 60.5                      | 3390.21                                       | 2965.68                                       | 12.52             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .50                           | 40                 | 67                        | 3745.67                                       | 3155.47                                       | 15.76             |
| Rep 2   | .50                           | 40                 | 64                        | 5163.64                                       | 4576.56                                       | 11.37             |
| Rep 3   | .50                           | 40                 | 49                        | 2905.77                                       | 2601.15                                       | 10.48             |
| Rep 4   | .50                           | 40                 | 48                        | 5460.97                                       | 4996.49                                       | 8.51              |
| Mean    |                               |                    | 57.0                      | 4263.83                                       | 3762.44                                       | 11.76             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .75                           | 20                 | 66                        | 5239.82                                       | 4258.85                                       | 18.72             |
| Rep 2   | .75                           | 20                 | 63                        | 4795.49                                       | 4168.39                                       | 13.08             |
| Mean    |                               |                    | 64.5                      | 5020.36                                       | 4214.55                                       | 16.05             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .75                           | 40                 | 51                        | 4684.89                                       | 4171.46                                       | 10.96             |
| Rep 2   | .75                           | 40                 | 55                        | 5101.31                                       | 4545.91                                       | 10.89             |
| Mean    |                               |                    | 53.0                      | 4898.74                                       | 4363.74                                       | 10.92             |

**Table 5. Mean Plant Volume and Percent Dead Volume – 1983**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total #<br/>Plants</b> | <b>Plant<br/>Volume<br/>Dead<br/>M<sup>3</sup></b> | <b>Plant<br/>Volume<br/>Live<br/>M<sup>3</sup></b> | <b>%<br/>Dead</b> |
|---------|-------------------------------|--------------------|---------------------------|----------------------------------------------------|----------------------------------------------------|-------------------|
| Rep 1 E | 0.0                           |                    | 73                        | 0.207                                              | 0.193                                              | 6.98              |
| Rep 1 W | 0.0                           |                    | 61                        | 0.155                                              | 0.144                                              | 6.61              |
| Rep 2 E | 0.0                           |                    | 57                        | 0.230                                              | 0.212                                              | 7.87              |
| Rep 2 W | 0.0                           |                    | 87                        | 0.123                                              | 0.108                                              | 12.20             |
| Mean    |                               |                    | 69.5                      | 0.171                                              | 0.156                                              | 8.52              |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .25                           | 20                 | 55                        | 0.312                                              | 0.270                                              | 13.61             |
| Rep 2   | .25                           | 20                 | 51                        | 0.337                                              | 0.308                                              | 8.48              |
| Mean    |                               |                    | 53.0                      | 0.324                                              | 0.288                                              | 11.16             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .25                           | 40                 | 69                        | 0.153                                              | 0.130                                              | 14.95             |
| Rep 2   | .25                           | 40                 | 77                        | 0.156                                              | 0.136                                              | 13.44             |
| Mean    |                               |                    | 73.0                      | 0.155                                              | 0.133                                              | 14.15             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .50                           | 20                 | 61                        | 0.157                                              | 0.134                                              | 14.46             |
| Rep 2   | .50                           | 20                 | 66                        | 0.309                                              | 0.282                                              | 8.97              |
| Rep 3   | .50                           | 20                 | 71                        | 0.137                                              | 0.115                                              | 16.10             |
| Rep 4   | .50                           | 20                 | 44                        | 0.126                                              | 0.105                                              | 16.64             |
| Mean    |                               |                    | 60.5                      | 0.179                                              | 0.155                                              | 13.45             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .50                           | 40                 | 67                        | 0.198                                              | 0.162                                              | 17.99             |
| Rep 2   | .50                           | 40                 | 64                        | 0.296                                              | 0.259                                              | 12.59             |
| Rep 3   | .50                           | 40                 | 49                        | 0.132                                              | 0.118                                              | 10.89             |
| Rep 4   | .50                           | 40                 | 48                        | 0.304                                              | 0.274                                              | 9.91              |
| Mean    |                               |                    | 57.0                      | 0.227                                              | 0.197                                              | 13.21             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .75                           | 20                 | 66                        | 0.318                                              | 0.258                                              | 18.72             |
| Rep 2   | .75                           | 20                 | 63                        | 0.272                                              | 0.236                                              | 13.06             |
| Mean    |                               |                    | 64.5                      | 0.295                                              | 0.247                                              | 16.04             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .75                           | 40                 | 51                        | 0.256                                              | 0.220                                              | 14.14             |
| Rep 2   | .75                           | 40                 | 55                        | 0.286                                              | 0.252                                              | 11.77             |
| Mean    |                               |                    | 53.0                      | 0.272                                              | 0.237                                              | 12.80             |

**Table 6. Mean Percent Dead, Summary – 1983**

| <b>Rate<br/>Lbs<br/>Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Height<br/>% Dead</b> | <b><u>Diameter</u><br/>N-S<br/>% Dead</b> | <b><u>Diameter</u><br/>E-W<br/>% Dead</b> | <b><u>Total<br/>Height<br/>Diameter</u><br/>N-S<br/>E-W</b> | <b>Area<br/>% Dead</b> | <b>Volume<br/>% Dead</b> |
|-----------------------------------|--------------------|--------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------|--------------------------|
| 0.0                               |                    | 0.85                     | 4.39                                      | 3.50                                      | 8.74                                                        | 7.75                   | 8.52                     |
| .25                               | 20                 | 2.93                     | 5.35                                      | 3.30                                      | 11.58                                                       | 8.50                   | 11.16                    |
| .25                               | 40                 | 1.25                     | 6.53                                      | 7.00                                      | 14.78                                                       | 13.07                  | 14.15                    |
| .50                               | 20                 | 0.97                     | 5.52                                      | 7.51                                      | 14.00                                                       | 12.52                  | 13.45                    |
| .50                               | 40                 | 1.62                     | 5.53                                      | 6.62                                      | 13.77                                                       | 11.76                  | 13.21                    |
| .75                               | 20                 | 0.00                     | 6.57                                      | 10.14                                     | 16.71                                                       | 16.05                  | 16.04                    |
| .75                               | 40                 | 2.12                     | 5.86                                      | 5.37                                      | 13.35                                                       | 10.92                  | 12.80                    |

**Table 7. Mean Height and Two Diameters in Centimeters of Silver Sage – 1984**

|         | Rate<br>Lbs Ai / Acre | Conc.<br>% | Total #<br>Plants | Height     |            | Diameter<br>N-S |            | Diameter<br>E-W |            |
|---------|-----------------------|------------|-------------------|------------|------------|-----------------|------------|-----------------|------------|
|         |                       |            |                   | Dead<br>cm | Live<br>cm | Dead<br>cm      | Live<br>cm | Dead<br>cm      | Live<br>cm |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1 E | 0.0                   |            | 73                | 68.96      | 66.03      | 58.17           | 55.22      | 53.76           | 51.08      |
| Rep 1 W | 0.0                   |            | 66                | 64.77      | 59.68      | 56.39           | 47.52      | 56.81           | 48.83      |
| Rep 2 E | 0.0                   |            | 59                | 74.14      | 72.22      | 66.38           | 61.99      | 60.42           | 55.74      |
| Rep 2 W | 0.0                   |            | 77                | 68.87      | 60.82      | 54.71           | 49.35      | 51.26           | 45.32      |
| Mean    |                       |            | 68.8              | 69.04      | 64.37      | 58.53           | 53.18      | 55.22           | 49.93      |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .25                   | 20         | 37                | 87.06      | 78.68      | 87.78           | 74.50      | 82.04           | 70.56      |
| Rep 2   | .25                   | 20         | 49                | 81.58      | 72.11      | 71.41           | 58.34      | 68.25           | 53.61      |
| Mean    |                       |            | 43.0              | 83.93      | 74.93      | 78.45           | 65.29      | 74.18           | 60.90      |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .25                   | 40         | 65                | 66.42      | 58.19      | 56.09           | 47.36      | 55.62           | 45.14      |
| Rep 2   | .25                   | 40         | 78                | 64.50      | 57.88      | 56.03           | 45.47      | 51.43           | 41.17      |
| Mean    |                       |            | 71.5              | 65.37      | 58.02      | 56.06           | 46.33      | 53.33           | 42.97      |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .50                   | 20         | 58                | 74.94      | 52.28      | 60.60           | 34.97      | 61.22           | 37.63      |
| Rep 2   | .50                   | 20         | 59                | 91.45      | 75.43      | 78.84           | 56.39      | 74.55           | 53.92      |
| Rep 3   | .50                   | 20         | 62                | 73.40      | 56.37      | 65.74           | 41.30      | 66.34           | 41.29      |
| Rep 4   | .50                   | 20         | 50                | 69.97      | 58.40      | 59.14           | 43.25      | 52.32           | 36.00      |
| Mean    |                       |            | 57.3              | 77.69      | 60.69      | 66.37           | 44.01      | 64.10           | 42.55      |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .50                   | 40         | 56                | 82.18      | 68.42      | 71.51           | 61.02      | 68.92           | 58.13      |
| Rep 2   | .50                   | 40         | 62                | 81.55      | 66.57      | 80.59           | 54.81      | 79.89           | 56.36      |
| Rep 3   | .50                   | 40         | 68                | 61.74      | 29.61      | 50.43           | 24.03      | 46.13           | 22.29      |
| Rep 4   | .50                   | 40         | 64                | 78.08      | 42.28      | 63.39           | 32.49      | 51.71           | 23.36      |
| Mean    |                       |            | 62.5              | 75.42      | 50.71      | 65.95           | 42.11      | 61.04           | 39.04      |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .75                   | 20         | 52                | 94.93      | 78.51      | 81.71           | 77.40      | 79.99           | 64.93      |
| Rep 2   | .75                   | 20         | 61                | 76.39      | 49.77      | 68.12           | 40.07      | 67.68           | 38.67      |
| Mean    |                       |            | 56.5              | 84.92      | 62.99      | 74.37           | 57.25      | 73.35           | 50.75      |
|         |                       |            |                   |            |            |                 |            |                 |            |
| Rep 1   | .75                   | 40         | 40                | 79.95      | 59.89      | 80.54           | 64.01      | 72.87           | 59.13      |
| Rep 2   | .75                   | 40         | 43                | 72.53      | 60.05      | 71.42           | 54.77      | 63.06           | 46.10      |
| Mean    |                       |            | 41.5              | 76.10      | 59.97      | 75.82           | 59.23      | 67.78           | 52.38      |

**Table 8. Mean Percentage of Dead Material – 1984**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total #<br/>Plants</b> | <b>Height<br/>% Dead</b> | <b>Diameter<br/>N-S<br/>% Dead</b> | <b>Diameter<br/>E-W<br/>% Dead</b> |
|---------|-------------------------------|--------------------|---------------------------|--------------------------|------------------------------------|------------------------------------|
| Rep 1 E | 0.0                           |                    | 73                        | 4.25                     | 5.07                               | 4.98                               |
| Rep 1 W | 0.0                           |                    | 66                        | 7.86                     | 15.73                              | 14.05                              |
| Rep 2 E | 0.0                           |                    | 59                        | 2.60                     | 6.61                               | 7.75                               |
| Rep 2 W | 0.0                           |                    | 77                        | 11.70                    | 9.80                               | 11.58                              |
| Mean    |                               |                    | 68.8                      | 6.76                     | 9.15                               | 9.59                               |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .25                           | 20                 | 37                        | 9.63                     | 15.13                              | 13.99                              |
| Rep 2   | .25                           | 20                 | 49                        | 11.61                    | 18.30                              | 21.45                              |
| Mean    |                               |                    | 43.0                      | 10.73                    | 16.77                              | 17.90                              |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .25                           | 40                 | 65                        | 12.40                    | 15.56                              | 18.84                              |
| Rep 2   | .25                           | 40                 | 78                        | 10.26                    | 18.84                              | 19.95                              |
| Mean    |                               |                    | 71.5                      | 11.25                    | 17.35                              | 19.43                              |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .50                           | 20                 | 58                        | 30.24                    | 42.29                              | 38.53                              |
| Rep 2   | .50                           | 20                 | 59                        | 17.51                    | 28.48                              | 27.68                              |
| Rep 3   | .50                           | 20                 | 62                        | 23.20                    | 37.19                              | 37.75                              |
| Rep 4   | .50                           | 20                 | 50                        | 16.54                    | 26.86                              | 30.43                              |
| Mean    |                               |                    | 57.3                      | 21.89                    | 33.70                              | 33.62                              |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .50                           | 40                 | 56                        | 16.75                    | 14.67                              | 15.66                              |
| Rep 2   | .50                           | 40                 | 62                        | 18.37                    | 31.99                              | 29.46                              |
| Rep 3   | .50                           | 40                 | 68                        | 52.04                    | 52.35                              | 51.68                              |
| Rep 4   | .50                           | 40                 | 64                        | 45.86                    | 48.75                              | 54.83                              |
| Mean    |                               |                    | 62.5                      | 32.76                    | 36.14                              | 36.04                              |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .75                           | 20                 | 52                        | 17.30                    | 5.27                               | 18.83                              |
| Rep 2   | .75                           | 20                 | 61                        | 34.85                    | 41.17                              | 42.87                              |
| Mean    |                               |                    | 56.5                      | 25.82                    | 23.02                              | 30.80                              |
|         |                               |                    |                           |                          |                                    |                                    |
| Rep 1   | .75                           | 40                 | 40                        | 25.10                    | 20.52                              | 18.85                              |
| Rep 2   | .75                           | 40                 | 43                        | 17.20                    | 23.31                              | 26.89                              |
| Mean    |                               |                    | 41.5                      | 21.20                    | 21.88                              | 22.72                              |

**Table 9. Plant Density of Silver Sage – 1984**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total<br/># of<br/>Plants</b> | <b>Density<br/># / m<sup>2</sup></b> | <b>#<br/>Plants<br/>With<br/>Dead</b> | <b>Plants<br/>% With<br/>Dead</b> | <b>#<br/>Plants<br/>Totally<br/>Dead</b> | <b>Plants %<br/>Totally<br/>Dead</b> |
|---------|-------------------------------|--------------------|----------------------------------|--------------------------------------|---------------------------------------|-----------------------------------|------------------------------------------|--------------------------------------|
| Rep 1 E | 0.0                           |                    | 73                               | 1.19                                 | 24                                    | 32.88                             | 2                                        | 2.74                                 |
| Rep 1 W | 0.0                           |                    | 66                               | 1.08                                 | 27                                    | 40.91                             | 1                                        | 1.52                                 |
| Rep 2 E | 0.0                           |                    | 59                               | 0.96                                 | 19                                    | 32.20                             | 0                                        | 0.00                                 |
| Rep 2 W | 0.0                           |                    | 77                               | 1.26                                 | 37                                    | 48.05                             | 6                                        | 7.79                                 |
| Mean    |                               |                    | 68.8                             | 1.12                                 | 26.8                                  | 38.91                             | 2.3                                      | 3.27                                 |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .25                           | 20                 | 37                               | 0.60                                 | 29                                    | 78.38                             | 1                                        | 2.70                                 |
| Rep 2   | .25                           | 20                 | 49                               | 0.80                                 | 22                                    | 44.90                             | 3                                        | 6.12                                 |
| Mean    |                               |                    | 43.0                             | 0.70                                 | 25.5                                  | 59.30                             | 2.0                                      | 4.65                                 |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .25                           | 40                 | 65                               | 1.06                                 | 34                                    | 52.31                             | 3                                        | 4.62                                 |
| Rep 2   | .25                           | 40                 | 78                               | 1.27                                 | 39                                    | 50.00                             | 5                                        | 6.41                                 |
| Mean    |                               |                    | 71.5                             | 1.17                                 | 36.5                                  | 51.05                             | 4.0                                      | 5.59                                 |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .50                           | 20                 | 58                               | 0.95                                 | 34                                    | 58.62                             | 16                                       | 27.59                                |
| Rep 2   | .50                           | 20                 | 59                               | 0.96                                 | 55                                    | 93.22                             | 5                                        | 8.47                                 |
| Rep 3   | .50                           | 20                 | 62                               | 1.01                                 | 51                                    | 82.26                             | 13                                       | 20.97                                |
| Rep 4   | .50                           | 20                 | 50                               | 0.82                                 | 32                                    | 64.00                             | 7                                        | 14.00                                |
| Mean    |                               |                    | 57.3                             | 0.94                                 | 43.0                                  | 75.11                             | 10.3                                     | 17.90                                |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .50                           | 40                 | 56                               | 0.91                                 | 40                                    | 71.43                             | 7                                        | 12.50                                |
| Rep 2   | .50                           | 40                 | 62                               | 1.01                                 | 50                                    | 80.65                             | 4                                        | 6.45                                 |
| Rep 3   | .50                           | 40                 | 68                               | 1.11                                 | 42                                    | 61.76                             | 30                                       | 44.12                                |
| Rep 4   | .50                           | 40                 | 64                               | 1.04                                 | 46                                    | 71.88                             | 28                                       | 43.75                                |
| Mean    |                               |                    | 62.5                             | 1.02                                 | 44.5                                  | 71.20                             | 17.3                                     | 27.60                                |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .75                           | 20                 | 52                               | 0.85                                 | 49                                    | 94.23                             | 2                                        | 3.85                                 |
| Rep 2   | .75                           | 20                 | 61                               | 0.99                                 | 54                                    | 88.52                             | 17                                       | 27.87                                |
| Mean    |                               |                    | 56.5                             | 0.92                                 | 51.5                                  | 91.15                             | 9.5                                      | 16.81                                |
|         |                               |                    |                                  |                                      |                                       |                                   |                                          |                                      |
| Rep 1   | .75                           | 40                 | 40                               | 0.65                                 | 19                                    | 47.50                             | 7                                        | 17.50                                |
| Rep 2   | .75                           | 40                 | 43                               | 0.70                                 | 20                                    | 46.51                             | 5                                        | 11.63                                |
| Mean    |                               |                    | 41.5                             | 0.68                                 | 19.5                                  | 46.99                             | 6.0                                      | 14.46                                |

**Table 10. Mean Crown Area and Percent Dead Area – 1984**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total #<br/>Plants</b> | <b>Crown Area<br/>Dead<br/>Cm<sup>2</sup></b> | <b>Crown Area<br/>Live<br/>Cm<sup>2</sup></b> | <b>%<br/>Dead</b> |
|---------|-------------------------------|--------------------|---------------------------|-----------------------------------------------|-----------------------------------------------|-------------------|
| Rep 1 E | 0.0                           |                    | 73                        | 2460.00                                       | 2218.80                                       | 9.80              |
| Rep 1 W | 0.0                           |                    | 66                        | 2516.00                                       | 1822.60                                       | 27.56             |
| Rep 2 E | 0.0                           |                    | 59                        | 3156.79                                       | 2721.26                                       | 13.80             |
| Rep 2 W | 0.0                           |                    | 77                        | 2204.72                                       | 1759.72                                       | 20.18             |
| Mean    |                               |                    | 68.8                      | 2540.77                                       | 2087.37                                       | 17.84             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .25                           | 20                 | 37                        | 5662.24                                       | 4131.64                                       | 27.03             |
| Rep 2   | .25                           | 20                 | 49                        | 3829.62                                       | 2460.85                                       | 35.74             |
| Mean    |                               |                    | 43.0                      | 4574.30                                       | 3126.92                                       | 31.64             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .25                           | 40                 | 65                        | 2450.17                                       | 1680.02                                       | 31.43             |
| Rep 2   | .25                           | 40                 | 78                        | 2267.28                                       | 1473.93                                       | 34.99             |
| Mean    |                               |                    | 71.5                      | 2349.53                                       | 1565.93                                       | 33.35             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .50                           | 20                 | 58                        | 2913.88                                       | 1035.01                                       | 64.48             |
| Rep 2   | .50                           | 20                 | 59                        | 4620.31                                       | 2388.95                                       | 48.29             |
| Rep 3   | .50                           | 20                 | 62                        | 3425.38                                       | 1339.23                                       | 60.90             |
| Rep 4   | .50                           | 20                 | 50                        | 2439.32                                       | 1245.79                                       | 48.93             |
| Mean    |                               |                    | 57.3                      | 3342.45                                       | 1471.14                                       | 55.99             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .50                           | 40                 | 56                        | 3872.15                                       | 2787.19                                       | 28.02             |
| Rep 2   | .50                           | 40                 | 62                        | 5057.00                                       | 2426.47                                       | 52.02             |
| Rep 3   | .50                           | 40                 | 68                        | 1830.80                                       | 421.26                                        | 76.99             |
| Rep 4   | .50                           | 40                 | 64                        | 2601.03                                       | 612.36                                        | 76.46             |
| Mean    |                               |                    | 62.5                      | 3166.20                                       | 1293.10                                       | 59.16             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .75                           | 20                 | 52                        | 5134.05                                       | 3977.98                                       | 22.52             |
| Rep 2   | .75                           | 20                 | 61                        | 3621.01                                       | 1217.34                                       | 66.38             |
| Mean    |                               |                    | 56.5                      | 4284.55                                       | 2290.45                                       | 46.54             |
|         |                               |                    |                           |                                               |                                               |                   |
| Rep 1   | .75                           | 40                 | 40                        | 4620.71                                       | 2977.34                                       | 35.57             |
| Rep 2   | .75                           | 40                 | 43                        | 3550.78                                       | 1997.98                                       | 43.73             |
| Mean    |                               |                    | 41.5                      | 4048.85                                       | 2445.66                                       | 39.60             |

**Table 11. Mean Plant Volume and Percent Dead Volume – 1984**

|         | <b>Rate<br/>Lbs Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Total #<br/>Plants</b> | <b>Plant<br/>Volume<br/>Dead<br/>M<sup>3</sup></b> | <b>Plant<br/>Volume<br/>Live<br/>M<sup>3</sup></b> | <b>%<br/>Dead</b> |
|---------|-------------------------------|--------------------|---------------------------|----------------------------------------------------|----------------------------------------------------|-------------------|
| Rep 1 E | 0.0                           |                    | 73                        | 0.113                                              | 0.098                                              | 13.64             |
| Rep 1 W | 0.0                           |                    | 66                        | 0.109                                              | 0.073                                              | 33.26             |
| Rep 2 E | 0.0                           |                    | 59                        | 0.156                                              | 0.131                                              | 16.09             |
| Rep 2 W | 0.0                           |                    | 77                        | 0.101                                              | 0.071                                              | 29.57             |
| Mean    |                               |                    | 68.8                      | 0.117                                              | 0.089                                              | 23.41             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .25                           | 20                 | 37                        | 0.328                                              | 0.217                                              | 34.03             |
| Rep 2   | .25                           | 20                 | 49                        | 0.208                                              | 0.118                                              | 43.27             |
| Mean    |                               |                    | 43.0                      | 0.226                                              | 0.156                                              | 39.00             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .25                           | 40                 | 65                        | 0.108                                              | 0.065                                              | 39.97             |
| Rep 2   | .25                           | 40                 | 78                        | 0.097                                              | 0.057                                              | 41.70             |
| Mean    |                               |                    | 71.5                      | 0.102                                              | 0.060                                              | 40.90             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .50                           | 20                 | 58                        | 0.146                                              | 0.036                                              | 75.25             |
| Rep 2   | .50                           | 20                 | 59                        | 0.281                                              | 0.120                                              | 57.34             |
| Rep 3   | .50                           | 20                 | 62                        | 0.168                                              | 0.050                                              | 69.97             |
| Rep 4   | .50                           | 20                 | 50                        | 0.113                                              | 0.048                                              | 57.53             |
| Mean    |                               |                    | 57.3                      | 0.173                                              | 0.060                                              | 65.62             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .50                           | 40                 | 56                        | 0.212                                              | 0.127                                              | 40.09             |
| Rep 2   | .50                           | 40                 | 62                        | 0.275                                              | 0.108                                              | 60.84             |
| Rep 3   | .50                           | 40                 | 68                        | 0.075                                              | 0.008                                              | 88.96             |
| Rep 4   | .50                           | 40                 | 64                        | 0.134                                              | 0.017                                              | 87.47             |
| Mean    |                               |                    | 62.5                      | 0.159                                              | 0.044                                              | 72.54             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .75                           | 20                 | 52                        | 0.325                                              | 0.207                                              | 36.40             |
| Rep 2   | .75                           | 20                 | 61                        | 0.184                                              | 0.040                                              | 78.10             |
| Mean    |                               |                    | 56.5                      | 0.243                                              | 0.096                                              | 60.49             |
|         |                               |                    |                           |                                                    |                                                    |                   |
| Rep 1   | .75                           | 40                 | 40                        | 0.246                                              | 0.119                                              | 51.69             |
| Rep 2   | .75                           | 40                 | 43                        | 0.171                                              | 0.079                                              | 53.57             |
| Mean    |                               |                    | 41.5                      | 0.205                                              | 0.097                                              | 52.43             |

**Table 12. Mean Percent Dead, Summary – 1984**

| <b>Rate<br/>Lbs<br/>Ai / Acre</b> | <b>Conc.<br/>%</b> | <b>Height<br/>% Dead</b> | <b><u>Diameter</u><br/>N-S<br/>% Dead</b> | <b><u>Diameter</u><br/>E-W<br/>% Dead</b> | <b>Total<br/>Height<br/><u>Diameter</u><br/>N-S<br/>E-W</b> | <b>Area<br/>% Dead</b> | <b>Volume<br/>% Dead</b> |
|-----------------------------------|--------------------|--------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------------------------|------------------------|--------------------------|
| 0.0                               |                    | 6.76                     | 9.15                                      | 9.59                                      | 25.50                                                       | 17.84                  | 23.41                    |
| .25                               | 20                 | 10.73                    | 16.77                                     | 17.90                                     | 45.40                                                       | 31.64                  | 39.00                    |
| .25                               | 40                 | 11.25                    | 17.35                                     | 19.43                                     | 48.03                                                       | 33.35                  | 40.90                    |
| .50                               | 20                 | 21.89                    | 33.70                                     | 33.62                                     | 89.21                                                       | 55.99                  | 65.62                    |
| .50                               | 40                 | 32.76                    | 36.14                                     | 36.04                                     | 104.94                                                      | 59.16                  | 72.54                    |
| .75                               | 20                 | 25.82                    | 23.02                                     | 30.80                                     | 79.64                                                       | 46.54                  | 60.49                    |
| .75                               | 40                 | 21.20                    | 21.88                                     | 22.72                                     | 65.80                                                       | 39.60                  | 52.43                    |

**Table 13. Percentage of Reduction in Mean Plant Size per Plot and Total Plant Size per Plot 94 and 413 Days after Treatment of Tebuthiuron**

|                                   | Treatment |  |                      |       |  |                      |       |  |                      |       |
|-----------------------------------|-----------|--|----------------------|-------|--|----------------------|-------|--|----------------------|-------|
|                                   | 0.0       |  | .25 lbs<br>Ai / Acre |       |  | .50 lbs<br>Ai / Acre |       |  | .75 lbs<br>Ai / Acre |       |
|                                   |           |  | 20%                  | 40%   |  | 20%                  | 40%   |  | 20%                  | 40%   |
| MEAN PLANT SIZE PER PLOT:         |           |  |                      |       |  |                      |       |  |                      |       |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Mean Height   cm                  | 77.0      |  | 85.0                 | 72.7  |  | 79.1                 | 79.8  |  | 88.1                 | 83.3  |
| % Reduction in 94 Days            | 0.8       |  | 2.9                  | 1.3   |  | 1.0                  | 1.6   |  | 0.0                  | 2.1   |
| % Reduction in 413 Days           | 16.5      |  | 11.9                 | 20.2  |  | 23.3                 | 36.5  |  | 28.5                 | 28.0  |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Mean Diameter N-S   cm            | 66.3      |  | 86.7                 | 63.6  |  | 68.5                 | 75.2  |  | 79.0                 | 80.3  |
| % Reduction in 94 Days            | 4.4       |  | 5.4                  | 6.5   |  | 5.5                  | 5.5   |  | 6.6                  | 5.9   |
| % Reduction in 413 Days           | 19.8      |  | 24.7                 | 27.1  |  | 35.7                 | 44.0  |  | 27.6                 | 26.2  |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Mean Diameter E-W   cm            | 63.8      |  | 83.9                 | 64.1  |  | 62.9                 | 72.1  |  | 80.9                 | 77.7  |
| % Reduction in 94 Days            | 3.5       |  | 3.3                  | 7.0   |  | 7.5                  | 6.6   |  | 10.1                 | 5.4   |
| % Reduction in 413 Days           | 21.7      |  | 27.4                 | 33.0  |  | 32.4                 | 45.9  |  | 37.3                 | 32.6  |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Mean Crown Area   m <sup>2</sup>  | 0.332     |  | 0.572                | 0.320 |  | 0.339                | 0.426 |  | 0.502                | 0.485 |
| % Reduction in 94 Days            | 7.8       |  | 8.5                  | 13.1  |  | 12.5                 | 11.8  |  | 16.1                 | 10.9  |
| % Reduction in 413 Days           | 37.2      |  | 45.3                 | 51.1  |  | 56.6                 | 69.7  |  | 54.4                 | 50.1  |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Mean Volume   m <sup>3</sup>      | 0.171     |  | 0.324                | 0.155 |  | 0.179                | 0.227 |  | 0.295                | 0.272 |
| % Reduction in 94 Days            | 8.8       |  | 11.1                 | 14.2  |  | 13.4                 | 13.2  |  | 16.3                 | 12.9  |
| % Reduction in 413 Days           | 48.0      |  | 51.9                 | 61.3  |  | 66.5                 | 80.6  |  | 67.5                 | 64.3  |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| TOTAL PLANT SIZE PER PLOT:        |           |  |                      |       |  |                      |       |  |                      |       |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Total Crown Area   m <sup>2</sup> | 23.1      |  | 30.3                 | 23.4  |  | 20.5                 | 24.3  |  | 32.4                 | 26.0  |
| % Reduction in 94 Days            | 7.8       |  | 8.5                  | 13.1  |  | 12.5                 | 11.7  |  | 16.1                 | 10.9  |
| % Reduction in 413 Days           | 37.9      |  | 55.6                 | 52.1  |  | 59.0                 | 66.8  |  | 60.0                 | 60.9  |
|                                   |           |  |                      |       |  |                      |       |  |                      |       |
| Total Volume   m <sup>3</sup>     | 11.9      |  | 17.2                 | 11.3  |  | 10.8                 | 12.9  |  | 19.0                 | 14.4  |
| % Reduction in 94 Days            | 8.5       |  | 11.2                 | 14.1  |  | 13.4                 | 13.2  |  | 16.0                 | 12.8  |
| % Reduction in 413 Days           | 48.2      |  | 60.9                 | 61.8  |  | 68.4                 | 78.9  |  | 71.5                 | 72.0  |

**Table 14. Plant Species Present on Shrub Reduction Treatments – 1984**  
**Dominant (D), Abundant (A), Frequent (F), and Scarce (S)**

|                                               | <u>0.0</u> | Treatments               |     |                          |     |                          |     |
|-----------------------------------------------|------------|--------------------------|-----|--------------------------|-----|--------------------------|-----|
|                                               |            | <u>.25 lbs Ai / Acre</u> |     | <u>.50 lbs Ai / Acre</u> |     | <u>.75 lbs Ai / Acre</u> |     |
|                                               |            | 20%                      | 40% | 20%                      | 40% | 20%                      | 40% |
| <b><u>GRAMINOIDS:</u></b>                     |            |                          |     |                          |     |                          |     |
| Agropyron desertorum<br>Crested wheatgrass    |            | S                        |     | F                        | A   |                          |     |
| Agropyron smithii<br>Western wheatgrass       | D          | D                        | D   | D                        | D   | D                        | D   |
| Agropyron trachycaulum<br>Slender wheatgrass  | F          | F                        | S   | F                        | F   | F                        | F   |
| Bouteloua gracilis<br>Blue grama              | F          | F                        | F   | S                        | S   | S                        |     |
| Bromus inermis<br>Smooth brome                |            |                          | S   |                          |     |                          |     |
| Bromus japonicus<br>Japanese chess            |            | S                        |     | S                        |     |                          | S   |
| Calamagrostis montanensis<br>Plains reedgrass |            |                          |     | S                        |     |                          |     |
| Distichlis stricta<br>Saltgrass               | S          |                          |     |                          |     |                          |     |
| Koeleria pyramidata<br>Prairie junegrass      |            |                          | S   |                          |     |                          |     |
| Poa pratensis<br>Kentucky bluegrass           | D          | D                        | D   | A                        | A   | A                        | A   |
| Stipa comata<br>Needleandthread               | S          |                          | F   |                          |     |                          |     |
| Stipa viridula<br>Green needlegrass           | D          | D                        | D   | D                        | D   | D                        | D   |
| Carex heliophila<br>Sun sedge                 |            |                          |     |                          |     | S                        |     |
| <b><u>FORBS:</u></b>                          |            |                          |     |                          |     |                          |     |
| Achillea millefolium                          |            |                          |     |                          |     |                          |     |

|                                     |   |   |   |   |   |   |   |
|-------------------------------------|---|---|---|---|---|---|---|
| Yarrow                              | F | A | F | F | A | A | A |
| Artemisia dracunculus<br>Green sage | S |   |   |   |   |   |   |

**Table 14 (Cont.) Plant Species Present on Shrub Reduction Treatments – 1984**  
**Dominant (D), Abundant (A), Frequent (F) and Scarce (S)**

|                                              | <u>0.0</u> | Treatment                |     |                          |     |                          |     |
|----------------------------------------------|------------|--------------------------|-----|--------------------------|-----|--------------------------|-----|
|                                              |            | <u>.25 lbs Ai / Acre</u> |     | <u>.50 lbs Ai / Acre</u> |     | <u>.75 lbs Ai / Acre</u> |     |
|                                              |            | 20%                      | 40% | 20%                      | 40% | 20%                      | 40% |
| <b><u>FORBS (Cont.):</u></b>                 |            |                          |     |                          |     |                          |     |
| Artemisia frigida<br>Fringed sage            |            |                          | S   |                          |     |                          |     |
| Artemisia ludoviciana<br>White sage          | F          | F                        | F   | F                        | F   | F                        | F   |
| Aster ericoides<br>White prairie aster       | F          | S                        | S   | F                        | S   | S                        | S   |
| Aster laevis<br>Smooth blue aster            |            |                          |     |                          |     |                          |     |
| Astragalus canadensis<br>Little rattlespod   |            |                          |     | S                        | S   |                          | S   |
| Conyza canadensis<br>Horseweed               |            |                          |     |                          |     |                          |     |
| Descurainia sophia<br>Flixweed               |            |                          | S   |                          |     |                          |     |
| Galium boreale<br>Northern bedstraw          |            |                          |     | S                        |     |                          |     |
| Lactuca oblongifolia<br>Blue wild lettuce    | F          | F                        | F   | F                        | F   | F                        | F   |
| Lepidium densiflorum<br>Peppergrass          |            |                          |     |                          |     |                          |     |
| Linum rigidum<br>Stiffstem flax              | S          |                          | S   | S                        | S   |                          |     |
| Melilotus officinalis<br>Yellow sweet clover |            |                          |     |                          |     |                          |     |
| Polygala alba<br>White milkwort              |            |                          |     |                          |     |                          |     |

|                                                |   |   |   |   |   |   |   |
|------------------------------------------------|---|---|---|---|---|---|---|
| Psoralea argophylla<br>Silverleaf scurfpea     |   |   |   |   | S |   |   |
| Ratibida columnifera<br>Long headed coneflower | F | S | F | F | S | S | S |

**Table 14 (Cont.) Plant Species Present on Shrub Reduction Treatments – 1984**  
**Dominant (D), Abundant (A), Frequent (F), and Scarce (S)**

|                                             | <u>0.0</u> | Treatments               |     |                          |     |                          |     |
|---------------------------------------------|------------|--------------------------|-----|--------------------------|-----|--------------------------|-----|
|                                             |            | <u>.25 lbs Ai / Acre</u> |     | <u>.50 lbs Ai / Acre</u> |     | <u>.75 lbs Ai / Acre</u> |     |
|                                             |            | 20%                      | 40% | 20%                      | 40% | 20%                      | 40% |
| <b>FORBS (Cont.):</b>                       |            |                          |     |                          |     |                          |     |
| Solidago rigida<br>Stiff goldenrod          |            |                          |     | S                        |     |                          |     |
| Sphaeralcea coccinea<br>Scarlet globemallow |            | S                        | S   |                          |     | F                        |     |
| Taraxacum officinale<br>Dandelion           | S          | S                        | S   |                          |     |                          |     |
| Vicia americana<br>Wild vetch               | A          | F                        | A   | F                        | F   | A                        | F   |
| <b>SHRUBS:</b>                              |            |                          |     |                          |     |                          |     |
| Artemisia cana<br>Silver sagebrush          | D          | D                        | D   | D                        | D   | D                        | D   |
| Ribes americanum<br>Wild black current      |            | S                        |     | S                        |     |                          | S   |
| Prunus virginiana<br>Chokecherry            |            |                          |     |                          |     |                          |     |
| Rosa woodsii<br>Western wildrose            |            | F                        |     | S                        |     | S                        |     |
| Symphoricarpos occidentalis<br>Wolfberry    | F          | F                        | S   | F                        | F   |                          | F   |

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