

SECTION III

RANGE AND

PASTURE MANAGEMENT RESEARCH

1984

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Complementary Rotation Grazing System – 1984

Dickinson Experiment Station

L. Manske and T. J. Conlon

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.

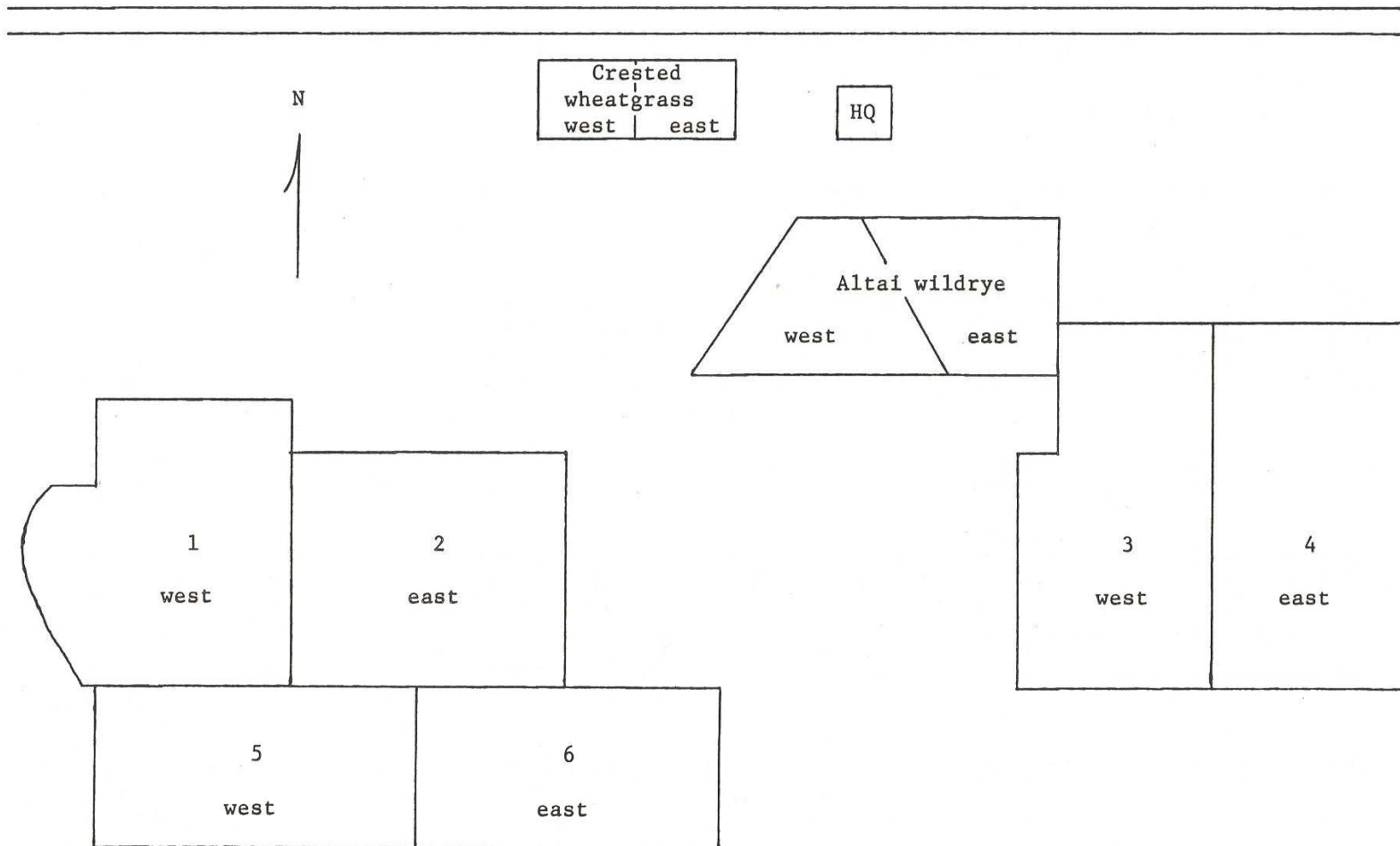


Figure 1. Diagram of the crested wheatgrass, native range and altai wildrye pastures of the west and east systems for the complementary rotation grazing system at the Ranch Headquarters of the Dickinson Experiment Station.

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

Treatment Pasture	Pasture Size in Acres	Dates Grazed	Days In Period	Total Days Grazed	Number of Head	Number of AUM's	Stocking Rate AUM/Acre
WEST SYSTEM:							
Untreated 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 01 Aug – 31 Aug	14 30	44	19 Cow/calf 1 Bull 19 Cow/calf	27.87	0.35
3 (A)	75	15 Jun – 29 Jun 31 Aug – 01 Oct	14 31	45	19 Cow/calf 1 Bull 19 Cow/calf	28.49	0.38
1 (B)	85	29 Jun – 01 Aug 01 Oct – 16 Oct	33 15	48	19 Cow/calf 1 Bull 19 Cow/calf	30.98	0.36
Altai Wildrye	30	16 Oct – 03 Dec 03 Dec – 18 Dec 18 Dec – 31 Dec 16 Oct – 31 Dec	48 15 13	76	19 Cow/calf 19 Cow 19 Cow 19 Cow	29.90 9.34 8.10 47.34	1.00 0.31 0.27 1.58

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

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

Treatment Animal Class	Crested Wheatgrass	Native Range			Altai Wildrye
		<u>C</u>	<u>A</u>	<u>B</u>	
WEST SYSTEM:		<u>C</u> 5	<u>A</u> 3	<u>B</u> 1	
<u>Calf</u>					
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
<u>Cow</u>					
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
<u>Bull</u>					
Gain/day/head		0.86	2.86	0.73	
Gain/day/acre		0.01	0.04	0.01	
EAST SYSTEM:		<u>C</u> 6	<u>A</u> 4	<u>B</u> 2	
<u>Calf</u>					
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
<u>Cow</u>					
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
<u>Bull</u>					
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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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

	25 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West		I-----I									
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		
System – East											
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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West					I-----I					I-----I	
Pasture – 1											
Site -Clayey											
Ungrazed:											
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
Total			861.7	1426.1	1184.9	1464.7	1819.7	1826.8	1942.4	2378.0	3179.1
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West	I-----I						I-----I				
Pasture – 1											
Site - Sandy											
Ungrazed:											
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
Total			934.1	1635.2	1255.2	1751.9	1892.8	1225.3	1454.3	1671.6	2133.7
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West	I-----I						I-----I				
Pasture – 1											
Site - Shallow											
Ungrazed:											
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
Total			654.4	780.7	711.5	1040.1	1088.2	1009.8	792.1	1197.0	556.6
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East	I-----I						I-----I				
Pasture – 2 Site – Clayey											
Ungrazed:											
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
Total			559.8	1171.7	1187.1	1411.1	2301.4	1386.9	1472.5	1687.7	1693.0
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East	I-----I								I-----I		
Pasture – 2 Site – Sandy											
Ungrazed:											
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
Total			1089.7	1174.6	978.0	1769.7	1771.5	1065.8	1259.1	2017.7	2099.8
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East	I-----I										
Pasture – 2											
Site - Shallow											
Ungrazed:											
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
Total			714.0	984.8	896.3	1063.3	1165.0	1063.3	991.6	1006.2	1077.5
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East	I-----I						I-----I				
Pasture – 2 Site – Silty											
Ungrazed:											
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
Total			946.9	1320.8	1365.8	1286.3	2806.2	1325.1	1472.2	2008.8	1661.1
Grazed:											
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
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West				I-----I					I-----I		
Pasture – 3 Site - Silty											
Ungrazed:											
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
Total			810.7	941.6	1065.0	2197.9	1762.6	1388.0	1067.9	1797.1	1764.4
Grazed:											
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
Total				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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East				I-----I					I-----I		
Pasture – 4 Site - Sandy											
Ungrazed:											
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
Total			748.2	901.3	1090.0	1555.6	1998.1	1439.3	1586.0	2465.5	2023.1
Grazed:											
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
Total				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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East				I-----I					I-----I		
Pasture – 4											
Site - Shallow											
Ungrazed:											
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
Total			1040.4	1196.7	1027.6	1216.7	958.0	1076.5	726.4	1148.9	929.5
Grazed:											
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
Total				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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West			I-----I				I-----I				
Pasture – 5											
Site – Sandy											
Ungrazed:											
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
Total			1193.8	1389.7	1197.1	1284.5	1703.7	1133.6	1564.1	1773.3	1509.3
Grazed:											
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
Total			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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West			I-----I				I-----I				
Pasture – 5 Site - Shallow											
Ungrazed:											
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
Total			545.6	869.0	920.6	922.3	1445.0	993.3	552.7	804.6	701.1
Grazed:											
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
Total			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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – West			I-----I				I-----I				
Pasture – 5 Site – Silty											
Ungrazed:											
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
Total			1074.7	1330.9	1441.5	1396.9	1666.3	1283.1	1034.7	2214.0	1407.6
Grazed:											
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
Total			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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East			I-----I				I-----I				
Pasture – 6 Site - Sandy											
Ungrazed:											
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
Total			1080.0	1255.9	1236.3	1272.0	1300.6	1588.8	1157.5	2092.6	1883.9
Grazed:											
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
Total			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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – East			I-----I				I-----I				
Pasture – 6											
Site – Shallow											
Ungrazed:											
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
Total			550.9	756.4	756.4	731.4	890.2	708.6	646.9	1079.4	965.1
Grazed:											
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
Total			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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – WEST	I-----I						I-----I				
Pasture – 1											
Site – Clayey											
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
Site – Sandy											
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
Site – Shallow											
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
Site – Silty											
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
System - EAST	I-----I						I-----I				
Pasture - 2											
Site – Clayey											
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
Site – Sandy											
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
Site – Shallow											
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
Site – Silty											
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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – WEST				I-----I			I-----I				
Pasture – 3											
<u>Site – Clayey</u>											
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
<u>Site – Sandy</u>											
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
<u>Site – Shallow</u>											
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
<u>Site – Silty</u>											
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
System – EAST				I-----I			I-----I				
Pasture – 4											
<u>Site – Clayey</u>											
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
<u>Site – Sandy</u>											
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
<u>Site – Shallow</u>											
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
<u>Site – Silty</u>											
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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct
System – WEST			I-----I				I-----I				
Pasture - 5											
Site – Clayey											
Ungrazed											
Grazed											
Site – Sandy											
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
Site – Shallow											
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
Site – Silty											
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
System – EAST			I-----I				I-----I				
Pasture - 6											
Site – Clayey											
Ungrazed											
Grazed											
Site – Sandy											
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
Site – Shallow											
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
Site – Silty											
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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	15 Oct	14 Jan
System – WEST										I-----I	
Ungrazed:											
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	
Total			2592.2	4435.5	4188.8	6948.1	5863.9	6514.9	3770.4	6934.8	
Grazed:											
Altai Wildrye										6318.4	2761.1
Other Grasses											33.9
Grass Total										6318.4	2795.0
Forbs										616.4	145.4
Shrubs											
Total										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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	15 Oct	14 Jan
System – EAST										I-----I	
Ungrazed:											
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	
Total			3039.9	5530.0	4259.4	5260.5	5158.4	6168.4	2972.1	6482.5	
Grazed:											
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
Total										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

	25 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	15 Oct	14 Jan
System – WEST										I----- I	
Ungrazed			2592.2	4435.5	4188.8	6948.1	5863.9	6514.9	3770.4	6934.8	
Grazed										6934.8	2940.4
System – EAST											
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

	25 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 Jan
System – WEST	I-----I											
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			
Total			59.3	57.7	55.1	45.7	55.0	52.6	55.9			
System – EAST	I-----I											
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			
Total			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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 Jan
System – EAST				I-----I					I-----I			
Pasture – 4												
Site – Clayey												
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	
Total					22.2	39.4	-0.7	14.1	30.6	62.0	37.9	
System – EAST												
Pasture – 4												
Site – Sandy												
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	
Total					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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 Jan
System – EAST			I-----I				I-----I					
Pasture – 6												
Site – Sandy												
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	
Total				-3.3	-12.9	24.1	-20.4	40.0	44.9	27.8	45.5	
System – EAST												
Pasture – 6												
Site – Shallow												
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	
Total				-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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 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 Apr	15 May	30 May	15 Jun	30 Jun	15 Jul	31 Jul	15 Aug	30 Aug	2 Oct	15 Oct	14 Jan
System – WEST												
Pasture – 1												
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	
Pasture – 3												
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	
Pasture – 5												
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	
System – EAST												
Pasture – 2												
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	
Pasture – 4												
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	
Pasture – 6												
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 comata	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 comata	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 comata	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 hoodii	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 comata	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatrix 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

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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
<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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance 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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 oligosanthes	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Bouteloua gracilis</i>	15.70	48.46	72.00	34.62	83.08
<i>Koeleria pyramidata</i>	1.80	5.56	16.00	7.69	13.25
<i>Stipa comata</i>	3.80	11.73	36.00	17.31	29.04
<i>Carex filifolia</i>	7.40	22.84	49.00	23.56	46.40
<i>Artemisia dracunculus</i>	0.20	0.62	2.00	0.96	1.58
<i>Aster ericoides</i>	0.50	1.54	5.00	2.40	3.94
<i>Echinacea angustifolia</i>	0.10	0.31	1.00	0.48	0.79
<i>Grindelia squarrosa</i>	0.20	0.62	2.00	0.96	1.58
<i>Liatris punctata</i>	0.20	0.62	2.00	0.96	1.58
<i>Lygodesmia juncea</i>	0.10	0.31	1.00	0.48	0.79
<i>Opuntia fragilis</i>	0.10	0.31	1.00	0.48	0.79
<i>Phlox hoodii</i>	0.80	2.47	7.00	3.37	5.84
<i>Psoralea esculenta</i>	0.10	0.31	1.00	0.48	0.79
<i>Ratibida columnifera</i>	0.30	0.93	3.00	1.44	2.37
<i>Sphaeralcea coccinea</i>	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance 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 comata	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 Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance 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 oligosanthes	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance 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. #	Grass	Sedge	Forbs	Shrubs	Club Moss	Lichen	Litter	Rock	Soil
Ungrazed:										
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
Grazed:										
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. #	Grass	Sedge	Forbs	Shrubs	Club Moss	Lichen	Furrow	Litter	Rock	Sod	Soil
Ungrazed:												
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
Grazed:												
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

System – WEST	Grass	Sedge	Forbs	Shrubs	Club Moss	Lichen	Furrow	Litter	Rock	Sod	Soil
Ungrazed:											
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
Grazed:											
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
System – EAST											
Ungrazed:											
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
Grazed:											
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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 crassicaarpus	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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatis 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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance 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

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

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

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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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 dracunculoides</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>Coryza 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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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 hoodii</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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

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

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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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 hoodii	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 hoodii	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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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
Achillea millefolium	0.08	2.17	4.00	2.78	4.95
Artemisia frigida	0.56	15.22	44.00	30.56	45.78
Grindelia squarrosa	0.04	1.09	4.00	2.78	3.87
Hedeoma hispida	2.48	67.39	56.00	38.89	106.28
Linum rigidum	0.04	1.09	4.00	2.78	3.87
Potentilla pensylvanica	0.04	1.09	4.00	2.78	3.87
Sphaeralcea coccinea	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
Achillea millefolium	0.24	6.59	8.00	4.44	11.03
Antennaria parvifolia	0.04	1.10	4.00	2.22	3.32
Arabis holboellii	0.04	1.10	4.00	2.22	3.32
Artemisia frigida	0.60	16.48	48.00	26.67	43.15
Erysimum asperum	0.08	2.20	8.00	4.44	6.64
Gutierrezia sarothrae	0.04	1.10	4.00	2.22	3.32
Hedeoma hispida	2.16	59.34	64.00	35.56	94.90
Lepidium densiflorum	0.04	1.10	4.00	2.22	3.32
Psoralea argophylla	0.28	7.69	24.00	13.33	21.02
Ratibida columnifera	0.04	1.10	4.00	2.22	3.32
Sphaeralcea coccinea	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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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 hoodii	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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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 hoodii</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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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>Liatis 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 hoodii</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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatis 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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance 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 hoodii</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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance 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 hoodii</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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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
Coryza 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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatriis 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

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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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
Coryza 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

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

System – EAST		13 Jul	22 Aug
Pasture – 2			
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
Pasture – 4			
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
Pasture – 6			
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

System – EAST		13 Jul	22 Aug
Pasture – 2			
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
Pasture – 4			
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
Pasture – 6			
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	<i>Agropyron desertorum</i>	Crested wheatgrass
Ag sm	<i>Agropyron smithii</i>	Western wheatgrass
Ag tr	<i>Agropyron trachycaulum</i>	Slender wheatgrass
An sc	<i>Andropogon scoparius</i>	Little bluestem
Ar lo	<i>Aristida longiseta</i>	Red threeawn
Av sa	<i>Avena sativa</i>	Oats
Bo cu	<i>Bouteloua curtipendula</i>	Side-oats grama
Bo gr	<i>Bouteloua gracilis</i>	Blue grama
Bu da	<i>Buchloe dactyloides</i>	Buffalo grass
Ca mo	<i>Calamagrostis montanensis</i>	Plains reedgrass
Ca lo	<i>Calamovilfa longifolia</i>	Prairie sandreed
El an	<i>Elymus angustus</i>	Altai wildrye
Ko py	<i>Koeleria pyramidata</i>	Prairie junegrass
Mu cu	<i>Muhlenbergia cuspidata</i>	Plains muhly
Mu sq	<i>Munroa squarrosa</i>	False buffalo grass
Pa ol	<i>Panicum oligosanthos</i>	Scribner panic grass
Po co	<i>Poa compressa</i>	Canada bluegrass
Po pr	<i>Poa pratensis</i>	Kentucky bluegrass
Sc pa	<i>Schedonnardus paniculatus</i>	Tumble grass
Se gl	<i>Setaria glauca</i>	Yellow pigeongrass
Se ve	<i>Setaria verticillata</i>	Bur pigeongrass
Se vi	<i>Setaria viridis</i>	Green pigeongrass
St co	<i>Stipa comata</i>	Needleandthread
St vi	<i>Stipa viridula</i>	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 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
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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 $\frac{1}{4}$ m² 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 $\frac{1}{4}$ m² 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.

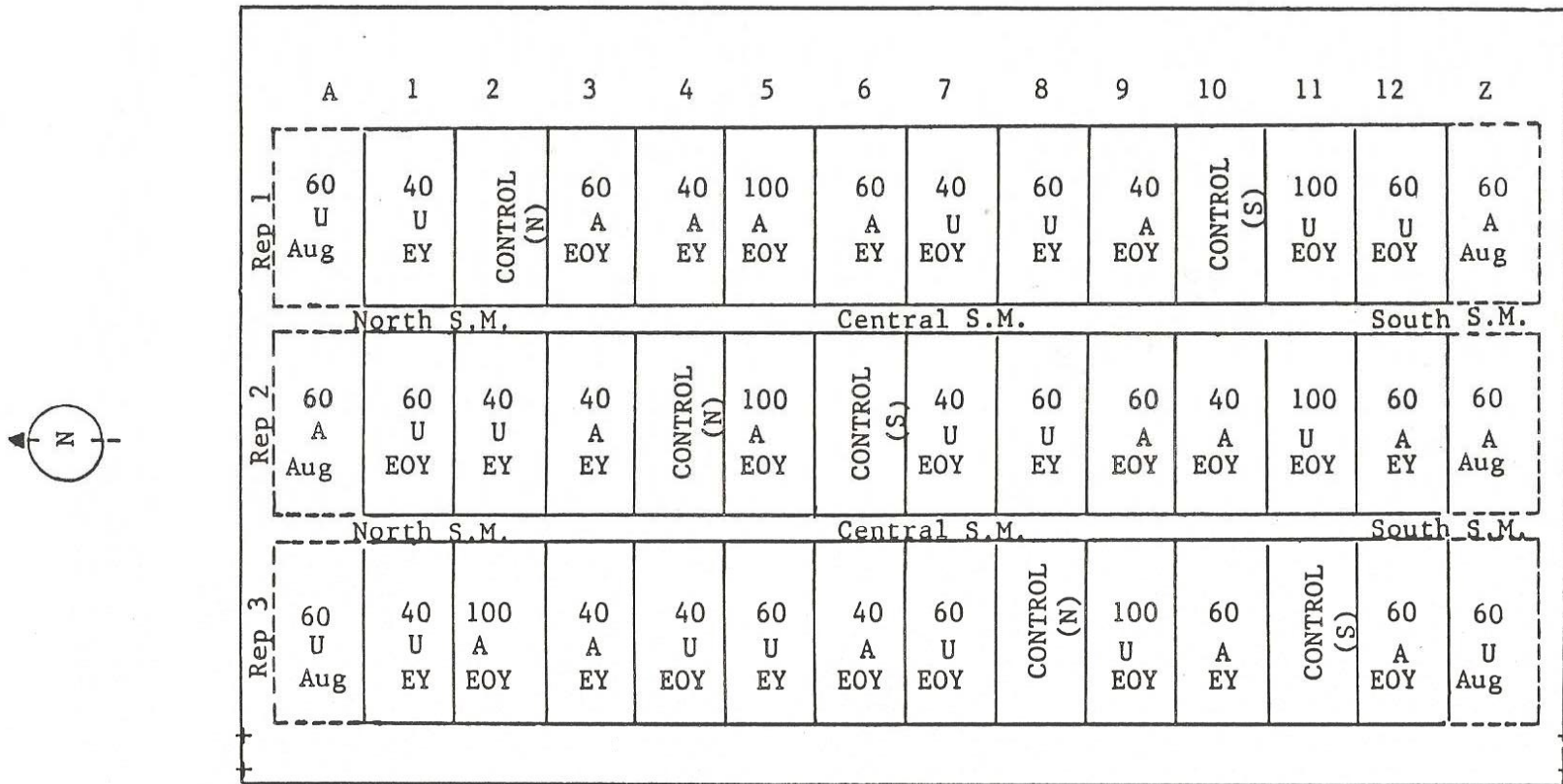


Figure 1. Native range fertilization with ammonium nitrate (A) and urea (U) randomized block plot design with three replications. Rates are 40, 60 and 100 lbs. of nitrogen per acre. Fertilizer is broadcast applied annually (EY) or biennially (EOY). Soil moisture (S.M.) samples collected at north, central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

Month	Temperature			Precipitation (in)
	Max (°F)	Min (°F)	Avg (°F)	
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

Lbs of N/Acre EY = Annually EOY = Biennially	30 May	25 Jun	18 Jul	2 Aug	15 Aug
Control:					
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
TOTAL	735.9	1131.4	1920.8	3395.6	3095.8
40 EY:					
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
TOTAL	843.8	1655.6	2542.2	3719.2	3260.6
40EOY:					
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
TOTAL	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

Lbs of N/Acre EY = Annually EOY = Biennially	30 May	25 Jun	18 Jul	2 Aug	15 Aug
60 EY:					
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
TOTAL	1080.4	1553.6	2596.9	4895.9	3514.5
60 EOY:					
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
TOTAL	908.7	1697.6	2517.8	4309.6	3284.9
100 EOY:					
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
TOTAL	1116.2	1596.7	2525.5	4222.1	3434.8

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

Lbs of N/Acre EY = Annually EOY = Biennially	30 May	25 Jun	18 Jul	2 Aug	15 Aug
Control:					
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
TOTAL	735.9	1131.4	1920.8	3395.6	3095.8
40 EY:					
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
TOTAL	77.2	1640.7	2207.9	3704.2	2934.1
40 EOY:					
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
TOTAL	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

Lbs of N/Acre EY = Annually EOY = Biennially	30 May	25 Jun	18 Jul	2 Aug	15 Aug
60 EY:					
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
TOTAL	1089.4	1405.5	2207.9	3745.2	3184.4
60 EOY:					
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
TOTAL	1137.0	1491.4	2168.2	3697.6	2978.7
100 EOY:					
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
TOTAL	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 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
<i>Agropyron smithii</i>	1.10	2.18	11.00	3.40	5.58
<i>Andropogon scoparius</i>	0.10	0.20	0.33	0.10	0.30
<i>Aristida longiseta</i>	0.13	0.26	1.33	0.41	0.67
<i>Bouteloua gracilis</i>	14.37	28.51	75.67	23.35	51.86
<i>Buchloe dactyloides</i>	0.03	0.07	0.33	0.10	0.17
<i>Koeleria pyramidata</i>	2.67	5.29	19.00	5.86	11.15
<i>Muhlenbergia cuspidata</i>	2.03	4.03	12.67	3.91	7.94
<i>Munroa squarrosa</i>	0.07	0.13	0.67	0.21	0.34
<i>Stipa comata</i>	5.00	9.92	38.33	11.83	21.75
<i>Stipa viridula</i>	1.20	2.38	9.33	2.88	5.26
<i>Carex filifolia</i>	4.47	8.86	31.67	9.77	18.63
<i>Carex heliophila</i>	0.03	0.07	0.33	0.10	0.17
<i>Achillea millefolium</i>	0.33	0.66	3.33	1.03	1.69
<i>Antennaria parvifolia</i>	0.97	1.92	6.67	2.06	3.98
<i>Artemisia dracunculus</i>	0.43	0.86	3.67	1.13	1.99
<i>Artemisia frigida</i>	0.87	1.72	8.00	2.47	4.19
<i>Aster ericoides</i>	0.03	0.07	0.33	0.10	0.17
<i>Astragalus canadensis</i>	0.03	0.07	0.33	0.10	0.17
<i>Astragalus crassicaarpus</i>	0.10	0.20	1.00	0.31	0.51
<i>Chrysopsis villosa</i>	0.17	0.33	0.67	0.21	0.54
<i>Cirsium undulatum</i>	0.03	0.07	0.33	0.10	0.17
<i>Erysimum asperum</i>	0.07	0.13	0.67	0.21	0.34
<i>Gaura coccinea</i>	0.03	0.07	0.33	0.10	0.17
<i>Grindelia squarrosa</i>	0.13	0.26	1.33	0.41	0.67
<i>Hedeoma hispida</i>	0.03	0.07	0.33	0.10	0.17
<i>Lactuca oblongifolia</i>	0.30	0.60	3.00	0.93	1.53
<i>Liatris punctata</i>	0.10	0.20	1.00	0.31	0.51
<i>Lotus americanus</i>	0.20	0.40	1.67	0.51	0.91
<i>Orthocarpus luteus</i>	0.03	0.07	0.33	0.10	0.17
<i>Petalostemon purpureum</i>	0.03	0.07	0.33	0.10	0.17
<i>Phlox hoodii</i>	0.83	1.65	7.67	2.37	4.02
<i>Plantago purshii</i>	0.07	0.13	0.67	0.21	0.34
<i>Polygala alba</i>	0.27	0.53	2.67	0.82	1.35
<i>Psoralea argophylla</i>	0.07	0.13	0.67	0.21	0.34
<i>Ratibida columnifera</i>	0.63	1.26	6.00	1.85	3.11
<i>Solidago rigida</i>	0.17	0.33	1.67	0.51	0.84
<i>Sphaeralcea coccinea</i>	0.73	1.46	7.00	2.16	3.62
<i>Selaginella densa</i>	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

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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatrix 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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 dracuncululus	0.40	0.74	4.00	1.21	1.95
Artemisia frigida	0.33	0.62	3.33	1.01	1.63
Astragalus crassicaulus	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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 dracuncululus	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
Liatis 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
<i>Agropyron smithii</i>	1.67	3.43	14.00	4.15	7.58
<i>Bouteloua gracilis</i>	11.00	22.63	62.67	18.58	41.21
<i>Koeleria pyramidata</i>	2.33	4.80	18.00	5.34	10.14
<i>Muhlenbergia cuspidata</i>	0.73	1.51	4.67	1.38	2.89
<i>Panicum oligosanthes</i>	0.73	1.51	6.00	1.78	3.29
<i>Poa compressa</i>	0.13	0.27	1.33	0.40	0.67
<i>Stipa comata</i>	7.93	16.32	53.33	15.81	32.13
<i>Stipa viridula</i>	2.93	6.04	19.33	5.73	11.77
<i>Carex filifolia</i>	4.67	9.60	30.67	9.09	18.69
<i>Carex heliophila</i>	0.20	0.41	2.00	0.59	1.00
<i>Achillea millefolium</i>	1.20	2.47	10.00	2.96	5.43
<i>Antennaria parvifolia</i>	0.60	1.23	4.67	1.38	2.61
<i>Arabis holboellii</i>	0.07	0.14	0.67	0.20	0.34
<i>Artemisia dracunculus</i>	0.20	0.41	2.00	0.59	1.00
<i>Artemisia frigida</i>	1.40	2.88	13.33	3.95	6.83
<i>Cirsium undulatum</i>	0.07	0.14	0.67	0.20	0.34
<i>Echinacea angustifolia</i>	0.13	0.27	1.33	0.40	0.67
<i>Erigeron strigosus</i>	0.07	0.14	0.67	0.20	0.34
<i>Erysimum asperum</i>	0.47	0.96	4.00	1.19	2.15
<i>Grindelia squarrosa</i>	0.33	0.69	2.67	0.79	1.48
<i>Hedeoma hispida</i>	0.13	0.27	1.33	0.40	0.67
<i>Lactuca oblongifolia</i>	0.07	0.14	0.67	0.20	0.34
<i>Liatris punctata</i>	0.07	0.14	0.67	0.20	0.34
<i>Linum rigidum</i>	0.07	0.14	0.67	0.20	0.34
<i>Orthocarpus luteus</i>	0.07	0.14	0.67	0.20	0.34
<i>Phlox hoodii</i>	0.67	1.37	6.00	1.78	3.15
<i>Plantago purshii</i>	0.13	0.27	1.33	0.40	0.67
<i>Potentilla pensylvanica</i>	0.07	0.14	0.67	0.20	0.34
<i>Psoralea argophylla</i>	0.07	0.14	0.67	0.20	0.34
<i>Psoralea esculenta</i>	0.07	0.14	0.67	0.20	0.34
<i>Ratibida columnifera</i>	1.13	2.33	10.67	3.16	5.49
<i>Senecio plattensis</i>	0.07	0.14	0.67	0.20	0.34
<i>Sphaeralcea coccinea</i>	1.00	2.06	10.00	2.96	5.02
<i>Symphoricarpos occidentalis</i>	0.07	0.14	0.67	0.20	0.34
<i>Selaginella densa</i>	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 Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Agropyron smithii</i>	2.13	4.26	17.33	5.58	9.84
<i>Andropogon scoparius</i>	0.07	0.13	0.67	0.21	0.34
<i>Bouteloua gracilis</i>	12.53	25.00	68.67	22.10	47.10
<i>Buchloe dactyloides</i>	0.07	0.13	0.67	0.21	0.34
<i>Koeleria pyramidata</i>	2.73	5.45	24.00	7.73	13.18
<i>Muhlenbergia cuspidata</i>	0.67	1.33	4.67	1.50	2.83
<i>Stipa comata</i>	5.53	11.04	40.67	13.09	24.13
<i>Stipa viridula</i>	1.27	2.53	12.00	3.86	6.39
<i>Carex filifolia</i>	1.53	3.06	14.00	4.51	7.57
<i>Carex heliophila</i>	0.07	0.13	0.67	0.21	0.34
<i>Achillea millefolium</i>	0.73	1.46	5.33	1.72	3.18
<i>Antennaria parvifolia</i>	1.67	3.32	12.00	3.86	7.18
<i>Artemisia dracuncululus</i>	0.07	0.13	0.67	0.21	0.34
<i>Artemisia frigida</i>	0.87	1.73	7.33	2.36	4.09
<i>Aster ericoides</i>	0.13	0.27	1.33	0.43	0.70
<i>Cerastium arvense</i>	0.07	0.13	0.67	0.21	0.34
<i>Erigeron strigosus</i>	0.13	0.27	1.33	0.43	0.70
<i>Erysimum asperum</i>	0.13	0.27	1.33	0.43	0.70
<i>Grindelia squarrosa</i>	0.13	0.27	0.67	0.21	0.48
<i>Hedeoma hispida</i>	0.27	0.53	2.67	0.86	1.39
<i>Liatris punctata</i>	0.13	0.27	1.33	0.43	0.70
<i>Linum rigidum</i>	0.20	0.40	2.00	0.64	1.04
<i>Phlox hoodii</i>	0.87	1.73	6.00	1.93	3.66
<i>Psoralea esculenta</i>	0.07	0.13	0.67	0.21	0.34
<i>Ratibida columnifera</i>	1.07	2.13	10.67	3.43	5.56
<i>Sphaeralcea coccinea</i>	0.53	1.06	5.33	1.72	2.78
<i>Selaginella densa</i>	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 dracuncululus	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
Liatris 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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatris 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

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

Treatment	Application Rate	Grass	Sedge	Forbs	Shrubs	Club Moss	Lichen	Litter	Rock	Soil
Control	0 lbs	26.70	4.50	6.65	0.00	7.70	4.83	49.43	0.00	0.17
Ammonium Nitrate										
	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
Urea										
	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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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 dracuncululus</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>Liatis punctata</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 hoodii</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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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 hirsuta</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 crassicaulus</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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
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

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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<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

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

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

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

Treatment	Application Rate	Forbs	Shrubs
Control	0 lbs	10.38	0.00
Ammonium Nitrate	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
Urea	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 Location	26 Jun			25 Jul			27 Aug		
	East Rep	West Rep	Mean	East Rep	West Rep	Mean	East Rep	West Rep	Mean
North:									
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
Central:									
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
South:									
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

Depth in Inches	26 JUN	25 JUL	27 AUG
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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P Lbs/Acre	K Lbs/Acre	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	Ph	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
			Lbs/Acre					
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth	pH	NO ₃ -N	P	K	E.C.	Org.	SO ₄ -S
	In.		Lbs/Acre			Mmhos	Matter	ppm
						/cm	%	
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth	pH	NO ₃ -N	P	K	E.C.	Org.	SO ₄ -S
	In.		Lbs/Acre			Mmhos/cm	Matter %	ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	So₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
			Lbs/Acre					
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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

Treatment	Depth In.	pH	NO₃-N Lbs/Acre	P	K	E.C. Mmhos /cm	Org. Matter %	SO₄-S ppm
Control	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
40 EY	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
40 EOY	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
60 EY	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
60 EOY	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
100 EOY	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
Control	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
<hr/>							
40 EY	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
<hr/>							
40 EOY	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
<hr/>							
60 EY	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
<hr/>							
60 EOY	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
<hr/>							
100 EOY	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	<i>Agropyron smithii</i>	Western wheatgrass
Ag sp	<i>Agropyron spicatum</i>	Bluebunch wheatgrass
Ag tr	<i>Agropyron trachycaulum</i>	Slender wheatgrass
An sc	<i>Andropogon scoparius</i>	Little bluestem
Ar lo	<i>Aristida longiseta</i>	Red threeawn
Bo gr	<i>Bouteloua gracilis</i>	Blue gramma
Bu da	<i>Buchloe dactyloides</i>	Buffalo grass
Ca mo	<i>Calamagrostis montanensis</i>	Plains reedgrass
Ca lo	<i>Calamovilfa longifolia</i>	Prairie sandreed
Ko py	<i>Koeleria pyramidata</i>	Prairie junegrass
Mu cu	<i>Muhlenbergia cuspidata</i>	Plains muhly
Mu sq	<i>Munroa squarrosa</i>	False buffalo grass
Pa ol	<i>Panicum oligosanthes</i>	Scribner panic grass
Po co	<i>Poa compressa</i>	Canada bluegrass
St co	<i>Stipa comata</i>	Needleandthread
St vi	<i>Stipa viridula</i>	Green needlegrass
Ca fi	<i>Carex filifolia</i>	Threadleaved sedge
Ca he	<i>Carex heliophila</i>	Yellow sedge

Forbs:

Ac mi	<i>Achillea millefolium</i>	Yarrow
Ag gl	<i>Agoseris glauca</i>	Prairie dandelion
An oc	<i>Androsace occidentalis</i>	Fairy candelabra
An cy	<i>Anemone cylindrica</i>	Cottonweed
An pa	<i>Antennaria parvifolia</i>	Pussytoes
Ar hi	<i>Arabis hirsuta</i>	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 hispida</i>	Rough pennyroyal

Forbs (Continued):

He ri	<i>Helianthus rigidus</i>	Stiff sunflower
Hi vu	<i>Hippuris vulgaris</i>	Marestail
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 le	<i>Linum lewisii</i>	Wild blueflax
Le 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
Me of	<i>Melilotus officinalis</i>	Yellow sweetclover
Ne pa	<i>Neslia paniculata</i>	Ball mustard
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 gr	<i>Penstemon gracilis</i>	Slender 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>Potentilla arguta</i>	Tall cinguefoil
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
Se pl	<i>Senecio plattensis</i>	Prairie ragwort
Si mo	<i>Sisyrinchium montanum</i>	Blue-eyed grass
So mi	<i>Solidago missouriensis</i>	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>Veronia 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
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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 $\frac{1}{4}$ m² 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 $\frac{1}{4}$ m² 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 m² quadrats were spaced at 6 foot intervals along each of the five minor transects.

Alfalfa Interseeding Row Spacing Techniques Trial

Location:	Dickinson Experiment Station Ranch Headquarters NE ¹ / ₄ , NW ¹ / ₄ , SW ¹ / ₄ Sec. 23, T. 143 N., R. 96 W.	
Replications:	Three	Randomized Block Design
Study Size:	183' x 241'	1.01 acres
Plot Size:	33' x 50'	0.04 acres
Perimeter border:	10' on west and south, 3' on north and 0' on east	
Alleys:	10'	
Soil:	Vebar	
Range Site:	Sandy with a few thin claypen sites	
Seeding Date:	21 Apr 1983	
Seeding Rate:	0.50 lbs. PLS/row/acre	
Alfalfa Variety:	Travois	
Chisel Plow Shovel:	4" twisted	
Row Spacings:	0, 2, 3, 4, 5, 8 and 10 foot	

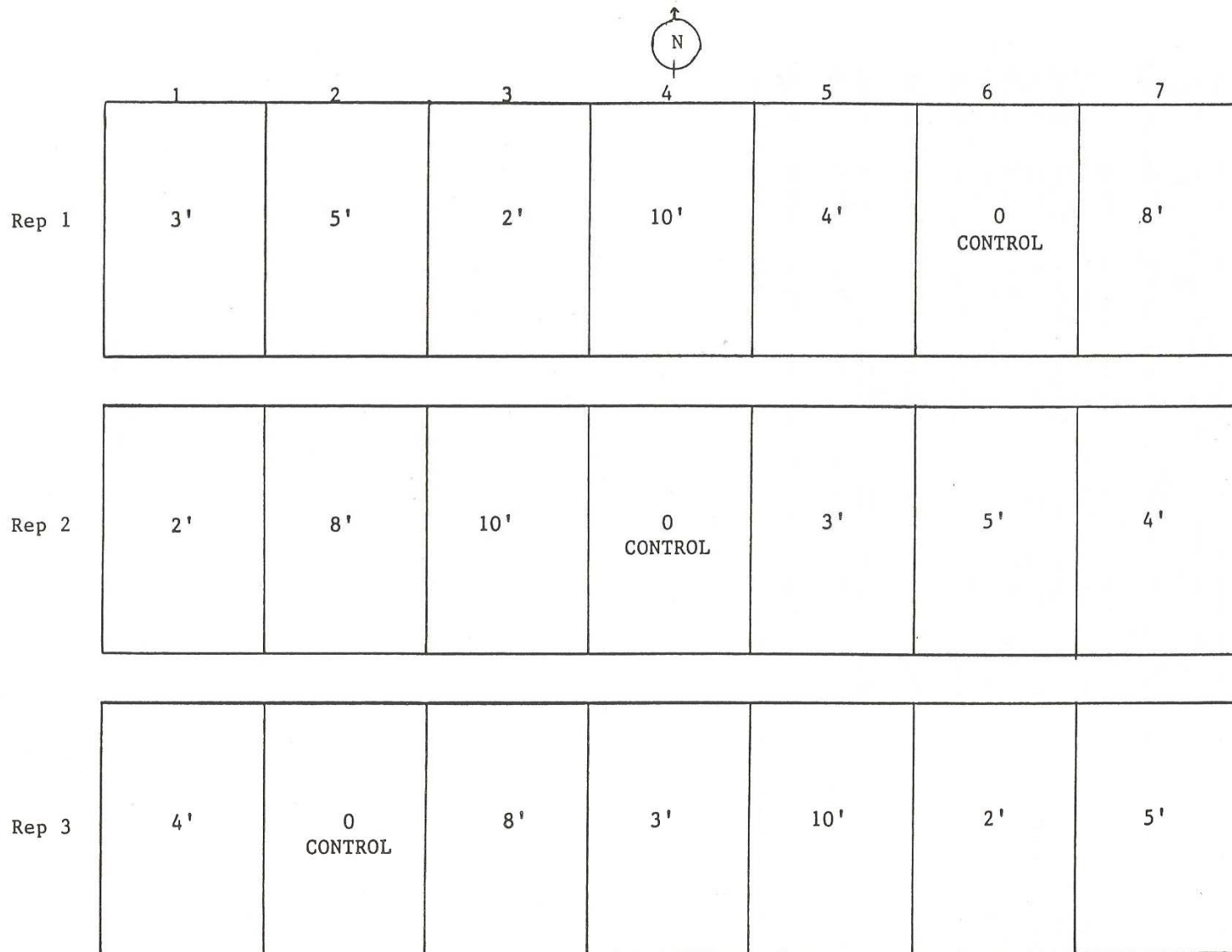


Figure 1. Alfalfa interseeding row spacing techniques trial with 0, 2, 3, 4, 5, 8 and 10 foot row spacings, seeded 21 Apr 1983.

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 Foot	2 Foot	3 Foot	4 Foot	5 Foot	8 Foot	10 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
Total Grass	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
Total	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**

	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	0.53	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 oligosanthes	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

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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatris 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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatrix 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
Liatis 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

Row Spacing	Grass	Sedge	Forbs	Shrubs	Club Moss	Lichen	Furrow	Litter	Rock	Sod	Soil
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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance 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 dracuncululus</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 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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Antennaria parvifolia</i>	0.03	0.82	1.33	0.70	1.52
<i>Artemisia dracuncululus</i>	0.47	14.40	28.00	14.69	29.09
<i>Artemisia frigida</i>	0.08	2.47	6.67	3.50	5.97
<i>Artemisia ludoviciana</i>	0.11	3.29	1.33	0.70	3.99
<i>Aster ericoides</i>	0.63	19.34	16.00	8.39	27.73
<i>Chrysopsis villosa</i>	0.01	0.41	1.33	0.70	1.11
<i>Echinacea angustifolia</i>	0.01	0.41	1.33	0.70	1.11
<i>Erysimum asperum</i>	0.11	3.29	9.33	4.90	8.19
<i>Euphorbia geyeri</i>	0.01	0.41	1.33	0.70	1.11
<i>Gaura coccinea</i>	0.07	2.06	5.33	2.80	4.86
<i>Grindelia squarrosa</i>	0.19	5.76	13.33	6.99	12.75
<i>Gutierrezia sarothrae</i>	0.07	2.06	2.67	1.40	3.46
<i>Haplopappus spinulosus</i>	0.11	3.29	9.33	4.90	8.19
<i>Hedeoma hispida</i>	0.08	2.47	8.00	4.20	6.67
<i>Lepidium densiflorum</i>	0.04	1.23	4.00	2.10	3.33
<i>Liatris punctata</i>	0.33	10.29	17.33	9.09	19.38
<i>Linum rigidum</i>	0.05	1.65	4.00	2.10	3.75
<i>Lotus americanus</i>	0.01	0.41	1.33	0.70	1.11
<i>Lygodesmia juncea</i>	0.11	3.29	8.00	4.20	7.49
<i>Opuntia fragilis</i>	0.01	0.41	1.33	0.70	1.11
<i>Oxytropis lambertii</i>	0.03	0.82	2.67	1.40	2.22
<i>Petalostemon purpureum</i>	0.03	0.82	1.33	0.70	1.52
<i>Phlox hoodii</i>	0.23	7.00	12.00	6.29	13.29
<i>Plantago purshii</i>	0.01	0.41	1.33	0.70	1.11
<i>Potentilla pensylvanica</i>	0.01	0.41	1.33	0.70	1.11
<i>Psoralea argophylla</i>	0.05	1.65	5.33	2.80	4.45
<i>Psoralea esculenta</i>	0.08	2.47	8.00	4.20	6.67
<i>Ratibida columnifera</i>	0.04	1.23	4.00	2.10	3.33
<i>Solidago missouriensis</i>	0.03	0.82	1.33	0.70	1.52
<i>Sphaeralcea coccinea</i>	0.15	4.53	9.33	4.90	9.43
<i>Rosa arkansana</i>	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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance 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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Achillea millefolium</i>	0.01	0.33	1.33	0.53	0.86
<i>Antennaria parvifolia</i>	0.13	3.27	5.33	2.14	5.41
<i>Artemisia dracunculus</i>	0.11	2.61	9.33	3.74	6.35
<i>Artemisia frigida</i>	0.27	6.54	18.67	7.49	14.03
<i>Artemisia ludoviciana</i>	0.31	7.52	12.00	4.81	12.33
<i>Aster ericoides</i>	0.47	11.44	14.67	5.88	17.32
<i>Aster laevis</i>	0.01	0.33	1.33	0.53	0.86
<i>Chrysopsis villosa</i>	0.08	1.96	2.67	1.07	3.03
<i>Echinacea angustifolia</i>	0.44	10.78	28.00	11.23	22.01
<i>Erysimum asperum</i>	0.03	0.65	2.67	1.07	1.72
<i>Euphorbia geyeri</i>	0.07	1.63	1.33	0.53	2.16
<i>Gaura coccinea</i>	0.13	3.27	9.33	3.74	7.01
<i>Glycyrrhiza lepidota</i>	0.09	2.29	5.33	2.14	4.43
<i>Grindelia squarrosa</i>	0.19	4.58	9.33	3.74	8.32
<i>Gutierrezia sarothrae</i>	0.03	0.65	2.67	1.07	1.72
<i>Hedeoma hispida</i>	0.09	2.29	5.33	2.14	4.43
<i>Liatris punctata</i>	0.16	3.92	12.00	4.81	8.73
<i>Linum rigidum</i>	0.05	1.31	5.33	2.14	3.45
<i>Lotus americanus</i>	0.03	0.65	2.67	1.07	1.72
<i>Lygodesmia juncea</i>	0.05	1.31	5.33	2.14	3.45
<i>Oxytropis lambertii</i>	0.09	2.29	6.67	2.67	4.96
<i>Petalostemon purpureum</i>	0.47	11.44	30.67	12.30	23.74
<i>Phlox hoodii</i>	0.15	3.59	12.00	4.81	8.40
<i>Plantago purshii</i>	0.01	0.33	1.33	0.53	0.86
<i>Potentilla pensylvanica</i>	0.01	0.33	1.33	0.53	0.86
<i>Psoralea argophylla</i>	0.04	0.98	4.00	1.60	2.58
<i>Psoralea esculenta</i>	0.03	0.65	2.67	1.07	1.72
<i>Solidago missouriensis</i>	0.03	0.65	2.67	1.07	1.72
<i>Solidago rigida</i>	0.19	4.58	8.00	3.21	7.79
<i>Sphaeralcea coccinea</i>	0.03	0.65	1.33	0.53	1.18
<i>Taraxacum officinale</i>	0.03	0.65	1.33	0.53	1.18
<i>Rosa arkansana</i>	0.25	6.21	21.33	8.56	14.77
<i>Symphoricarpos occidentalis</i>	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

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

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

Row Spacing	Forbs	Shrubs
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 $\frac{1}{4}$ m² 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 m² quadrats were spaced at 6 foot intervals along each of the five minor transects.

Alfalfa Interseeding Furrow Width Techniques Trial

Location:	Dickinson Experiment Station Ranch Headquarters NE¼, NW¼, SW¼ Sec. 23, T. 143 N., R. 96 W.
Replications:	Three Randomized Block Design
Study Size:	183' x 142' 0.60 acres
Plot Size:	33' x 50' 0.04 acres
Perimeter border:	10' on east and south, 3' on north and 0' on west
Alleys:	10'
Soil:	Vebar
Range Site:	Sandy with a few thin claypen sites
Seedling Date:	21 Apr 1983
Seedling Rate:	0.50 lbs. PLS/row/acre
Alfalfa Variety:	Travois
Row Spacing:	3'
Chisel Plow Shovels:	0", 2", 3" twisted and 4" twisted

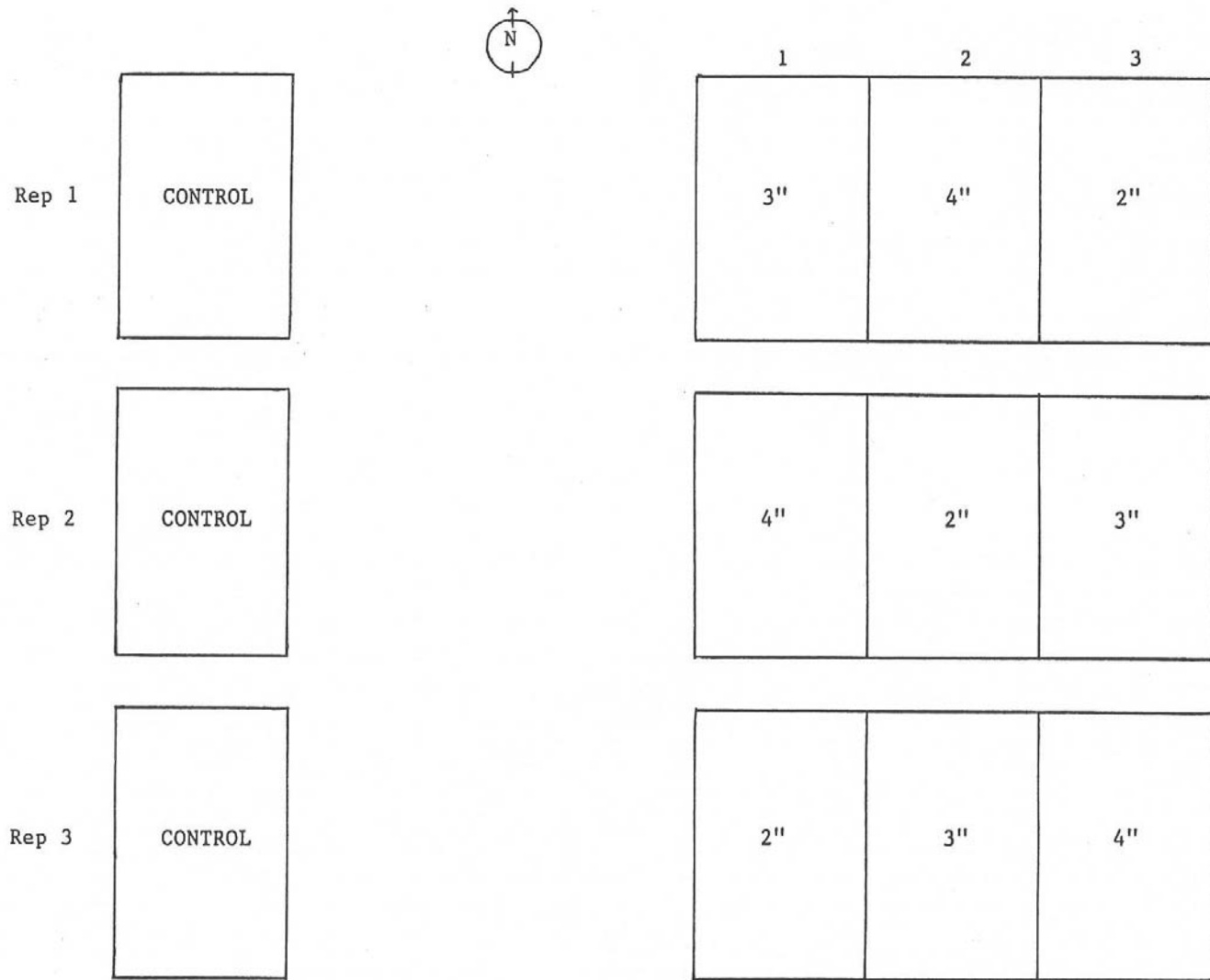


Figure 2. Alfalfa interseeding furrow width techniques trial using 2, 3 and 4 inch chisel plow shovels, seeded 21 Apr 1983.

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 Categories	Furrow Width			
	0 Inch	2 Inch	3 Inch	4 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
Total Grass	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
Total	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 cuspidata	0.47	1.48	4.67	2.08	3.56
Panicum oligosanthes	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

Species	Basal Cover	Relative Basal Cover	Percent Frequency	Relative Percent Frequency	Importance Value
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
Liatris 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

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

Furrow Width	Grass	Sedge	Forbs	Shrubs	Club Moss	Lichen	Furrow	Litter	Rock	Sod	Soil
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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance 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 dracuncululus</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 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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Antennaria parvifolia</i>	0.03	0.93	1.33	0.70	1.63
<i>Artemisia dracuncululus</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

Species	Density	Relative Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Achillea millefolium</i>	0.03	1.10	2.67	1.52	2.62
<i>Artemisia dracunculus</i>	0.07	2.75	6.67	3.79	6.54
<i>Artemisia frigida</i>	0.03	1.10	2.67	1.52	2.62
<i>Artemisia ludoviciana</i>	0.03	1.10	1.33	0.76	1.86
<i>Aster ericoides</i>	0.16	6.59	8.00	4.55	11.14
<i>Aster oblongifolius</i>	0.01	0.55	1.33	0.76	1.31
<i>Astragalus crassicaarpus</i>	0.01	0.55	1.33	0.76	1.31
<i>Chrysopsis villosa</i>	0.03	1.10	2.67	1.52	2.62
<i>Commandra umbellata</i>	0.01	0.55	1.33	0.76	1.31
<i>Echinacea angustifolia</i>	0.17	7.14	16.00	9.09	16.23
<i>Erysimum asperum</i>	0.03	1.10	2.67	1.52	2.62
<i>Gaura coccinea</i>	0.08	3.30	6.67	3.79	7.09
<i>Gutierrezia sarothrae</i>	0.03	1.10	2.67	1.52	2.62
<i>Haplopappus spinulosus</i>	0.03	1.10	1.33	0.76	1.86
<i>Hedeoma hispida</i>	0.11	4.40	8.00	4.55	8.95
<i>Helianthus rigidus</i>	0.44	18.13	20.00	11.36	29.49
<i>Liatrix punctata</i>	0.17	7.14	10.67	6.06	13.20
<i>Linum rigidum</i>	0.03	1.10	2.67	1.52	2.62
<i>Lotus americanus</i>	0.07	2.75	6.67	3.79	6.54
<i>Lygodesmia juncea</i>	0.09	3.85	8.00	4.55	8.40
<i>Opuntia fragilis</i>	0.01	0.55	1.33	0.76	1.31
<i>Petalostemon purpureum</i>	0.13	5.49	12.00	6.82	12.31
<i>Phlox hoodii</i>	0.13	5.49	8.00	4.55	10.04
<i>Psoralea argophylla</i>	0.03	1.10	2.67	1.52	2.62
<i>Psoralea esculenta</i>	0.07	2.75	6.67	3.79	6.54
<i>Ratibida columnifera</i>	0.03	1.10	2.67	1.52	2.62
<i>Solidago missouriensis</i>	0.08	3.30	4.00	2.27	5.57
<i>Sphaeralcea coccinea</i>	0.12	4.95	10.67	6.06	11.01
<i>Rosa arkansana</i>	0.20	8.24	13.33	7.58	15.82
<i>Symphoricarpos occidentalis</i>	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 Percent Density	Percent Frequency	Relative Percent Frequency	Importance Value
<i>Achillea millefolium</i>	0.01	0.41	1.33	0.69	1.10
<i>Antennaria parvifolia</i>	0.12	3.69	8.00	4.17	7.86
<i>Artemisia dracuncululus</i>	0.21	6.56	13.33	6.94	13.50
<i>Artemisia frigida</i>	0.12	3.69	10.67	5.56	9.25
<i>Artemisia ludoviciana</i>	0.09	2.87	4.00	2.08	4.95
<i>Aster ericoides</i>	0.81	25.00	21.33	11.11	36.11
<i>Chrysopsis villosa</i>	0.04	1.23	4.00	2.08	3.31
<i>Commandra umbellata</i>	0.01	0.41	1.33	0.69	1.10
<i>Echinacea angustifolia</i>	0.35	10.66	25.33	13.19	23.85
<i>Erysimum asperum</i>	0.01	0.41	1.33	0.69	1.10
<i>Gaura coccinea</i>	0.04	1.23	2.67	1.39	2.62
<i>Grindelia squarrosa</i>	0.04	1.23	2.67	1.39	2.62
<i>Haplopappus spinulosus</i>	0.03	0.82	2.67	1.39	2.21
<i>Hedeoma hispida</i>	0.01	0.41	1.33	0.69	1.10
<i>Helianthus rigidus</i>	0.03	0.82	1.33	0.69	1.51
<i>Liatris punctata</i>	0.12	3.69	8.00	4.17	7.86
<i>Linum rigidum</i>	0.08	2.46	8.00	4.17	6.63
<i>Lotus americanus</i>	0.01	0.41	1.33	0.69	1.10
<i>Lygodesmia juncea</i>	0.03	0.82	1.33	0.69	1.51
<i>Medicago falcata</i>	0.01	0.41	1.33	0.69	1.10
<i>Opuntia fragilis</i>	0.04	1.23	2.67	1.39	2.62
<i>Oxytropis lambertii</i>	0.05	1.64	4.00	2.08	3.72
<i>Petalostemon purpureum</i>	0.09	2.87	8.00	4.17	7.04
<i>Phlox hoodii</i>	0.01	0.41	1.33	0.69	1.10
<i>Psoralea argophylla</i>	0.05	1.64	4.00	2.08	3.72
<i>Psoralea esculenta</i>	0.05	1.64	5.33	2.78	4.42
<i>Ratibida columnifera</i>	0.03	0.82	2.67	1.39	2.21
<i>Solidago missouriensis</i>	0.16	4.92	9.33	4.86	9.78
<i>Solidago rigida</i>	0.05	1.64	1.33	0.69	2.33
<i>Sphaeralcea coccinea</i>	0.21	6.56	14.67	7.64	14.20
<i>Rosa arkansana</i>	0.29	9.02	16.00	8.33	17.35
<i>Symphoricarpos occidentalis</i>	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

Furrow Width	Forbs	Shrubs
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 In Square Feet				Percentage of Seed Bed per Acre			
Spacing In Feet	# Rows Per Rod	Furrow 2 Inch	Furrow 3 Inch	Furrow 4 Inch	Furrow 12 Inch	Furrow 2 Inch	Furrow 3 Inch	Furrow 4 Inch	Furrow 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 $\frac{1}{4}$ m² 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

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

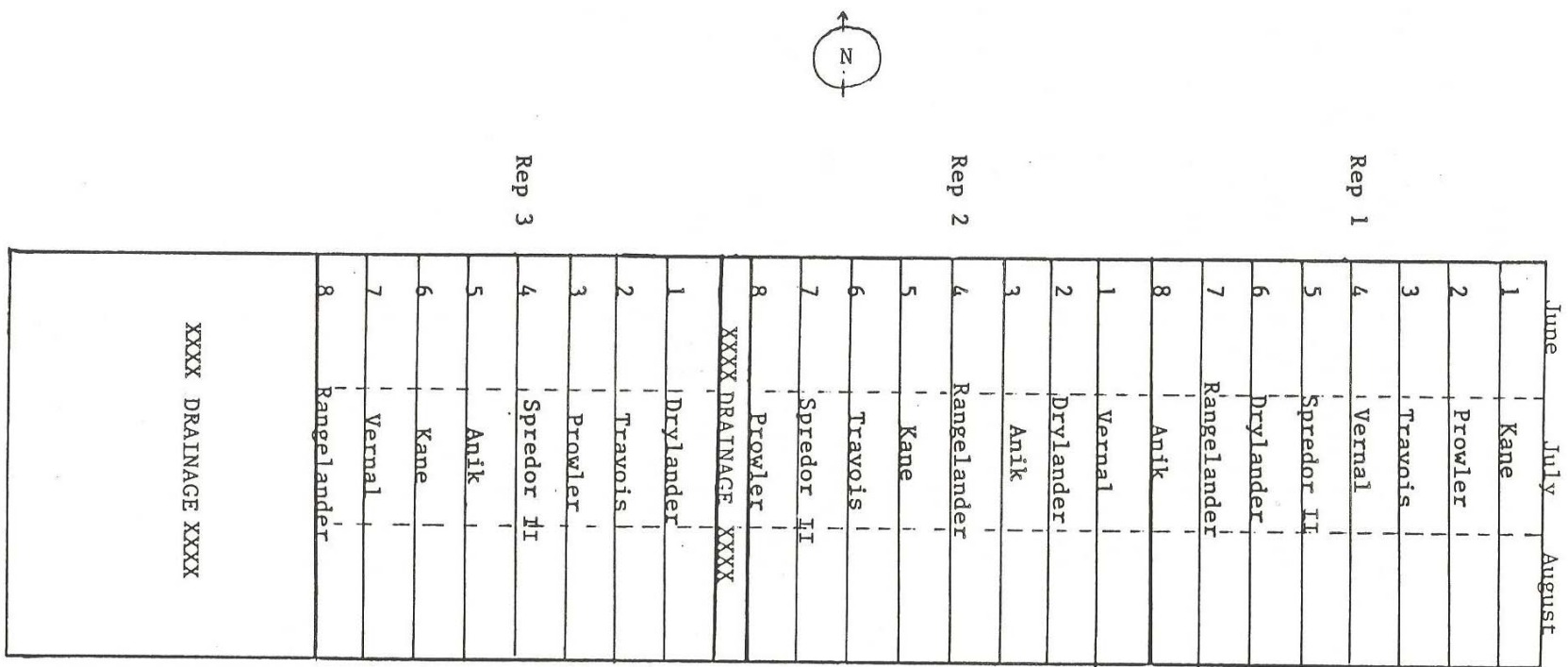


Figure 3. Interseeded alfalfa variety response to grazing, seeded 27-28 Apr 1983.

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
Total	1244.0	1744.8	2026.6	1646.0	1666.3	2271.6	1734.0	1732.9	1654.4	1514.0	1505.7	1615.1
	Rangelander			Spredor II			Travois			Vernal		
	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug
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
Total	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

Clip Categories	Anik	Drylander	Kane	Prowler	Rangelander	Spredor II	Travois	Vernal
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
Total	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

Variety	Grazing Treatment									Mean		
	Jun			Jul			Aug			Seedling	Adult	Total
	Seedling	Adult	Total	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

Variety	Grazing Treatment									Mean		
	Jun			Jul			Aug			Seedling	Adult	Total
	Seedling	Adult	Total	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

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

Forbs:

Ac mi	<i>Achillea millefolium</i>	Yarrow
Al st	<i>Allium textile</i>	White wild onion
Am re	<i>Amaranthus retroflexus</i>	Rough pigweed
An oc	<i>Androsace occidentalis</i>	Fairy candelabra
An ne	<i>Antennaria neglecta</i>	Pussytoes
An pa	<i>Antennaria parvifolia</i>	Pussytoes
Ar ho	<i>Arabis holboellii</i>	Slim rockcress
Ar dr	<i>Artemisia dracunculus</i>	Green sage
Ar fr	<i>Artemisia frigida</i>	Fringed sage
Ar lu	<i>Artemisia ludoviciana</i>	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 crassicaarpus</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>Grindelio 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
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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 enclosure 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 (lbs/acre)			% Utilization
	12 Jul Pre grazed	24 Aug Ungrazed	24 Aug 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

Pasture	Mean Initial Weight	Mean Final Weight	Mean Gain Per Head	Mean Gain Per Day Per Head	Mean Gain Per Day Per Acre
Native Range Control:					
Calf	263	336	72.38	2.01	0.89
Cow	1044	1049	5.63	0.16	0.07
Alfalfa Interseeded:					
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

Treatment Year	Pasture Size Acres	Dates Pasture Grazed	Days In Period	No. of Head	No. Of AUM's	Stocking Rate AUM/Acre
Native Range Control:						
1978	18	19 Jun-14 Aug	56	10 cow-calf 1 bull	20.20	1.12
1979	18	22 Jun-20 Jul	28	10 cow-calf 1 bull	10.10	0.56
1980	18	7 Jul-23 Jul	16	7 cow-calf 1 bull	4.20	0.23
1981	18	24 Jun-28 Jul	35	8 cow-calf 1 bull	10.33	0.57
1982	18	21 Jun-20 Aug 21 Jun- 4 Aug	60 44	10 cow-calf 1 bull	21.11	1.17
1983	18	12 Jul- 3 Aug	22	5 cow-4 calf 21 heifer 1 bull	15.69	0.87
1984	18	19 Jul-24 Aug	36	8 cow-calf	9.44	0.52
Alfalfa Interseeded:						
1978	10	19 Jun- 7 Aug	49	10 cow-calf 1 bull	17.67	1.77
1979	10	22 Jun-20 Jul	28	10 cow-calf 1 bull	10.10	1.01
1980	10	7 Jul-16 Jul	9	7 cow-calf 1 bull	2.36	0.24
1981	10	24 Jun-21 Jul	28	8 cow-calf 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 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 Rangelander 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 Rangelander 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 Rangelander 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, Rangelander, 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), Rangelander (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, Rangelander, 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, Rangelander, 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, Rangelander, 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 – 1984¹

Variety	1980 Clip-27 Jun		1981 Clip-23 Jun		1982 Clip-2 Jul		1983 Clip-1 Jul		1984 Clip-3 Jul		1980 - 1984 Mean	
	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre	% 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

¹Means 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

Type Alfalfa	1980	1981	1982	1983	1984	Mean
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

Winterhardy Category	1980	1981	1982	1983	1984	Mean
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

Varieties	1983		1984		Mean	
	# of Plt. / Ft. sq.	Wt. / Plt. In oz.	# of Plt. / Ft. sq.	Wt. / Plt. In oz.	# of Plt. / Ft. sq.	Wt. / Plt. In oz.
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

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	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

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	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 Clip-7 Jul		1983 Clip-28 Jun		1984 Clip-2 Jul		1982 – 1984 Mean	
	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / Acre ¹	% Vernal	Total Lbs. / 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

¹Means 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

Type Alfalfa	1982	1983	1984	Mean
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

Winterhardy Category	1982	1983	1984	Mean
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 Plt. / Ft. sq.	Wt. / Plt. In oz.	# of Plt. / Ft. sq.	Wt. / Plt. In oz.	# of Plt. / Ft. sq.	Wt. / Plt. 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 - 1984¹

Variety	Annual Herbage Production in Lbs / Acre					Mean
	1980 23 Jun	1981 30 Jun	1982 28 Jun	1983 23 Jun	1984 5 Jul	
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*

¹Means 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 $\frac{1}{4}$ m² 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 $\frac{1}{4}$ m² 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 $\frac{1}{4}$ m² 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

Location:	NE¼, NE¼, SW¼ Sec. 22, T. 141 N., R. 104 W. Property of Dale Maus
Replications:	Two Randomized Block Design
Study Size:	53' x 80' 0.1 acres
Plot Size:	10' x 53' 0.012 acres
Perimeter border:	2'
Soil:	Vebar fine sand loam
Range Site:	Sandy
Herbicide:	Tebuthiuron 20% concentrated pellets
Application Date:	12 July 1983
Treatments:	0 lbs ai/acre 1 lbs ai/acre 2 lbs ai/acre 3 lbs ai/acre

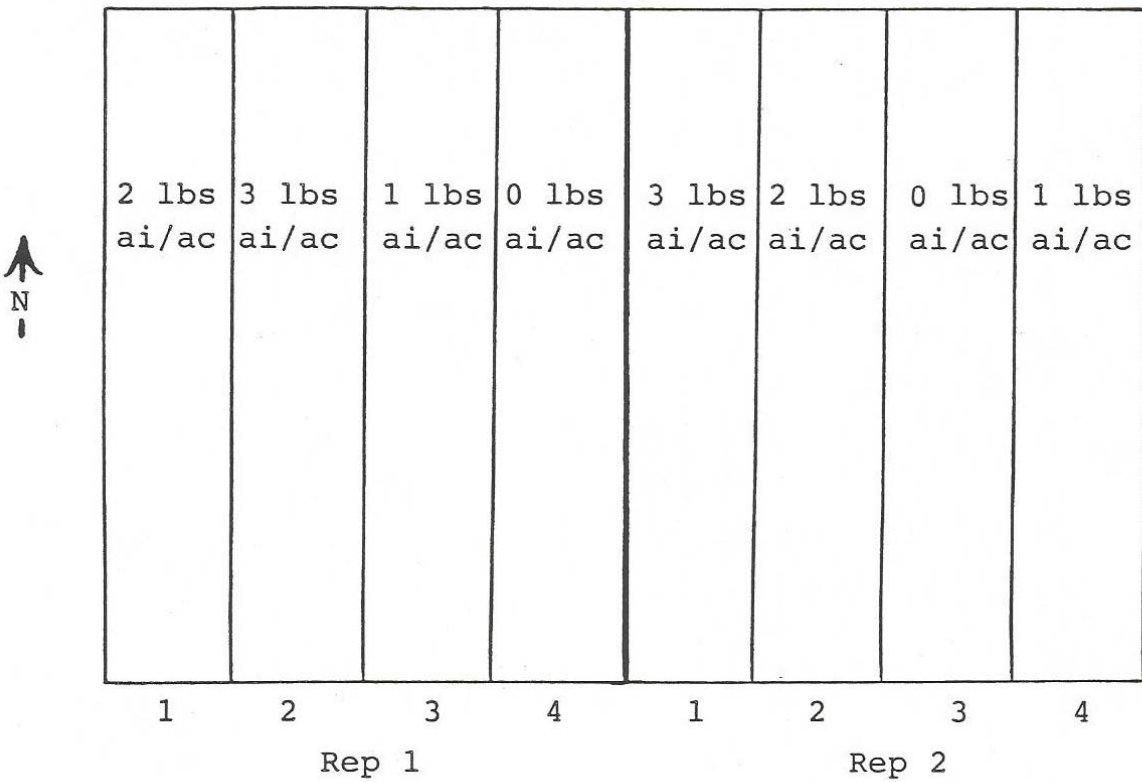


Figure 1. Control of Leafy Spurge with Tebuthiuron randomized block plot design with two replications. Rates are 0,1,2 and 3 pounds of active ingredient per acre using 20 percent concentration pellets. Located at NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 22, T.141 N., R.104 W. Plots are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

Leafy Spurge Control by Tebuthiuron Applied in 1984

Location: NE $\frac{1}{4}$, SE $\frac{1}{4}$, NE $\frac{1}{4}$ Sec. 4, T. 140 N., R. 103 W.
Property of Cecil Adams

Replications: Two Randomized Block Design

Study Size: 44' x 120' 0.12 acres
Plot Size: 22' x 30' 0.02 acres
Perimeter Border: 2'

Soil: Havrelon silt loam

Range Site: Overflow

Herbicide: Tebuthiuron
20% concentrated pellets

Application Date: 4 June 1984

Treatments: 0 lbs ai/acre
1 lbs ai/acre
2 lbs ai/acre
3 lbs ai/acre

N
↑

	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

Herbicide Rate In Lbs Ai / Acre	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
0 Lbs:						
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
TOTAL	1638.6	2189.9	2156.9	1529.8	1441.5	1371.9
1 Lbs:						
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
TOTAL	915.0	1542.3	1359.9	1495.9	788.5	493.3
2 Lbs:						
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
TOTAL	1020.5	701.8	702.8	906.1	389.8	316.7
3 Lbs:						
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
TOTAL	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

Herbicide Rate In Lbs Ai / Acre	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct	8 Nov
0 Lbs:							
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
1 Lbs:							
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
2 Lbs:							
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
3 Lbs:							
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 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 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:						
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
1 Lbs:						
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
2 Lbs:						
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
3 Lbs:						
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 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 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 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:							
Herbage Production:							
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	
1 Lbs:							
Herbage Production::							
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	
2 Lbs:							
Herbage Production:							
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	
3 Lbs:							
Herbage Production:							
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

Herbicide Rate In Lbs Ai / Acre	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
0 Lbs:						
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
TOTAL	2223.6	2602.0	3015.9	2073.0	2164.0	1891.0
1 Lbs:						
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
TOTAL	2423.6	2372.7	2420.9	1717.1	1464.7	1574.4
2 Lbs:						
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
TOTAL	2701.0	2766.1	2047.2	1503.9	1220.3	1361.2
3 Lbs:						
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
TOTAL	2783.0	2471.7	1433.4	1523.5	854.5	1291.6

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

Herbicide Rate In Lbs Ai / Acre	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct	8 Nov
0 Lbs:							
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
1 Lbs:							
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
2 Lbs:							
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
3 Lbs:							
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 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 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:						
Spurge		+17.89	+36.80	- 6.04	- 4.77	-19.23
Grass		+ 2.00	-79.93	-40.02	-100.00	+1050.00
1 Lbs:						
Spurge		- 0.88	+ 2.71	-27.32	-37.35	-33.92
Grass		- 79.63	-59.25	-62.96	-100.00	-38.88
2 Lbs:						
Spurge		+ 7.57	-20.20	-41.45	-52.27	-47.45
Grass		- 77.49	-82.48	-100.00	-100.00	-50.00
3 Lbs:						
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 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 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 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:							
Herbage Production:							
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	
1 Lbs:							
Herbage Production:							
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	
2 Lbs:							
Herbage Production:							
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	
3 Lbs:							
Herbage Production:							
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

Location:	NE $\frac{1}{4}$, SE $\frac{1}{4}$, NE $\frac{1}{4}$ Sec. 4, T. 140 N., R. 103 W. Property of Cecil Adams
Replications:	Two Randomized Block Design
Study Size:	62' x 178' 0.25 acres
Plot Size:	22' x 30' 0.02 acres
Perimeter Border:	2'
Soil:	Havrelon silt loam
Range Site:	Overflow
Application Rate:	2 lbs ai / acre of Tordon 2K pellets
Application Dates:	Early June – 4 Jun 1984 Early July – 6 Jul 1984 Mid August – 8 Aug 1984
Treatments:	Control Early June Mow Early June Mow + Tordon 2K Early June Tordon 2K Early July Mow Early July Mow + Tordon 2K Early July Tordon 2K Mid August Tordon 2K

N 

	1	2	3	4	5	6	7	8
Rep 1	Early July Mow + Tordon 2K	Early July Tordon 2K	Early July Mow	Early June Mow + Tordon 2K	Early June Tordon 2K	Early June Mow	Control	Mid August Tordon 2K
Rep 2	Early June Mow + Tordon 2K	Control	Early June Tordon 2K	Early July Mow + Tordon 2K	Mid August Tordon 2K	Early July Mow	Early June Mow	Early July 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

Treatments	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Control:						
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
TOTAL	2260.3	3535.9	3999.7	3635.8	2709.0	2875.8
Jun Mow:						
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
TOTAL	2503.0	578.9	1475.4	2023.1	580.7	525.4
Jun Mow + Tordon:						
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
TOTAL	1743.9	499.5	250.7	230.1	584.3	56.2
Jun Tordon:						
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
TOTAL	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

Treatments	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Jul Mow:						
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
TOTAL	2137.2	2717.0	3436.9	235.5	130.2	135.6
Jul Mow + Tordon:						
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
TOTAL	1924.1	2534.2	2560.9	193.6	167.7	216.8
Jul Tordon:						
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
TOTAL	2518.1	3287.9	2769.7	1673.4	1261.3	1136.4
Aug Tordon:						
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
TOTAL	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

Treatments	5 Jun	19 Jun	6 Jul	8 Aug	6 Sep	8 Oct
Control:						
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
Jun Mow:						
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
Jun Mow + Tordon:						
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
Jun Tordon:						
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
Jul Mow:						
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
Jul Mow + Tordon:						
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
Jul Tordon:						
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
Aug Tordon:						
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
Control:						
Spurge		+57.72	+77.13	+62.71	+21.24	+16.57
Grass		- 7.13	+235.71	-100.00	-100.00	+2071.10
Jun Mow:						
Spurge		-76.61	-40.01	-18.93	-77.04	-79.58
Grass		-90.24	- 100.00	-19.50	-56.08	-36.59
Jun Mow + Tordon:						
Spurge		-74.90	-91.03	-91.96	-90.61	-98.24
Grass		+279.99	+304.99	+395.01	+2270.01	+45.01
June Tordon:						
Spurge		+26.36	-54.55	-52.54	-70.21	-59.13
Grass		-83.10	+ 9.87	-52.11	-100.00	-98.59
Jul Mow:						
Spurge			-93.29	-96.17	-97.50	
Grass			-75.37	-55.06	-13.05	
Jul Mow + Tordon:						
Spurge			-93.09	-98.97	-98.97	
Grass			-81.54	-16.92	+10.77	
Jul Tordon:						
Spurge			-39.68	-54.46	-59.07	
Grass			+100.00	0.00	+100.00	
Aug Tordon:						
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
Control:						
Herbage Production:						
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
Jun Mow:						
Herbage Production:						
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
Jun Mow + Tordon:						
Herbage Production:						
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
Jun Tordon:						
Herbage Production:						
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

Treatment	Days After Treatment					
	0	14	31	62	93	125
Jul Mow:						
Herbage Production:						
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	
Jul Mow + Tordon:						
Herbage Production:						
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	
Jul Tordon:						
Herbage Production:						
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	
Aug Tordon:						
Herbage Production:						
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

Treatment	Rep 1	Rep 2
Control	Alive, very tough, buds	Alive, tough, buds
June:		
Mow	Alive, tough	Alive, tough
Mow + Tordon	Dead, very decayed	Dead, decaying
Tordon	Dead, very decayed	Near dead, some decay
July:		
Mow	Alive, tough, few buds	Alive, tough
Mow + Tordon	Dead, decaying	Dead, decaying
Tordon	Near dead, some decay	Dead, decaying
August:		
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.

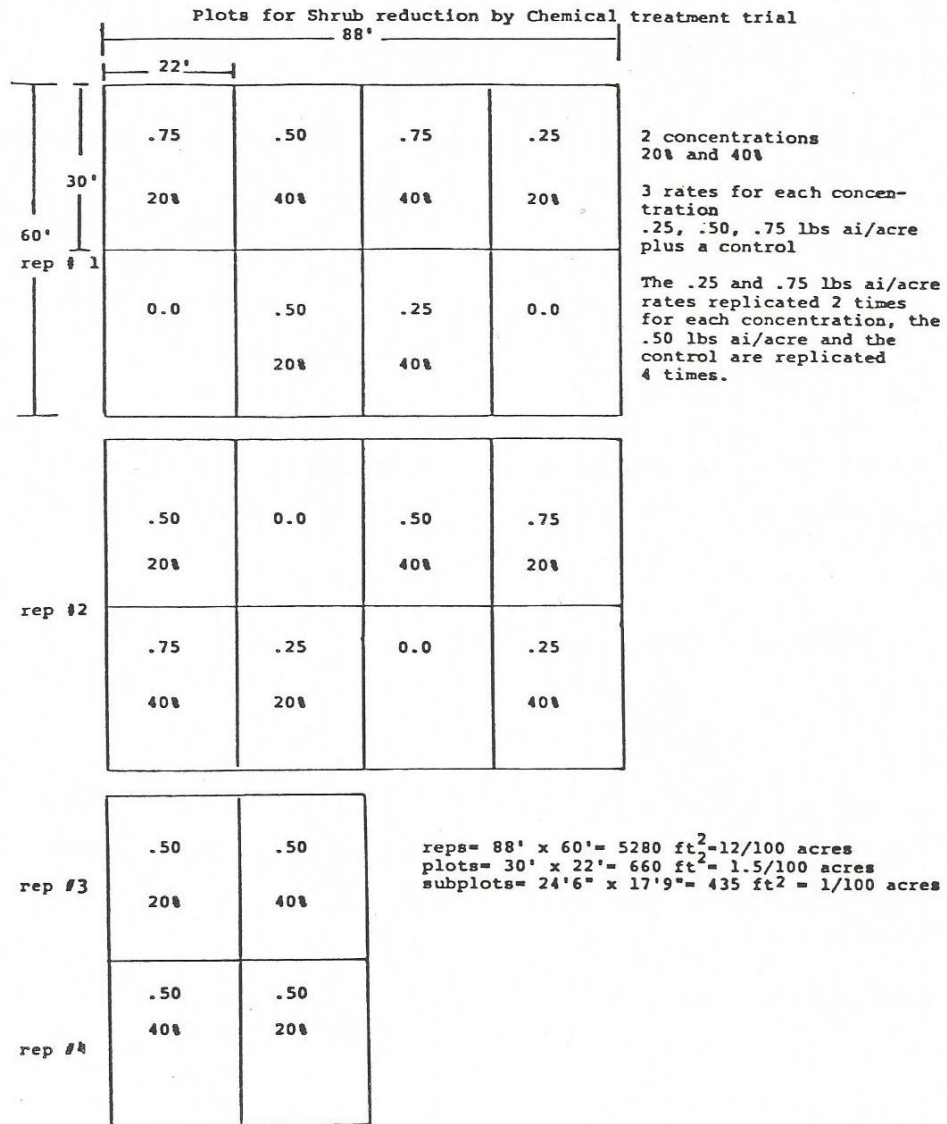


Figure 1. Shrub reduction trial plot diagram.

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

	Rate Lbs. Ai / Acre	Conc. %	Total # Plants	Height		Diameter N-S		Diameter E-W	
				Dead Cm	Live Cm	Dead Cm	Live Cm	Dead Cm	Live 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

	Rate Lbs Ai / Acre	Conc. %	Total # Plants	Height % Dead	Diameter N-S % Dead	Diameter E-W % Dead
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

	Rate Lbs Ai / Acre	Conc. %	Total # of Plants	Density # / m²	# Plants With Dead	Plants % with Dead	# Plants Totally Dead	Plants % Totally Dead
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

	Rate Lbs Ai / Acre	Conc. %	Total # Plants	Crown Area Dead Cm²	Crown Area Live Cm²	% Dead
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

	Rate Lbs Ai / Acre	Conc. %	Total # Plants	Plant Volume Dead M³	Plant Volume Live M³	% Dead
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

Rate Lbs Ai / Acre	Conc. %	Height % Dead	<u>Diameter</u> N-S % Dead	<u>Diameter</u> E-W % Dead	Total Height <u>Diameter</u> N-S E-W	Area % Dead	Volume % Dead
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 Lbs Ai / Acre	Conc. %	Total # Plants	Height		Diameter N-S		Diameter E-W	
				Dead cm	Live cm	Dead cm	Live cm	Dead cm	Live 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

	Rate Lbs Ai / Acre	Conc. %	Total # Plants	Height % Dead	Diameter N-S % Dead	Diameter E-W % Dead
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

	Rate Lbs Ai / Acre	Conc. %	Total # of Plants	Density # / m²	# Plants With Dead	Plants % With Dead	# Plants Totally Dead	Plants % Totally Dead
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

	Rate Lbs Ai / Acre	Conc. %	Total # Plants	Crown Area Dead Cm²	Crown Area Live Cm²	% Dead
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

	Rate Lbs Ai / Acre	Conc. %	Total # Plants	Plant Volume Dead M³	Plant Volume Live M³	% Dead
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

Rate Lbs Ai / Acre	Conc. %	Height % Dead	<u>Diameter</u> N-S % Dead	<u>Diameter</u> E-W % Dead	Total Height <u>Diameter</u> N-S E-W	Area % Dead	Volume % Dead
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 Ai / Acre		.50 lbs Ai / Acre		.75 lbs 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 ²	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 ³	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 ²	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 ³	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>	<u>.25 lbs Ai / Acre</u>		<u>.50 lbs Ai / Acre</u>		<u>.75 lbs Ai / Acre</u>		
		20%	40%	20%	40%	20%	40%	
<u>GRAMINOIDS:</u>								
Agropyron desertorum Crested wheatgrass		S		F	A			
Agropyron smithii Western wheatgrass	D	D	D	D	D	D	D	D
Agropyron trachycaulum Slender wheatgrass	F	F	S	F	F	F	F	F
Bouteloua gracilis Blue grama	F	F	F	S	S	S		
Bromus inermis Smooth brome			S					
Bromus japonicus Japanese chess		S		S				S
Calamagrostis montanensis Plains reedgrass				S				
Distichlis stricta Saltgrass	S							
Koeleria pyramidata Prairie junegrass			S					
Poa pratensis Kentucky bluegrass	D	D	D	A	A	A	A	A
Stipa comata Needleandthread	S		F					
Stipa viridula Green needlegrass	D	D	D	D	D	D	D	D
Carex heliophila Sun sedge							S	
<u>FORBS:</u>								
Achillea millefolium Yarrow	F	A	F	F	A	A	A	A
Artemisia dracunculus 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>	<u>.25 lbs Ai / Acre</u>		<u>Treatment</u> <u>.50 lbs Ai / Acre</u>		<u>.75 lbs Ai / Acre</u>		
		20%	40%	20%	40%	20%	40%	
<u>FORBS (Cont.):</u>								
Artemisia frigida Fringed sage		S						
Artemisia ludoviciana White sage	F	F	F	F	F	F	F	
Aster ericoides White prairie aster	F	S	S	F	S	S	S	
Aster laevis Smooth blue aster								
Astragalus canadensis Little rattlepod				S	S		S	
Conyza canadensis Horseweed								
Descurainia sophia Flixweed		S						
Galium boreale Northern bedstraw				S				
Lactuca oblongifolia Blue wild lettuce	F	F	F	F	F	F	F	
Lepidium densiflorum Peppergrass								
Linum rigidum Stiffstem flax	S		S	S	S			
Melilotus officinalis Yellow sweet clover								
Polygala alba White milkwort								
Psoralea argophylla Silverleaf scurfpea					S			
Ratibida columnifera 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>	<u>.25 lbs Ai / Acre</u>		<u>.50 lbs Ai / Acre</u>		<u>.75 lbs Ai / Acre</u>		
		20%	40%	20%	40%	20%	40%	
FORBS (Cont.):								
Solidago rigida Stiff goldenrod					S			
Sphaeralcea coccinea Scarlet globemallow		S	S				F	
Taraxacum officinale Dandelion	S	S	S					
Vicia americana Wild vetch	A	F	A	F	F	A	F	
SHRUBS:								
Artemisia cana Silver sagebrush	D	D	D	D	D	D	D	D
Ribes americanum Wild black current		S		S				S
Prunus virginiana Chokecherry								
Rosa woodsii Western wildrose		F		S		S		
Symphoricarpos occidentalis Wolfberry	F	F	S	F	F			F

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Hatch 1922: Short Term Grazing Systems

Dickinson Experiment Station

D. Kirby

Short duration grazing systems use: (1) multiple pastures, 3 to 60, (2) 1 to 15 day grazing periods, (3) 30 to 60 day rest periods, and (4) 1 herd stocked at a heavier rate when compared with recommended seasonlong stocking rates. It has been suggested that this system will maintain or improve range condition and increase carrying capacity over conventional rangeland management systems. This project was initiated to test his hypothesis.

The grazing trial began in June, 1981 by dividing section 16, Dickinson Experiment Station, Ranch Headquarters, into a 320 acre seasonlong (SL) pasture and 8-40 acre short duration grazed (SDG) pastures. On June 25, 1981, June 22, 1982 and June 17, 1983, 20 cow-calf pairs and 1 bull were allocated to the SL pasture and 35 cow-calf pairs and 1 bull were allocated to the SDG system. In 1984 25 cow-calf pairs were allocated to the SL pasture. Cattle were rotated every 5 days on the SDG system as pastures received 35 days rest between grazings. Drought, causing low forage production, forced removal of livestock from both systems on September 3 in 1981. In 1982, 1983, and 1984 cattle were removed October 12 and 26, and November 5 concluding 112, 131 and 131 day grazing seasons, respectively.

Forage production and utilization and livestock performance are summarized in Table 1. Forage produced and utilized was similar between grazing treatments in 1981 and 1982. In 1983 the range sites used for estimating forage production and utilization were changed to better represent the "true" sites according to the newly revised Dunn County Soil Survey. We feel the difference in forage production in 1983 on the two grazing treatments is a result of this site change and not an effect of the grazing treatment. Forage production was again greater on the SL treatment in 1984. Utilization of forage is quite similar between treatments from year to year despite the increased stocking rate on the SDG treatment. Livestock performance per head was similar but production of calf per acre was higher each year for the SDG system which reflects the increased stocking rate.

Livestock performance by year, season and 28 day weigh period are shown in Tables 2 and 3. Data from 1981 was omitted due to the shortened grazing season. Cows gained and maintained more weight over the season on the SL treatment each year. Cows on both grazing treatments began losing weight usually in the 4th weigh period which ran from mid-September to mid-October. Cows on the SDG treatment in both 1983 and 1984 were able to maintain weight better in the latter weigh periods than SL cows. Calf seasonal and daily gains were not different for the SL and SDG treatments in all years. Calf gain also dropped off dramatically in weigh period 4. This suggests some management in fall might be needed to maintain condition of cows and/or weight gain of calves.

Botanical composition (%) of cow diets on the short duration system indicated cattle select more grasses throughout the grazing season (Table 4). Grass averaged over 80% of cattle diets each year and generally increased in diets from early summer through late fall. Forbs were an important part of diets in early summer but were selected less as seasons progressed. Except for 1981, a drought year, browse contributed little to cattle diets in any season.

Research has shown that various species of grazing animals have different forage preferences. When animals don't compete for the same type of forage, an increase in stocking rate is possible without causing detrimental effects to the condition of the rangeland. Consequently, a study to determine dietary overlap of sheep and cattle on the two grazing treatments was begun in 1983.

Esophageally fistulated sheep were grazed seasonally on both short duration and seasonlong grazing treatments. Botanical composition of the collected diets were determined to class and species using microscopic analysis.

Botanical composition of sheep diets indicated that forb use was highest in early summer and summer on both grazing treatments (Tables 5-8). The last half of the grazing season showed decreases in the amount of forbs selected in diets and increases in grass and browse selection. The decrease in forb use is due to the disappearance of forb species in the latter months of the grazing season and to the decrease in palatability of forbs when mature. Forb selection on the short duration grazing treatment was higher in the early summer and summer than on the seasonlong treatment. Forb and grass use was quite similar for both treatments in the early fall and fall. Comparing sheep and cattle diets, indicates that sheep have little dietary overlap with cattle for forbs. The only competitive overlap in diets appears to be for the short, warm-season grass, blue grama (Tables 9 and 10). Any competitive overlap in diets would appear to increase in the latter part of the grazing season.

Table 1. Forage Production and Utilization and Livestock Performance on Short Duration Grazing and Seasonlong Systems on the Dickinson Experiment Station

Year	System	Forage		Livestock			
		Production (lbs / ac)	Utilization (%)	ADG (lbs)	Cows (AG/ac) (lbs)	ADG (lbs)	Calves (AG/ac) (lbs)
1981	SD	678	55	0.4	3	2.2	16
	SL	679	51	0.7	3	2.3	10
1982	SD	1645	41	0.3	4	2.1	25
	SL	1766	36	0.5	4	2.1	15
1983	SD	1057	46	0.3	5	2.1	30
	SL	1720	43	0.5	5	2.2	18
1984	SD	919	60	0.0	0	1.9	26
	SL	1371	60	0.0	0	1.9	19

Table 2. Cow Gains (lbs) by Year, Grazing Treatment, Weigh Period and Season on the Dickinson Experiment Station Ranch Headquarters

Treatment	Weigh Period ^{1/}					Total
	I	II	III	IV	V	
1982						
SL	50a ^{2/}	22b	5b	-17c	---	53a
SD	58a	4b	1b	-33d	---	30b
1983						
SL	71a	39a	20ac	-2ad	6ad	135a
SD	74a	-26b	25c	9d	11d	92a
1984						
SL	77a	23b	-14cd	-48e	-25d	14a
SD	27b	20b	1c	-32d	-11c	3a

^{1/} Weights were recorded every 28 days throughout grazing seasons.

^{2/} Means in a row or column for each year followed by a similar letter are not different ($P \leq 0.05$).

Table 3. Calf Gains (lbs) by Year, Grazing Treatment, Weigh Period and Season on the Dickinson Experiment Station Ranch Headquarters

Treatment	Weigh Period					Total	ADG
	I	II	III	IV	V		
1982							
SL	66a ^{2/}	69a	61a	40b	---	231a	2.1a
SD	67a	68a	65a	30c	---	230a	2.1a
1983							
SL	64a	69a	61a	69a	22b	285a	2.2a
SD	69ac	61c	63ac	62c	22b	277a	2.1a
1984							
SL	70a	71a	58b	29c	15d	243a	1.9a
SD	66a	66a	61ab	25c	27c	239a	1.9a

^{1/}Weights were recorded every 28 days throughout grazing seasons.

^{2/}Means in a row or column for each year followed by a similar letter are not different ($P \leq 0.05$).

Table 4. Botanical Composition (%) of Cow Diets on a Short Duration Grazing System, Dickinson Experiment Station Ranch Headquarters

Year	Class	Season				Mean
		ES	S	F	LF	
1981	Grass	87	92	85	---	88
	Forb	12	4	1	---	6
	Browse	1	4	14	---	6
1982	Grass	71	82	87	87	81
	Forb	25	14	9	9	15
	Browse	4	4	4	4	4
1983	Grass	86	88	93	95	91
	Forb	13	11	6	4	8
	Browse	1	1	1	1	1

Table 5. Botanical Composition (%) of Sheep Diets on a Short Duration Grazing Treatment In 1983 on the Dickinson Experiment Station Ranch Headquarters

Forage Class and Species	Season			
	Early Summer	Summer	Early Fall	Fall
Grass	43	45	75	72
Bouteloua gracilis	25	32	61	48
Agropyron smithii	5	2	5	4
Stipa spp.	2	4	5	5
Koeleria pyramidata	7	4	1	13
Other	4	3	3	2
Forb	56	51	17	21
Sphaeralcea coccinea	11	16	5	12
Lotus purshianus	9	24	1	---
Artemisia ludoviciana	2	---	1	---
Solidago mollis	19	---	---	1
Other	15	11	10	8
Browse	1	4	8	7
Artemisia frigida	1	4	8	7
Other	---	---	---	---

Table 6. Botanical Composition (%) of Sheep Diets on a Seasonlong Grazing Treatment In 1983 on the Dickinson Experiment Station Ranch Headquarters

Forage Class and Species	Season			
	Early Summer	Summer	Early Fall	Fall
Grass	64	50	70	72
Bouteloua gracilis	41	42	50	38
Agropyron smithii	9	1	2	6
Stipa spp.	2	2	7	4
Koeleria pyramidata	7	3	7	21
Other	5	2	4	3
Forb	35	48	21	27
Sphaeralcea coccinea	8	6	2	11
Lotus purshianus	3	21	2	---
Artemisia ludoviciana	13	7	4	9
Solidago mollis	1	---	---	1
Other	10	14	13	6
Browse	1	2	9	1
Artemisia frigida	1	2	5	---
Other	---	---	4	1

Table 7. Botanical Composition (%) of Sheep Diets on a Short Duration Grazing Treatment In 1984 on the Dickinson Experiment Station Ranch Headquarters

Forage Class and Species	Season			
	Early Summer	Summer	Early Fall	Fall
Grass	35	45	47	33
Bouteloua gracilis	20	33	34	30
Agropyron smithii	8	4	6	1
Stipa spp.	3	5	6	2
Koeleria pyramidata	2	3	1	0
Other	2	0	---	---
Forb	64	40	16	4
Sphaeralcea coccinea	10	1	1	0
Ratibida columnifera	10	11	6	1
Erigeron strigosus	11	9	1	1
Agoseris glauca	10	8	2	0
Other	25	11	6	2
Browse	1	15	37	63
Artemisia dracunculoides	.25	12	32	58
Other	.75	3	5	5

Table 8. Botanical Composition (%) of Sheep Diets on a Seasonlong Grazing Treatment In 1984 on the Dickinson Experiment Station Headquarters

Forage Class and Species	Early Summer	Season		
		Summer	Early Fall	Fall
Grass	37	42	32	53
Bouteloua gracilis	25	31	26	49
Agropyron smithii	5	5	2	1
Stipa spp.	3	4	3	2
Koeleria pyramidata	2	2	1	0
Other	2	---	---	1
Forb	60	42	26	12
Sphaeralcea coccinea	6	2	1	---
Ratibida columnifera	12	13	5	2
Erigeron strigosus	18	11	1	6
Agoseris glauca	17	6	1	---
Other	7	10	18	4
Browse	3	16	42	35
Artemisia dracunculoides	---	15	38	33
Other	3	1	4	2

Table 9. Botanical Composition (%) of Sheep Diets Grazing Commonly and Following Cattle on a Short Duration Grazing System in 1983

Forage Class and Species	I ^{1/}		II	
	Summer	Early Summer	Summer	Early Fall
Grass	54	68	45	75
Bouteloua gracilis	39	54	32	61
Agropyron smithii	8	8	2	5
Stipa spp.	3	2	4	5
Koeleria pyramidata	2	2	4	1
Other	2	2	3	3
Forb	45	22	51	17
Sphaeralcea coccinea	8	3	16	5
Lotus purshianus	11	---	24	1
Artemisia ludoviciana	9	5	---	1
Solidago mollis	---	---	---	---
Other	15	14	11	10
Half Shrub	3	10	4	8
Artemisia frigida	3	10	4	7
Other	---	---	---	---

^{1/} Collection periods were: (I) in common with a cattle herd grazing research paddocks, and (II) immediately following the movement of a cattle herd from research paddocks.

Table 10. Botanical Composition (%) of Sheep Diets Grazing Commonly and Following Cattle on a Short Duration Grazing System in 1984

Forage Class and Species	I ^{1/}		II	
	Summer	Early Fall	Summer	Early Fall
Grass	45	47	49	39
Bouteloua gracilis	33	34	34	32
Agropyron smithii	4	6	7	3
Stipa spp.	5	6	5	3
Koeleria pyramidata	3	1	3	1
Other	0	---	---	---
Forb	40	16	23	5
Sphaeralcea coccinea	1	1	2	---
Ratibida columnifera	11	6	8	2
Erigeron strigosus	9	1	4	1
Agoseris glauca	8	2	2	---
Other	11	6	7	2
Half Shrub	15	37	28	56
Artemisia dracunculoides	12	32	26	53
Other	3	5	2	3

^{1/} Collection periods were: (I) in common with a cattle herd grazing research paddocks, and (II) immediately following the movement of a cattle herd from research paddocks.

Table 11. Crude Protein (%) and In Vitro Digestible Organic Matter (%) Content of Sheep Diets on Short Duration (SD) and Seasonlong (SL) Grazing Treatments in 1983 and 1984

Nutrient	Treatment	Early Summer	Season		Fall
			Summer	Early Fall	
1983					
CP	SD	11.6a ^{1/}	13.0a	9.3c	9.7c
	SL	10.1bc	10.6b	9.4cd	8.8d
IVDOM	SD	60.8a	60.8a	55.4ab	51.9b
	SL	68.7c	58.7ab	53.0b	52.1b
1984					
CP	SD	13.0a	10.7b	8.8c	7.0d
	SL	14.3a	9.7b	9.0bc	6.0e
IVDOM	SD	78.3a	56.0b	50.9c	36.2d
	SL	78.0a	54.8b	50.8c	38.5d

^{1/} Means in a year, row, and column for each nutrient followed by a different letter are significantly different ($P \leq 0.05$).