NATIVE RANGELAND IMPROVEMENT STUDIES

A. Native Grassland Fertilization

A new native grassland fertilization trial was initiated in the autumn of 1969. Yield and species composition data were first gathered during the summer of 1970. Various other phases of the study concerned with soil water, soil nitrogen, plant analysis, and individual species changes have been implemented but will not be reported at this time.

The study consists of 12 different fertilizer treatments with nitrogen alone at rates of 200, 300, and 400 pounds per acre, alternate years of application of 67 and 100 pounds nitrogen per acre, nitrogen in combination with phosphorus and potassium, phosphorus alone, and potassium alone. Plots containing potassium alone or in combination with other fertilizer will be included in 1971. The alternate year applications with nitrogen fertilizer will likewise be included initially in the 1971 season. Plots receiving no nitrogen have been included as a comparison with all plots with different treatments. All fertilizer rates are reported as pounds of elemental fertilizer per acre.

The trial is located approximately three miles northwest of the Dickinson Experiment Station on a well drained upland range site. The vegetation is predominantly western wheatgrass (Agropyron smithii), plains reedgrass (Calamagrostis montanensis), needle-and-thread (Stipa comata), and blue grama grass (Bouteloua gracilis). Forbs or weedy plants consist mainly of fringed sage (Artemisia frigida) and numerous less abundant species. The pasture has been rather heavily grazed for many years prior to the initiation of this trial.

The data in Table 1 show that the highest total yield (4,120 pounds per acre) was obtained at the 300 pounds-nitrogen-per-acre rate. In terms of individual yield components, the highest yield was also observed at this rate in the mid, shortgrass, and perennial forb categories. Annual forbs did not contribute significantly to the total production in any of the treatments in this trial.

The 400-pound-nitrogen rate showed a smaller increase over check plots than was observed at the 300-pound-nitrogen rate. The increase, however, was greater than that indicated at the 67, 100, or 200-pound-nitrogen rates with total yields of 3012, 3378, and 3253 pounds production per acre, respectively (Table 1). In terms of increase in production for each added increment of fertilizer, the 67 pound nitrogen rate was the most efficient. Nitrogen in combination with phosphorus did not show an appreciable yield beyond that realized with nitrogen alone (3076 vs. 3012 lbs/acre). The phosphorus treatment without any other fertilizer combination indicated a yield less than plots without any type of treatment. With the exception of the annual forbs component, the grasses and perennial forbs appeared to have been inhibited in their growth and development with the application of the phosphorus fertilizer (Table 1).

Table 2 shows the percentage composition of the various field components at the end of the 1970 growing season. In general, the mid-grass component was slightly higher than the shortgrass components when comparing the nitrogen treatments as a group. The one notable exception being the 67-pound-nitrogen rate which appears to indicate an opposite effect. In all probability an error in sampling of the vegetation may account for this singular difference. Plots fertilized with the phosphorus alone or in combination with the nitrogen showed a reverse trend in that the warm-season shortgrasses appear to be favored over the cool-season midgrasses. The forb components did not change appreciably within the different treatments, although the plots with no fertilization showed a considerably smaller percentage of the total yield in the forb component (Table 2).

The duration of this trial has thus far been for only a single growth season. Concrete and sound conclusions cannot be drawn from a single year's data when dealing with a complex situation such as a native grassland. The long-term effects of nitrogen and other fertilizers must be closely observed over a period of many years. Based on previous experimental work involving different range sites, it became obvious after several years that species composition changes were taking place and that nitrogen fertilization was an important tool in increasing grass production and quality, making better use of available soil water, and improving the condition of the range under proper management practices. At the present time it may be economically feasible in most years to apply nitrogen on selected sites at approximately the 67-pound-nitrogen rate. In the present trial it will be determined if alternate year application or one time heavy application of nitrogen may be more economically feasible, as well as more beneficial in terms of changing the grassland from a short to a more midgrass prairie. The detrimental effects of nitrogen may be the increase in the perennial forb component which might require some control by herbicide treatment or other management practices.

Table 1. Forage production from a native grassland fertilized with nitrogen and phosphorus at different rates – 1970 season.

Treatments lbs/fertilizer	Mid grasses	Short grasses	Perennial forbs	Annual forbs	Total grasses	Total forbs	Total yield
	Dry weight yield – pounds per acre						
67 N every year	973	1531	497	11	2504	508	3012
100 N every year	1570	1299	502	7	2869	509	3378
200 N[1/]	1635	1186	428	4	2821	432	3253
300 N[1/]	1995	1463	658	4	3458	662	4120
400 N[1]/	1701	1363	456	6	3064	462	3526
67 n + 50 P every year	835	1583	640	18	2418	658	3076
50 P every year	700	1142	242	36	1842	278	2120
Check No fertilizer	905	1078	171	32	1983	203	2186

[1/] One-time application, spring, 1970.

Table 2. Percentages composition of yields from a native grassland site fertilized with nitrogen and phosphorus at different rates – 1970 season.

Treatments lbs/fertilizer	Mid grasses	Short grasses	Perennial forbs	Annual forbs	Total grasses	Total forbs	Total yield
	Dry weight yield – pounds per acre						
67 N every year	32.3	50.8	16.5	0.4	83.1	16.9	3012
100 N every year	46.5	38.4	14.9	0.2	84.9	15.1	3378
200 N[1/]	50.3	36.4	13.2	0.1	86.7	13.3	3253
300 N[1/]	48.4	55.5	16.0	0.1	83.9	16.1	4120
400 N[1]/	48.2	38.7	12.9	0.2	86.9	13.1	3526
67 n + 50 P every year	27.1	51.5	20.8	0.6	78.6	21.4	3076
50 P every year	33.0	53.9	11.4	1.7	86.9	13.1	2120
Check No fertilizer	41.4	49.3	7.8	1.5	90.7	9.3	2186

[1/] One-time application, spring, 1970.

B. Interseeding Native Grassland with Native and Introduce Grasses and Legumes.

A native grassland interseeding trial was initiated on plots adjacent to the fertilizer trial in the autumn of 1969. Included in the interseeding trial were species of grasses native to the upland grasslands as well as some introduced grasses and legumes. The native grasses interseeded into the existing grassland on this site are presently found there in greatly reduced quantity and vigor due to prolonged heavy early spring and summer grazing. The introduced grasses interseeded are early cool-season species already established for use in the area either as early spring grazing or for hay. The legume species selected include hardy, high yielding, and good quality alfalfa varieties. Two other legume species, sainfoin and crown vetch, were planted as experimental varieties for comparison with the alfalfa varieties.

The trial consisted of five species of grasses, three species of alfalfa, one species of sainfoin and one species of crown vetch, interseeded in 40-in rows on 50x150 ft. plots with four replications. The grass and legume species interseeded included: western wheatgrass (Agropyron smithii), green needlegrass (Stipa viridula), crested wheatgrass (Agropyron cristatum), Russian wildrye (Elymus junceus), smooth bromegrass (Bromus inermus), Ladak, Ranger and Travois alfalfa (Medicago sp.), Eski sainfoin (Onobrychis sp.), and Emerald crown vetch (Viccia sp.).

No quantitative data were taken from this trial in 1970. Seedling establishment was observed to be excellent in the alfalfa species but only moderate in the grasses. It is assumed that a certain proportion of the seeds may not have germinated in the first season following seeding in some of the species. However, an appreciably high mortality of seedlings was observed due to high early summer temperatures. Drought and insect damage to the seedlings appeared to be minimal during the 1970 growing season. Vigorous weed and perennial forb growth was observed on a large proportion of the plots. Elimination of competition from the established grasses due to the cutting blade from the interseeder and increased release of nitrogen from added organic matter to the soil surface, resulted in the increased growth. This effect may not be nearly so prominent in the 1971 season.

The establishment and changes of plant species in the interseeding will be closely observed and measured in the 1971 season. Yields, plant composition, and range conditions will be observed and evaluated. Soil water use and efficiency, available nitrogen releases and uptake, and plant competition will be studied during the growing season.

The interseeding trial was employed to demonstrate the possible feasibility of native grassland improvement by means of planting selected grasses and legumes directly into an established native grassland. This method of grassland improvement may have its greatest utility and application in situations where desirable native species haveabeen eliminated due to severe overgrazing and abuse. The introduction of legumes may serve the two-fold purpose of improving the forage quality and contributing of nitrogen of use by the grass species. The trial will be continued for an extended period of time in order to fully assess the impact of introducing various plant species directly into the grassland community.