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NATIVE RANGE FERTILIZATION AND INTERSEEDING STUDY

The native range fertilization and interseeding study initiated in the fall of 1969 in western North Dakota was continued in the 1975 growing season. Fertilizer treatments consisted of a one time nitrogen application of 200, 300, and 400 lbs/acre. Every year treatments included 67 and 100 lbs N/acre, 67N +50P, 67 lbs N + 50P + 200 lbs K/acre, 50 lbs P/acre, and 200 lbs K/acre. Nitrogen alone is applied at the 100 lbs/A rate at biennial intervals as another treatment.

Some of the parameters measured throughout the growing season by treatment at the 0-6, 6-12, 12-24, 24-36, and 36-48 inch soil depths at weekly intervals are available soil moisture, and available N, P, and K are determined at biweekly intervals at the same soil depths previously indicated. Protein content determinations are made from selected species at biweekly intervals. Production clippings are taken at the end of the growing season from all treatments, separated into categories of annual and perennial forbs, mid, short and tall grasses, dried and weighed. Species composition changes are determined by means of a 10 point frame on a percentage basis.

Available nutrient and soil moisture data indicate a cyclic phenomena closely associated with precipitation and plant development. Adequate soil moisture, nitrogen, phosphorous and potassium are available early in the growing season but are depleted to low levels soon after active growth commences. Available nitrogen is depleted more quickly than is apparent with potassium or phosphorous and responds more closely to the depletion of the available soil moisture, especially in the upper levels of the soil profile. Phosphorous generally shows a decline with the active growing period but exhibits a much narrower range of fluctuation than observed by the nitrogen and potassium nutrients. Other peaks in available nutrients are observable following the active growing period in early spring and summer. One of the major late summer increases in soil nutrients occurs during the period immediately following summer dormancy and before active initiation of new growth by many species shortly before winter freeze up. A decline is again evident as winter approaches.

Average production data by yield components from the 6-year fertilizer trial indicates the highest forage yields were observed from the 50P +67N every year treatment (Table1). The total yield of 3318 lbs/acre was closely followed by the 50P + 67N + 200K/acre (3208 lbs/acre), 300 N/A (3242 lbs/acre), 400 N (3195 lbs/acre), and the 100 N every year (3178, and 67N every year (3139 lbs/acre) treatments. Check plot yields were 2414 lbs/acre. Other treatments were below these yields reported with a lower than check plot yield reported from the 50 P/A treatment (2344 vs 2414). The 200 K/A treatment yielded only a slightly greater amount of forage than was observed from the check plot. Species composition changes have been observed on the treated plots since early in the course of the experiment as evidenced by composition of yields. Some of the major changes observed and measured involve a shift of plants from warm-season, late growing grass to early-growing, cool season grasses and sedges. This shift in species is especially apparent in those plots where moderate or heavy applications of nitrogen are involved (Table 2). Substantial increases in perennial forbs were observed on all fertilized plots although the proportionate amount of total grasses compared to total yields remained relatively stable as reported in Table 2. Differences in basal cover were likewise evident with a decrease in warm-season grasses and a corresponding increase in cool-season. And forb species.

Protein content determinations will be made from the past 3 years' data along with anticipated digestibility and other proximate analyses this coming year. Earlier data have been taken and analyses of protein content during the course of the growing season from bluestem wheatgrass (Agropyron smithii), a needle-and-thread (Stipa comata), and a blue grama (Bouteloua gracilis) have been carried out. The data indicate a high protein value early in the growing season by all species analyzed. Advance of maturity results in a lowering of the protein content with the values below the minimum nutritional requirement of livestock reached by early fall. Western wheatgrass is highest in protein early in the season, followed by needle-and-thread and blue gama, respectively, regardless of fertilizer treatments. By late fall, blue gama retains a higher level of protein than either of the two other species. This observation has some far-reaching management implications in the Northern Great Plains grasslands.

The range interseeding trial was continued through the 1975 growing season. Treatments employed were the interseeding of Ladak, Travois, and Vernal alfalfa, crested wheatgrass (Agropyron cristatum), bromegrass (Bromus inermis) along with a plowed but not seeded treatment and a check plot. The highest total production over the 5-year period (6153 lbs/A) was observed from the interseeding of the Travois alfalfa (Table 3). Both the Ladak and Vernal alfalfa plots yielded amounts considerably less than the Travois plots at 5616 and 5740 lbs/A, respectively. Check plot yields were observed to be 2453 lbs/A. Grass species interseeded into the native range did not contribute as substantially to the total increase yields as was observed from the alfalfa species. In terms of percentage increase over that observed from check plots, the plowed but not interseeded plot yield was nearly as successful as the interseeded grass treatments (Table 3). Forbs increased appreciably on the plowed and grass interseeded plots but declined in yield below that recorded from check plots on the alfalfa plots.

It is readily apparent from the data thus far from both the fertilizer and interseeding trials that native ranges can be greatly improved as to total production. The application of fertilizers, especially nitrogen, has the advantage of easy application with little or no physical damaging effect on the land as experienced by interseeding. Fertilization may be the most effective tool in changing the composition of a native grassland community from a low producing to a highly productive one over a relatively short period of time. Increases in annual production can likewise be realized by proper level and timing of application, especially by the use of nitrogen. Increased protein content along with greater water use efficiency may be other desirable features of fertilization. Increase in undesirable perennial forbs may be a disadvantage.

Interseeding of native rangelands may be highly successful on range sites which require the reintroduction of exotic or native forage species due to severe overuse. The establishment of alfalfa appears to hold some real promise with doubling of forage yields a reality. The physical disturbance of the site is a disadvantage and extreme caution is required to avoid erosion and runoff problems. Plowing alone in the absence of any interseeding may be highly effective if a rhizomatous grass species like western wheatgrass is still present. The reduction in the sod forming species such as blue grama along with creation of an improved water and nutrient relationship allows a high degree of improved production by this process alone.

Table 1. Average forage production on fertilized native range - 1970-1975 seasons.

Treatments lbs/fertilizer/acre	Dry weight yield - pounds per acre - average						
	Mid grasses	Short grasses	Perennial forbs	Annual forbs	Total grasses	Total forbs	Total yield
67N every year	1830	767	494	48	2597	544	3139

67N every other year[1]	1401	810	469	51	2211	520	2731
100N every year	1941	733	465	41	2674	504	3178
100N every other year[1]	1526	739	530	75	2265	605	2870
200N	1626	747	316	43	2372	359	2732
300N	1975	820	417	30	2795	447	3242
400N	1922	744	489	40	2666	529	3195
50P, 67N every year	1882	951	454	31	2833	485	3318
50P, 67N, 200K every year[1]	2127	564	483	34	2691	517	3208
50P every year	1013	835	385	111	1848	496	2344
200K every year[1]	1116	1011	293	69	2127	362	2489
Check (No fertilizer)	1253	884	225	52	2137	277	2414
[1]Five year average (71, 72, 73, 74, 75); All others six year average (70, 71, 72, 73, 74, 75)							

Table 2. Average percent composition of forage yields on fertilized native range - 1970-1975 seasons.

Treatments lbs/fertilizer/acre	Mid grasses	Short grasses	Perennial forbs	Annual forbs	Total grasses	Total forbs	Total yield
67N every year	57.7	24.7	16.3	1.3	82.4	17.6	3139
67N every other year[1]	49.9	32.2	16.5	1.4	82.1	17.9	2731

100N every year	61.2	23.3	14.5	1.0	84.5	15.5	3178
100N every other year[1]	51.5	28.6	18.3	1.5	80.2	19.8	2870
200N	59.8	26.8	12.1	1.4	86.6	13.5	2732
300N	61.1	25.1	12.9	.8	86.2	13.8	3242
400N	60.1	22.7	16.1	1.1	82.8	17.2	3195
50P, 67N every year	55.7	29.8	13.7	.8	85.5	14.5	3318
50P, 67N, 200K every year[1]	65.6	17.8	15.6	1.0	83.4	16.6	3208
50P every year	42.7	63.8	16.4	4.0	79.5	20.5	2344
200K every year[1]	44.3	41.3	12.2	2.2	85.6	14.4	2489
Check (no fertilizer)	52.0	37.2	9.0	1.8	89.2	10.8	2414
[1]Five year average (71, 72, 73, 74, 75); All others six year average (70, 71, 72, 73, 74, 75)							

Table 3. Average percent composition of forage yield on interseeded native range - 1971-1974 seasons.

Treatment	Mid grasses	Short grasses	Perennial forbs	Annual forbs	Inter-seeded species	Total grasses	Total forbs	Total yield lbs/acre
Check - not plowed	47.1	38.1	13.6	1.2	---	85.1	14.9	2452.59
Check - plowed	56.2	18.9	14.5	2.0	8.4	75.07	16.40	4279.01
Crested wheatgrass	48.6	22.8	16.1	2.2	10.3	71.4	18.2	4275.89

Bromus inermis	61.6	15.7	10.6	1.2	10.9	77.3	11.8	4873.11
Green stipa	55.6	20.7	17.7	3.0	3.0	76.3	20.8	4407.10
Travois (alfalfa)	41.1	6.8	6.2	1.7	44.2	47.9	7.9	6152.58
Vernal (alfalfa)	46.7	13.4	7.0	1.1	31.8	60.1	8.2	5740.06
Ladak (alfalfa)	50.0	14.6	10.9	1.6	22.9	64.6	12.5	5616.37

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