

# Nitrogen and 2,4-D Increase Crested Wheatgrass Production

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Many more cattle could be grazed on the thousands of acres of old crested wheatgrass in western North Dakota by use of nitrogen fertilizer combined with herbicidal weed control where needed. Danger of soil erosion and loss of production for up to 2 years often rule out tillage to re-establish grass, and without fertilizer, the new stand is soon no more productive than the old one. Research at the Northern Great Plains Research Center near Mandan demonstrates an effective means of renovation without tillage. New vigor was put into a run-down weed-infested crested wheatgrass pasture by use of nitrogen fertilizer and 2,4-D herbicide (Lorenz and Rogler 1962).

## PROCEDURE

A renovation study was initiated in 1949 to evaluate various methods of increasing production from an old stand of crested wheatgrass *Agropyron desertorum* (Fisch ex Link.) Schult. The area selected for study was seeded in 1932 and was grazed each spring beginning in 1933. The vigor of the grass decreased each year, and a weed, fringed sagewort *Artemisia frigida* Willd., invaded the stand. This resulted in very low forage

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production and reduced livestock carrying capacity.

Each of the following treatments was replicated 3 times in 12- by 30-foot plots: (1) no treatment (check); (2) spring plowing followed by a corn crop and reseeding crested wheatgrass in the fall of 1949; (3) spring plowing followed by summer fallow and reseeding crested wheatgrass in the fall of 1949; (4) tearing up sod to a depth of 3 inches with a heavy field cultivator with shanks 9 inches apart and shovels 3 inches wide to kill about 1/3 of the crested wheatgrass plants on April 13, 1949 (scarification); (5) scarification followed by seeding Ladak alfalfa at 8 pounds per acre; (6) scarification followed by seeding common yellow sweetclover at 8 pounds per acre; (7) scarification plus application of 60 pounds of  $P_2O_5$  per acre each fall; (8) scarification plus application of 30 pounds of nitrogen per acre (30-N) each fall; (9) 30 pounds of nitrogen per acre (30-N) each fall; and (10) 60 pounds of nitrogen per acre (60-N) each fall.

Another study utilizing the entire crested wheatgrass pasture was initiated in 1963. The pasture was divided into 4 parts and each given one of the following treatments: (1) sprayed June 12, with 2.75 pounds acid equivalent of 2,4-D low volatile ester per acre and fertilized with 40 pounds of nitrogen; (2) sprayed but not fertilized; (3) fertilized but not spray-

ed; (4) no treatment. Study of rate of herbicide application was not included. The heavy rate was used to insure control of fringed sagewort. Six sets of wire cages to prevent grazing of sample areas were placed across the 4 treatments prior to grazing and the caged forage was harvested for hay early in July. The cages were set on a different location each year to eliminate the effect of repeated clipping.

## RESULTS

A summary of the results of the ten treatments is shown in table 1. Plowing and reseeding in 1949-1950 greatly increased production in 1951, but two years of grass production were lost in the reseeding process; and without further treatment yields rapidly declined to near those of the check. Scarification actually decreased yields the first year, and without further treatment the small benefit seen the following years soon disappeared. The productiveness of the legume increased total yields of the scarification plus alfalfa or sweetclover treatments. The biennial sweetclover was gone after the second year and residual benefits were small. The presence of alfalfa increased the total forage yield during the 12-year period. But for those

who prefer not to graze alfalfa, 30-N applied annually to crested wheatgrass resulted in yields as good as, or better than, those of the alfalfa-grass mixture. Scarification prior to application of N did not increase the effectiveness of the fertilizer; thus the simplest treatment — spreading ammonium nitrate on the undisturbed soil surface — was the most effective. Use of 60-N resulted in further increase in production but the return per pound of N was much smaller. Therefore in most cases it would be better to spread twice the area with 30-N than to use 60-N on half the acreage.

Weeds also responded to fertilizer; control measures were therefore necessary. Most broadleaf species were removed easily with 2,4-D. Fringed sagewort was more difficult to kill, but response to its removal made the effort worthwhile, as shown by the data from the second study (table 2). A single spraying in 1963 resulted in a 995-pound average annual per acre increase in hay production. Nitrogen fertilizer without spray more than doubled forage production, and nitrogen plus weed control resulted in an average annual increase of 2,950 pounds of hay per acre. This increase in hay yield would be profitable, and it

**Table 2. Yield of crested wheatgrass and fringed sagewort in caged areas of a 20-year-old crested wheatgrass pasture with and without N fertilizer and 2,4-D herbicide.<sup>1</sup>**

	Pounds per acre at 12 per cent moisture									
	Crested wheatgrass					Fringed sagewort				
	1963	1964	1965	1966	4-year	1963	1964	1965	1966	4-year
Check	2480	2050	1210	1430	1795	465	650	965	770	715
Sprayed	2915	2780	3680	1775	2790	295	70	0	390	190
40-N	3930	3495	5580	2885	3970	715	1320	890	405	830
Spray + 40-N	3875	4410	6770	3920	4745	390	63	0	90	135

<sup>1/</sup> Sprayed June 12, 1963 with 2.75 lbs. acid equivalent of 2,4-D low volatile ester per acre, ammonium nitrate applied on the soil surface either late fall or early spring of each year, and forage harvested about July 1 each year.

Table 1. Average hay yields from a 17-year-old crested wheatgrass pasture renovated by various means during a 12-year period.<sup>1</sup>

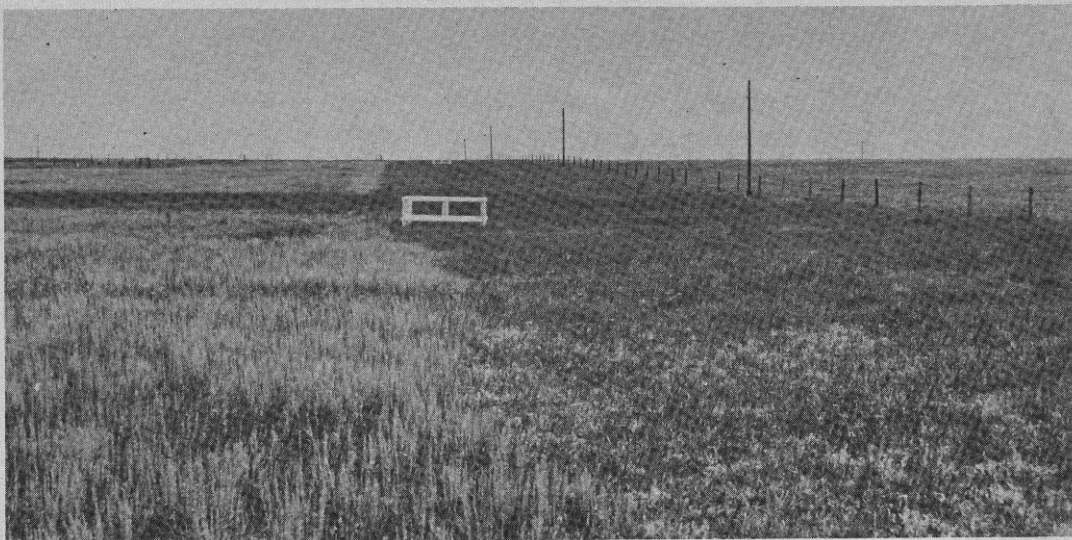
Harvest year	Pounds per acre at 12-per cent moisture										Av.
	Check	Plowed		Scarified				No tillage		Av.	
		+ corn	+ fallow	only	+ alfalfa	+ sweet-clover	+ 60 P <sub>2</sub> O <sub>5</sub>	+ 30-N	30-N		
1949	356 b <sup>2/</sup>	--- <sup>3/</sup>	---	257 ab	183 a	250 ab	157 a	380 b	641 c	907 d	313
1950	867 a	---	---	1074 b	1074 b	1090 b	1074 b	1911 d	1665 c	2195 e	1095
1951	363 a	1935 d	2882 e	587 ab	789 bc	758 bc	704 abc	1001 c	784 bc	1795 d	1160
1952	116 a	448 a	376 a	255 a	566 a	247 a	284 a	460 a	336 a	503 a	359
1953	1447 a	1773 a	1860 a	1473 a	1793 a	1720 a	1680 a	3300 b	3360 b	4013 c	2238
1954	560 a	700 a	753 a	627 a	1333 b	--- <sup>4/</sup>	613 a	1493 bc	1633 c	2413 d	1125
1955	573 a	833 a	887 a	747 a	2520 c	---	693 a	1880 b	1640 b	2840 d	1401
1956	807 a	733 a	780 a	873 a	2453 b	---	747 a	2193 b	1993 b	3953 c	1615
1957	561 a	743 a	812 a	654 a	2051 b	---	638 a	1731 b	1792 b	2388 c	1263
1958	320 a	400 a	432 a	479 a	1213 b	---	447 a	1218 b	1248 b	1826 c	843
1959	398 a	520 ab	641 b	479 a	1048 c	---	505 ab	981 c	997 c	1277 d	761
1960	896 a	1068 a	1304 a	999 a	2238 b	---	1030 a	2066 b	1949 b	3075 c	1625
12-year average	605 a	759 ab	894 b	709 a	1438 c		714 a	1551 c	1503 c	2265 d	1160

<sup>1/</sup> Each value is the mean of 3 replications. Fertilizer applied in October of each year, plowing, scarification and seeding of legumes in 1949 only.

<sup>2/</sup> Within each year, means followed by the same letter do not differ significantly (5%) (Duncan 1955).

<sup>3/</sup> 5241 pound per acre corn stover yield not included in averages or statistical analysis.

<sup>4/</sup> Scarification + sweetclover not harvested after 1953.



Fringed sagewort in the old crested wheatgrass pasture at Mandan was controlled by 2,4-D application June 13, 1963. This picture taken July 16 shows healthy sagewort on the left and dying sagewort plants on the right.

would be even more profitable if used as spring pasture.

The dry matter weight of fringed sagewort varied from year to year, but at the end of the fourth season after 2,4-D application, the effects of the herbicide were still obvious (table 2). In 1963 the yield of sagewort in the sprayed areas was about half that in areas not sprayed because of growth made before herbicide application. In 1964 and 1965 relatively small amounts of sagewort were present in sprayed areas. By 1966 lack of competition from grass in the sprayed area not fertilized allowed the sagewort population to increase, while the 40-N sprayed area still had relatively small amounts.

Proper management undoubtedly will help keep a single 2,4-D application effective for several years.

#### SUMMARY

Nitrogen fertilizer applied to an old crested wheatgrass stand in late fall of each year was the easiest, most effective, and most profitable renovation treatment at Mandan. Application of 2,4-D to control fringed sagewort was necessary to obtain maximum return from the fertilizer. However, the effects of good weed control lasted several years.

#### Literature Cited

- Duncan, D. B. 1955. Multiple range and multiple F tests. *Biometrics* 11:1-42.  
Lorenz, Russell J. and George A. Rogler. 1962. A comparison of methods of renovating old stands of crested wheatgrass. *J. Range Manage.* 15:215-219.