Can Fertilizers Effectively Increase Our Range Land Production?

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The recent widespread use of nitrogen fertilizer for wheat production in the Northwest has interested ranchers in the possibilities of using nitrogen to increase forage production on their adjoining ranges. Some areas in the West have reported excellent success with various fertilizers applied to range lands. California ranges respond to nitrogen, phosphate, and sulfur on certain sites. Many of the California sites (Williams, 1956) have areas where annual legumes can make effective use of the phosphorous and surfur, since legumes require more of these two elements than do grasses. These types of data cannot be transferred directly to the Washington ranges. In Washington the soils are relatively high in phosphate; however, grasses do not have a high phosphorous requirement.

Our main problem then is to determine the response that can be expected from the application of nitrogen to native or reseeded ranges. The response, as shown in Figure 1, in increased dry matter is not the whole answer, however. Ranges in central Washington have become infested with an introduced grass, cheatgrass *(Bromus tectorum)*, that now has essentially become a native which we must recognize and handle as such. It appears unwise to stimulate its production at the expense of our more desirable indigenous perennial species.

The data in Table 1 show the response that can be obtained by adding nitrogen fertilizer to native range in an annual rainfall area of 12 to 13 inches. The native grass species there make good use of the nitrogen at rates up to 40 pounds of N per acre. In fact, the production was doubled. It is also noteworthy to keep in mind that the naturalized cheatgrass prefers this high standard of living. Its production increased from an average of 6 percent (1956) to 13 percent (1957), where no fertilizer was applied, compared to 19 percent (1956) to 58 percent (1957) where 40 pounds of N were supplied. Increased rates of nitrogen aided the cheatgrass at the expense of the native grasses as can be seen in Tables 2 and 3. The Idaho fescue *(Festuca idahoensis)* production was severely decreased in both 1956 and 1957 by the cheatgrass competition.

Bluebunch wheatgrass *(Agropyron inerme)* was greatly reduced by the cheatgrass competition but Sandberg bluegrass *(Poa secunda)* was not greatly affected. This may seem strange at first since the two species depressed the most are much taller

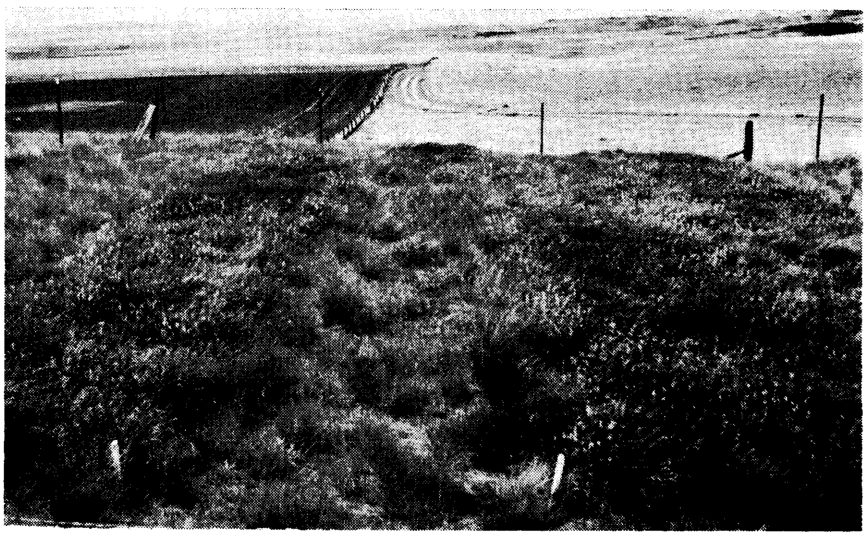

FIGURE 1. Response of native grass range to nitrogen fertilizer—80 pounds on the left, 0 pounds in the center and 60 pounds of N on the right. Note, also, the increased growth of cheatgrass on the fertilized plots.

Table 1. Oven dry herbage (*Poa, Festuca* and *Agropyron* spp.) produced on native grasslands with differential rates of nitrogen application at Hooper, Washington. 1953-1957.

Nitrogen (pounds) applied per acre	1953	1954	1955	1956	1957	Av.	Pounds herbage per pound N added
			Pounds per acre				
0	410	430	330	860	660	538	
20	580	780	640	1280	1040	864	16.
40	1080	940	640	1550	1240	1090	11.5
60	970	840	700	890	690	818	−12.5
80	1190	940	660	730	720	848	0.5
Average	850	780	590	1060	870	832	

than Sandberg bluegrass. However, the bluegrass begins active growth early in the spring and is able to complete its annual growth cycle much ahead of bluebunch wheatgrass or Idaho fescue. This may explain its ability to compete successfully with the prime invader, cheatgrass.

It would seem then that one could expect excellent increases in yield without any substantial ecological upset at moderate rates of nitrogen fertilizer. High rates, however, did not give a corresponding increase in yield of the desirable grasses and promoted a potentially serious ecological retrogression. No doubt, as can be seen by these data, one could expect excellent yield increases on cheatgrass range by the use of high nitrogen fertilization. This would likely lessen the chance for such a range to recover toward its climax species and thus the practice should be used only on those sites that are hopeless ecologically (areas with only remnants of the climax species).

Table 3. Oven dry herbage produced by four grass species on native grasslands under differential rates of nitrogen application at Hooper, Washington. 1957.

Nitrogen pounds per acre	*Agropyron inerme*	*Festuca idahoensis*	*Poa secunda*	*Bromus tectorum*	Total	Percent *Bromus tectorum*
			Pounds Per Acre			
0	503	30	128	103	764	13
20	463	137	440	913	1953	47
40	402	112	727	1717	2958	58
60	218	58	415	2497	3188	78
80	348	28	345	3198	3919	82
Average	387	73	411	1686	2557	66

Table 2. Oven dry herbage produced by four grass species on native grassland under differential rates of nitrogen application at Hooper, Washington. 1956.

Nitrogen pounds per acre	*Agropyron inerme*	*Festuca idahoensis*	*Poa secunda*	*Bromus tectorum*	Total	Percent *Bromus tectorum*
			Pounds per acre			
0	708	58	93	57	916	6
20	864	266	150	168	1448	12
40	1161	125	263	370	1919	19
60	621	42	224	443	1330	33
80	468	27	239	283	1017	28
Average	764	104	194	264	1326	20

Nitrogen response of seeded crested wheatgrass *(Agropyron desertorum)* (Table 4), promises even more hope for possible commercial application of fertilizer to range areas. The yield of crested wheatgrass was doubled by the use of 40 pounds of N. Furthermore, crested wheatgrass can utilize increased rates of fertilizer up to 80 pounds of N with substantial increases in production. It should be noted that the doubling of production of crested wheatgrass with 40 pounds of N resulted in about 1100 pounds gain in yield—the native grasses doubled their yield at the same rate of nitrogen but produced only 550 pounds of additional herbage. The percentage change was equal but the herbage available for feed was twice as much from crested wheatgrass compared to the native species.

Does this production increase pay? This is a question that can best be answered by each ranch operator. The cost per pound or ton of herbage can be calculated easily. As yet the cost is relatively high per pound of herbage gained. With N at about 15¢ per pound, the rancher would have a fertilizer cost of $6.00 for the 40 pounds of N that was the most efficient rate on either of the

Table 4. Fertilizer response of crested wheatgrass, oven-dry herbage per acre, Hooper, Washington

Nitrogen applied per acre	1953	1954	1955	1956	1957	5-yr. av.	Herbage per pound added N
			Pounds Per Acre				
0	2130	1050	850	1120	970	1220	
20	2680	1450	1180	1150	990	1490	13.5
40	3350	2160	1870	2550	1590	2300	40.5
60	4020	2390	1780	3420	2040	2730	21.5
80	4180	2570	1310	3680	3050	2960	11.5
Average	3270	1920	1400	2380	1730	2140	

two range types. The 1100 pounds of crested wheatgrass could be obtained for about $6.00 or at the rate of approximately $12 per ton. Similarly for $6.00, one could produce 550 pounds of native grass (plus some cheatgrass). This would be at the rate of slightly less than $20 per ton of the desired herbage. Good range management practices would allow use of only about one half of this increased production. The only cost calculated so far is that of the nitrogen added. Costs of application would need to be included. Under present costs and prices it would seem that only the rancher in areas receiving at least 13 inches of precipitation annually with crested wheatgrass range would benefit by nitrogen fertilizer application. A few more might use nitrogen fertilization to provide increased growth on a part of the range for early grazing to cut down winter feeding costs. This might be especially true of the cheatgrass areas not yet reseeded to crested wheatgrass.

LITERATURE CITED

Williams, William A., R. Merton Love and John P. Conrad. 1956. Range Improvement in California by Seeding Annual Clovers, Fertilization and Grazing Management. Jour. Range Mangt. 9:28-33.