RESIDUAL N FOR DRYLAND FORAGE CROPS

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Let me start with a few generalizations:

(1) Nitrogen is almost always a limiting factor in growth of grass.

(2) Under dryland conditions in southwestern Saskatchewan, moisture seldom penetrates below 2 - 3 feet under a stand of grass.

(3) Growth of forage at any time of the year is useful, as compared to grain production where only the final stage of growth is important.

After discussion with Dr. Jim Power, from Mandan, North Dakota, regarding his "nitrogen pool" theory, I decided to conduct a test with heavy rates of nitrogen in Saskatchewan. In the fall of 1969, nitrogen in the form of ammonia nitrate was applied at rates of 0, 50, 100, 400 and 800 lb/acre of N to old crested wheatgrass stands at two locations. Each treatment was applied with and without 100 lb/acre of P_2O_5 and all fertilizer was broadcast. The locations were at Swift Current where the stand on Haverhill clay loam was in excellent condition and at Maple Creek where the stand on Hatton fine sandy loam was overgrazed. Both stands were more than 25 years old.

Soil samples were taken prior to fertilizer application and each fall since. The hay was cut in late June or early July each year. There was no response to phosphorus at either location except for an increase in P content of the forage. Neither soil was extremely low in available P. The rainfall in all years except 1970 has been below average.

At both locations the yield was significantly increased by all rates of N in the first year. At Swift Current, the 400 and 800 pound rate continued to increase the yield significantly in all years including 1973. The total of the yield from the four years is shown in Table 1.

Table 1. Yield - total of 4 years lb dry matter/acre

Fertilizer Applied in Fall of 1969 lb/acre of Nitrogen	Swift Current	Maple Creek
0	3699	1681
50	6070	2409
100	6600	2457
400	8576	2510
800	8924	2706

At Maple Creek this yield increase was not sufficient to pay for the cost of fertilizer at any rate. At Swift Current, all except the 800 pound rate was profitable. This is based on 10 cents per pound for nitrogen and $20 per ton for dry matter.

Soil analysis shows that much of the applied N is held in the top four feet of soil, mostly between one and three feet. None of the N from the 50 or 100 pound rates could be detected in the fall of 1970 one year after application, but a large portion of the 400 and 800 pound applications still remain in the soil in the nitrate form (Table 2).

Table 2. Residual N remaining in the soil in Oct. 1972 (lb/acre in the 0 to 4 feet)

Fertilizer Applied in Fall of 1969 lb/acre of Nitrogen	Swift Current		Maple Creek	
	NO_3	NH_3	NO_3	NH_3
0	25	62	7	35
50	26	53	8	36
100	29	55	11	35
400	161	62	81	38
800	418	73	336	47

A sidelight of this project occurred in the fall of 1971. In the late fall, the gate to the plot area was opened to allow three or four horses access to the five-acre area as well as the rest of the half section pasture. There was no regrowth and the crested wheatgrass had been completely dead since mid-June. The horses subsequently grazed the plots. They hardly grazed the unfertilized plots, did little grazing on the plots that had received 50 or 100 pounds of N, but completely denuded the 400 and 800 pound plots.

The nitrogen content of the grass at harvest time was much higher where the heavy rates of N had been applied. There was 1.1% N in the grass from the check plot (6.6% protein) as compared with 2.5% in the

grass from the plots that received 800 pounds of N (15.5% protein). There was a difference of about 1% nitrogen between the 100 and 400 pound plots.

Please let me do a little theorizing on this. As we can use forage whenever it grows, and in the Southwest (and on rare occasions in other parts of the province) moisture is available for only part of the growing season it seems reasonable that nitrogen which is also needed, should be there when the moisture is available to provide maximum use of both. With the nitrogen held in the root zone, the plants will be able to use it for longer periods of time than they could use recently applied nitrogen near the soil surface where the moisture is available for a shorter time. The nitrogen held in the soil at 1 to 3 feet is available until the last of the moisture is used, thus is available for protein development as well as for the first flush of growth. The "loss" of the nitrogen from the low rate indicates that a certain amount is rapidly tied up in the soil biomass and may slowly become available for plant use.

Enough theorizing. The application of heavy rates of nitrogen to grass and the benefical effects of the residual nitrogen has possibilities, at least under certain conditions; (1) insufficient rainfall to cause leaching beyond the root zone, (2) a good stand of grass to use the nitrogen.