Influence of Fertilizer and Other Treatments on Old Brome Sod

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LOW production of old grassland has been variously said to be due to a sod bound condition, lack of fertility, improper management, insect injury and drought. There is considerable evidence to show that the sod bound condition and low production is frequently due to lack of fertility and this deficiency in fertility is in the main due to a lack of available nitrogen.

To determine what might be done to improve the production in old grass stands some test plats were laid out beginning in 1944, in an old brome grass field. The soil is Fargo clay on the Station at Fargo and this field was sown to brome grass in 1924. For a few years after seeding it down the field produced very satisfactory crops of forage and in some years relatively good seed crops. More recently the forage yields have been disappointing, the plants lack vigor and develop almost no seed heads.

This study was begun in an attempt to learn if nitrogen or phosphorous might be the limiting nutrient element causing lowered production on this old brome sod. The treatments and amendments were first applied in 1944, then applied on a new set of plats in 1945 and on still another set in 1946. The applications were made using ammonium sulphate (21% N) at the rate of 100 pounds per acre in 1944 and increased to 150 pounds per acre in 1945 and 1946; superphosphate (45% P_2O_5) at the rate of 100 pounds per acre and with a mixture of ammonium sulphate and superphosphate at the respective rates used when applied alone. Another plat received fresh barnyard manure at the rate of 10 tons per acre and another was cultivated to imitate the action of a field cultivator with narrow teeth set about six inches apart. The sixth plat was without treatment and used as a check. The series of treated plats were distributed in different parts of the field, constituting six replications.

All observations were made on square yard areas but treatments were applied upon an area four feet square to allow for border effect. The 1944 treatments were applied April 27; in 1945 March 31 and in 1946 April 15. Only in 1944 had the grass begun to green up when the applications were made. In 1944 the cultivation was done at the same time as the fertilizer applications were made while in 1945 and 1946 the cultivation was delayed until soil conditions were more favorable.

Rainfall was considerably above average in 1944 and below average in 1945 and 1946. The temperatures were generally cool for the three years. Rainfall in 1944 was heavy, nearly 2 inches above normal in May and

July and August had nearly 4 and 6 inches above normal, respectively. The temperature for 1944 was for the most part near normal except for a cool period in the first half of May. In 1945 rainfall was light with June and July receiving 3 and 2 inches less than normal, respectively. However, because of the high rainfall the previous year there was no serious moisture deficiency.

Temperatures in 1945 were cool throughout the growing season with May, June and first half of July distinctly below normal. Rainfall was again light in 1946 with April and May slightly below normal and July and August 2½ and 1 inch below normal, respectively. Temperatures in 1946 for May and early June were distinctly below normal. Severe freezing temperatures of 19 and 17 degrees Fahrenheit were experienced on successive nights of May 10 and 11. At that time the grass had already made considerable early growth. This severe freezing, with the drought that followed undoubtedly accounts in part at least, for lower yields of forage in 1946 as compared with the previous two years of this study. It may also account for the relatively few seed heads produced on all plats, irrespective of treatments.

The influence of the various treatments, as measured by the number of seed heads and forage yields which resulted that year, are given in Table 1. This preliminary report is a progress report giving early indications of the relative response of the several different treatments.

From this table it is seen that none of the treatments stimulated head formation during the year of the treatment, rather it appears as if there may have been a depressing effect in 1944 and 1945. In 1946, however, the application of nitrogen fertilizer appears to have brought about more head formation. Cultivation resulted in the formation of fewer heads, compared with the check plat, in each of the three years and also resulted in a lower yield of forage.

While nitrogen fertilizer did not bring about any increase in head formation it did bring about a larger forage yield. In this respect ammonium sulphate and the ammonium sulphate plus superphosphate treatments were about equally effective. Since superphosphate alone did

Table 1—Number of seed heads per square yard and yields in pounds of hay (85% dry matter) per acre in year of treatment.

	Number of heads per square yard (Average of 6 sq. yd. areas)				Pounds of hay per acre (Average of 6 sq. yd. areas)			
Treatment	**1944**	**1945**	**1946**	**Av.**	**1944**	**1945**	**1946**	**Av.**
Check	32.3	21.6	10.0	21.3	3227	3475	2029	2910
Cultivation	24.3	14.2	5.5	14.7	2610	2159	1701	2157
Manure	26.6	17.0	12.8	18.8	3625	3781	2138	3181
Ammonium sulphate	25.7	13.3	20.3	19.8	4527	4791	2969	4096
Ammonium sulphate plus superphosphate	29.6	15.8	18.5	21.3	4461	4779	2814	4018
Superphosphate	24.8	15.0	13.6	17.8	3265	3697	1978	2980

not bring about any significant increase in yield, the increase in the ammonium sulphate plus superphosphate treated plat presumably can be credited entirely to the nitrogen added. Manure applications brought about a small increase in forage yield, but not as large an increase as the plats treated with ammonium sulphate.

Residual Effect of Treatments

The residual effect of the treatments are given in Table 2. By "residual effects" are meant those effects noted one year after the first treatments.

about conditions which later enabled the plant to grow and head out normally, so that a very sharp increase in head formation over the check and other treated plats could be noted the year after the treatment. This residual effect carried over into the third year, but the increase over check was of a less order than the second year. The increase in forage yield was not as large as the increase in seed heads.

None of the other treatments appears to have given any residual effect, stimulating head

Table 2—Number of heads per square yard and yields in pounds of hay (85% dry matter) per acre one year after treatment.

	Number of heads per square yard (Average of 6 sq. yd. areas)			Pounds of hay per acre (Average of 6 sq. yd. areas)		
Treatments[1]	1945	1946	Av.	1945	1946	Ave.
Check	25.5	10.2	17.8	2523	2044	2284
Cultivation	40.0	64.0	52.0	2889	2174	2532
Manure	16.3	14.5	15.4	3182	2216	2699
Ammonium sulphate	14.8	23.8	19.3	2749	2268	2509
Ammonium sulphate plus superphosphate	13.8	11.8	12.8	2668	2105	2387
Superphosphate	17.8	13.0	15.4	2674	1937	2306

[1] Treatments made one year ago.

The observations recorded on the cultivated plats are of special interest here. While there were distinctly fewer seed heads formed on the cultivated plats, compared with the check plats, the year the treatment was made, the reverse was true the year following the treatments. Cultivation which tended to cut some of the grass roots and loosen the soil, did set the plant back the first year, but brought

formation the second year. There was some increase in the production of forage, again apparently resulting from the nitrogen applications. The residual effect of the manure appears to have been greater than that of the commercial nitrogen. The superphosphate again gave little or no response in either head formation or forage yield in these trials the second year.