

*Effect of Nitrogen Fertilizer on Wheat in the Palouse Area**

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FARMERS IN THE PALOUSE AREA have become very much interested in the use of nitrogen fertilizers on wheat as a means of obtaining maximum yields. In an attempt to have some information on the problem, the Agronomy Department of the University of Idaho started applying nitrogen fertilizer to continuous winter wheat in 1938. We were interested in several important phases of the problem. Would the use of nitrogen fertilizer on wheat be economical? What effect would it have upon the amount of straw produced? Would it increase the protein content of the wheat? What influence would it have on the soil organic matter level?

Ammonium sulfate was used as the nitrogen carrier and was applied at rates to supply an annual application of 20 lb., 30 lb., and 40 lb. of actual nitrogen per acre. All straw residues were returned to the plots. The field on which the comparison was made was in a relatively higher state of fertility at the start than most of the fields of the area. The first five years of the test, the 20-lb. and 40-lb. rates were applied in the early spring, while the 30-lb. rate was applied to the straw before plowing with the moldboard plow. In going over the yield data at the end of five years, it was observed that we were not obtaining the expected increases in yield from the 20 lb. and 40 lb. of nitrogen in comparison with the 30-lb. application. As a result, during the last five years all rates were applied in the fall before plowing.

Average annual precipitation at Moscow for the crop year September 1 to August 31 is 21.63 in., of which only about one-fourth comes during the five growing months. The annual precipitation during the ten years of the test varied from 16.12 in. to 30.03 in.

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Table 1.—Influence of nitrogen fertilizer applied to continuous winter wheat

	Yield grain	Yield straw	Protein content of wheat	Organic-matter content of soil*	
	1938 - 47	1939 - 47	1939 - 47*	1938	1947
	<i>bu.</i>	<i>ton</i>	<i>per cent</i>		
Check	23.6	1.02	12.09	3.77	3.40
20 lb. nitrogen	30.0	1.42	11.46	3.50	3.48
30 lb. nitrogen	34.6	1.39	12.08	3.65	3.50
40 lb. nitrogen	36.4	1.69	11.76	3.62	3.76
L. S. D.† at 5 per cent	3.98	—	—	—	—

* Analyses run by the Department of Agricultural Chemistry.

† Least significant difference.

Results obtained are shown in Table 1. For the ten years, 20 lb., 30 lb., and 40 lb. of nitrogen increased the yield 6.4 bu., 11.0 bu., and 12.8 bu. of wheat respectively. The most economical rate for the period was 30 lb. of nitrogen. The difference in yield between the 30-lb. and 40-lb. rate was not significant.

Application of nitrogen fertilizer increases the amount of straw produced. This factor needs to be considered in those areas where the farmers are already producing so much straw they have difficulty in the tillage operations when they incorporate it in the soil.

Protein content of the wheat was not increased when application of the nitrogen fertilizer was made to the straw residue before plowing. During the experiment, it was observed that early in the spring there was no noticeable color or growth difference between the unfertilized and fertilized plots. Great color differences became apparent after a few days of warm weather. It would appear that considerable of the available nitrogen must have been temporarily tied up by the soil organisms.

RESULTS AND TRENDS

RESULTS OF THE ANALYSES of organic matter are too few in number to make a statistical analysis, but definite trends are shown. Where the straw is utilized, the application of nitrogen fertilizer reduces the rate at which organic matter is lost from the soil. When 40 lb. of nitrogen were applied, there appeared to be a trend toward an increase in soil organic matter. It would seem that between 30 lb. and 40 lb. of nitrogen applied to the crop residue would be of material aid in maintaining soil organic matter.

The 1948 season was a year of severe erosion in the Palouse region. Rill measurements were taken of erosion losses on certain of the plots which had received identical tillage treatment. Where 30 lb. of nitrogen had been used, 14 tons of soil were lost. An adjoining plot which received 10 tons of barnyard manure every third year lost only a trace. This may indicate that the character of organic matter produced by straw and a nitrogen fertilizer is not as effective in controlling erosion as that produced from barnyard manure.

SUMMARY

THE USE OF NITROGEN FERTILIZER on wheat has been studied for the past ten years by the Agronomy Department of the University of Idaho; 20 lb., 30 lb., and 40 lb. of actual nitrogen have been applied annually to continuous winter wheat. The findings may be summarized as follows:

a) Application of nitrogen fertilizers to wheat in the Palouse area is an economic practice resulting in increased yields. It should be considered, however, as a supplemental practice to rotations, use of manures and of crop residues, and not as a substitute for them. Thirty pounds of nitrogen per acre gave the greatest profit per acre.

b) While the use of nitrogen fertilizer increases the amount of straw produced this increase is about in proportion to the increased grain yield. In areas where excessive straw is a problem, nitrogen fertilizers should be used with caution.

c) Protein content of the wheat was not increased by the rates and method of application used.

d) Soil organic matter can be maintained by the use of nitrogen fertilizer when the straw is utilized, but preliminary observations indicate that these materials are not so effective in controlling erosion as fertilizer produced from barnyard manure.