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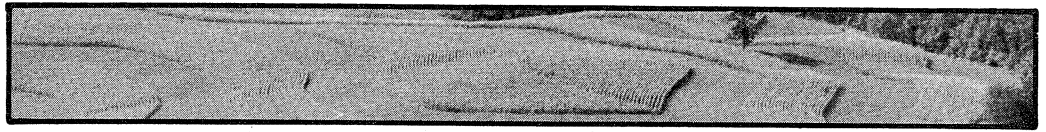
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AGRONOMY GUIDE



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Should N Be Applied to Alfalfa?

Fertilization

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Introduction

High yielding crops require large amounts of nitrogen. However, legumes if properly inoculated do not require nitrogen fertilizer after they are once established. This is due to the fact that microorganisms living in the nodules of legume roots are capable of fixing atmospheric nitrogen into a form usable by the legumes.

Since legume seedlings must rely on nitrogen from the soil until the nodules are formed on the roots, the application of 15-20 pounds of nitrogen at time of seeding on soils low in organic matter has been found to be beneficial.

In the past five years a number of researchers as well as farmers have obtained alfalfa yields in the range of eight to 10 tons per acre. Now the question is being raised as to whether yields might be further increased by adding nitrogen fertilizer to established alfalfa stands. The reasoning behind this being that the legume plant must provide food for the microorganisms in exchange for the nitrogen which the bacteria fix. If the legume plant did not have to "feed" the microorganisms, it is possible that this "food" could be used to produce even higher forage yields.

Research Plots Established

In the spring of 1966, researchers at Purdue University initiated an experiment on the Agronomy Farm to determine whether the application of nitrogen fertilizer to an established alfalfa stand would increase yield and protein content.

Culver alfalfa was seeded on April 8, 1966 with oats as a companion crop. The oat crop was harvested July 22 and the straw removed. At the time of seeding, 305 pounds per acre of 25-25-0 were applied. The soil type was Chalmers silty clay loam which was developed under a prairie type vegetation.

In April of 1967 nitrogen treatments were applied to the alfalfa plots. Ammonium nitrate was applied at rates of 0, 300, 600, 1200 and 2400 pounds per acre per year. This is equivalent to 0, 100, 200, 400 and 800 pounds per acre per year of actual nitrogen. The nitrogen was applied in four equal applications during the growing season. One-fourth of the annual rate was applied in early spring and one-fourth again after each cutting except the fourth cutting.

Lime and Fertilizer

Lime was applied at the beginning of the experiment to correct soil acidity.

Table 1. Effect of nitrogen on hay yields (12% moisture) of alfalfa

Year	Pounds N applied per acre annually				
	0	100	200	400	800
	Hay (tons/acre)				
1967	6.3	5.5	5.8	5.9	5.9
1968	8.4	7.9	7.6	8.1	8.3
1969	7.0	6.7	6.9	7.4	7.2
Average	7.2	6.7	6.8	7.2	7.1

In 1967, 100 pounds per acre of phosphorus (229 pounds P₂O₅) and 300 pounds per acre of potassium (360 pounds K₂O) were broadcast on August 9. Because of the high yields obtained in 1967, the rates of phosphorus and potassium were doubled in 1968 and 1969. At high levels of forage production large amounts of plant food, especially potassium, are removed. Therefore 100 pounds of phosphorus and 300 pounds of potassium were applied in early April and again in late summer in 1968 and 1969.

Hay Yields and Protein Contents

Alfalfa hay yields and crude protein contents at the various levels of nitrogen are presented in Tables 1 and 2. Results of this study show that the addition of nitrogen fertilizer to alfalfa does not have a marked effect on yield or crude protein content.

Over the three-year period nitrogen fertilization did not increase alfalfa yields. In fact, yields obtained at the 100 and 200 pounds per acre rates were slightly lower than the plots receiving no nitrogen fertilizer.

Crude protein contents were quite similar at all rates except at the 800 pound rate of nitrogen, where it appears that the crude protein content may be increased by approximately one percent. However, this small increase in crude protein content certainly would not justify the expense of 800 pounds of nitrogen fertilizer.

Although these data indicate that nitrogen fertilization does not have a pronounced effect on alfalfa yield or protein content, the following observations were noted on plots receiving nitrogen:

1. Frequently plants were taller
2. Often plants were a darker green color

Table 2. Effect of nitrogen fertilization on protein content of alfalfa hay (12% moisture)

Year	Pounds N applied per acre annually				
	0	100	200	400	800
	% Protein				
1967	19.0	18.9	17.6	18.1	19.0
1968	17.4	17.6	17.7	17.9	19.3
Average	18.2	18.3	17.6	18.0	19.2

3. Plants may have a slightly higher moisture content
4. Weeds may be more of a problem
5. There appeared to be a thinning of the alfalfa stand.

Results of this study indicate that it would not be profitable to fertilize a pure stand of alfalfa with nitrogen. However, the appearance of nitrogen fertilized alfalfa may lead one to believe that yield and protein are increased due to taller and darker green plants.

What About Alfalfa-Grass Mixtures?

Nitrogen fertilization of alfalfa-grass mixtures was not studied. However, N was applied to alfalfa-grass mixtures in a previous experiment which was reported in Research Bulletin No. 839, Managing Alfalfa Grass Mixtures for Yield and Protein. It appeared that when alfalfa comprised about 50 percent or more of the mixture it was not beneficial to apply N. The study also revealed that if fields where alfalfa-grass mixtures are grown are adequately limed and fertilized with P and especially K that there was no problem keeping alfalfa in the mixture. Alfalfa went out of the mixture only under severe heaving conditions. Thus, it appears that only where alfalfa makes up one-fourth to one-third of the mixture would it be profitable to apply N fertilizer. It is suggested that 100-300 pounds per acre of N be applied to these predominately grass mixtures depending on yield level desired. Refer to AY-176, Fertilizing Grasses with Nitrogen, for N fertilization of pure grass stands.

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