Cantaurus, Vol. 9, 27-28, May 2001 © McPherson College Division of Science and Technology

The Effects of Nitrogen on Yield and Nutrient Composition of Alfalfa

Jeremy Showalter

ABSTRACT

Adding nitrogen to established alfalfa crops is a somewhat common practice by farmers, however, the realistic gain that can be achieved by this process is still debated both from a yield and a nutrient stand point. Four plots were fertilized with a 32% Urea Ammonium Nitrate solution at a rate of 80 lb/a , 40 lb/a, 20 lb/a, or 0 lb/a (control) were utilized to gather information about the effectiveness of adding nitrogen to alfalfa. From the results that were received from the plots, it would be hard to justify the added expense of the fertilizer due to minimal gains in the tonnage and nutrient content. The plot receiving the 80 lb/a of N did show some gains in almost all categories, however, the gains in the other plots were not substantial enough. These results may have been affected somewhat by the rainfall that was received shortly after fertilization, causing some of the N to be washed away before it could be absorbed.

INTRODUCTION

Alfalfa is a very valuable crop to many farmers and ranchers. Over the yesrs it has begun to emerge as a very valuable cash crop. Many efforts have been made over the last several years to improve the amount and quality of the alfalfa that a producer can grow. (Hansund, 1988) One of these methods is the adding of nitrogen as a fertilizer. My grandfather and I are farmers in Rice County who have just recently taken on the commercial hay market after my grandfather sold his cow herd. We have planted more acres of hay and are always looking for ways to improve production. Some of our neighbors add commercial fertilizers, mainly nitrogen, to their crops in the spring as a means of boosting production. However, this practice may actually be counter productive to the plant since it is naturally a nitrogen fixing plant, (Hansund, 1988) making it rely on the added nitrogen rather than pulling it from the soil. The purpose of this study was to see what, if any, benefits there might be in terms of tonnage and nutrient content of the hay by adding the nitrogen.

MATERIALS AND METHODS

A piece of land was located that was as even between the plots that was possible to find. The soil type is Crete silt-loam that neither held water nor had excessive run-off. The alfalfa on the plots is a Kansas Common variety that was planted in the fall of 1997. Four plots were laid out in strips that were 48'x200'. The width of 48' was chosen because the swather has a 16' header, making three swathes. The middle one was used for the tests to prevent contamination from the other plots. The first plot was a control plot, where nothing was added. The second plot had 20 lbs/a of the 32% UAN solution applied on March 30 by Kruse Fertilizer Service. Plot three received 40 lb/a and plot four received 80 lb/a on the same day using a sprayer with a 48' boom applicator. These numbers were chosen to represent applying a low, medium, and large rate of the fertilizer, (Hansund, 1988) because some farmers apply more, and some less.

When the hay reached a 10% bloom, (or when the weather permitted) it was cut with the swather. The hay was then allowed to dry until the moisture content reached 15.5%, as checked randomly along the windrow using a hay probe. (Pioneer,pg.42-43) When this desired moisture was achieved, it was baled using the baler and tractor into small (14"x16") bales that weigh approximately 70lbs. The bales were then collected from each plot and weighed and the total was multiplied by 4.54 to get a per acre basis. Every other bale out of the chamber was selected from each plot and a sample was taken using a core sampler.(Pioneer, pg.43) The samples were then mixed together to get a composite from the plot and were sent off to SDK Laboratories Inc. in Hutchinson for analysis. This same step was repeated for each plot and for each of the three cuttings.

RESULTS

Visibly looking across the plots it was impossible to tell a difference in the plots. Only after looking closely could you see a difference in the number of leaves each stem seemed to have on it. This was most noticeable on the 80 lb/a and 40 lb/a plots. The 20 lb/a and control plots seemed to be very similar in leaf structure. Although not looking or testing for this leaf increase, it is very interesting due to the fact that the leaves are where most of the nutrients come from. (Bolton, J.L.) The leaf increase was most prevalent on the first cutting, with diminishing results on the next two cuttings.

On the first cutting, there was a noticeable gain in the 80 lb/a plot in both tonnage and protein level over the control plot. The RFV and TDN were also higher. This shows that the added fertilizer did have some positive effect on the content. But, for the amount that had to be added the gains seem small. As for the other plots, there were some very small gains, which could be attributed to variations in the field. The protein level on the 40 lb/a was very similar to that of the 80 lb/a

plot.

The second cutting still had the 80 lb/a plot having higher tonnage and nutrient content, especially protein. This indicates that not all of the nitrogen was washed away in the rainstorm that occurred after the fertilizer was applied because something has to be causing the higher results. The 40 lb/a plot also had a high protein content. The 20 lb/a plot and the control plot were very similar in all aspects. Small variations in the results may be due to variations throughout the plot.

The results of the third cutting of alfalfa were much closer together from the control plot to the 80 lb/a plot. There was no visible difference in the leaf number.

DISCUSSION

Only three cuttings were taken from the plots, which in a normal year there would have been four or maybe even five cuttings. This reduced the sample size and didn't allow for collection of as much data as originally planned.

The nitrogen that was left had either leached through the soil from all the heavy rain received in the end of June-beginning of July period or changed to an unusable form by now, which was expected.(Dewerff) One of the first problems that was encountered was the day after the fertilizer was applied, an unexpected rainstorm came along and deposited 3.2 inches of rain on the plots. This was not good because it caused some runoff of the fertilizer before it could soak into the plant and ground. How much of the fertilizer was lost is not known, but a guess of around 50% was presumed based on the advise of my extension agent. (Dewerff) Another not normal weather aspect during the research was the unusual rainfall pattern with much above normal rainfall in the spring and the much under normal rainfall and above normal temperatures in late summer. (Table 1)

Table 1. Month by month rainfall totals

Month	Total	Average
March	6.27	3.46
April	2.51	3.81
May	3.31	3.67
June	4.81	2.55
July	6.50	2.64
August	**0**.02	2.04
September	**0**.55	2.59
October	6.04	2.66
Total	**30.01**	**23.42**

Although the results were not what was expected, some difference in the plots was nice to see and to know that all the work was not for nothing. There is, however, the matter of cost for all of this nitrogen added to the soil. At the time of application, the cost was $.21 per lb/a plus a $3 per acre application fee, so the 80 lb/a cost was $19.80 per acre, the 40 lb/a was $11.40, and the 20 lb/a was $7.20. A good system of price setting for alfalfa hay is to sell it for $.50 per RFV point. The average of the 80 lb/a plots it is 170, so an average price of $85 per ton would be expected.

The 80 and 40 lb/a rates proved to be cost effective, especially the 80 lb/a. The 20 lb/a plot proved not cost effective, as the net income was under the control plot, actually costing money. These numbers strictly represent average prices and dos not take into account demand or any other influences. This year, we received an average of $.70 per RFV unit simply because the demand for lower quality hay was strong.

ACKNOWLEDGEMENTS

I would like to thank Don Dewerff, for providing excellent advice and for use of measuring equipment, Kruse Fertilizer Service for use of the sprayer and donation of the fertilizer, Delmar and Craig Conner for their labor and use of the equipment, and Al Dutrow for his expert advice on setting up my project.

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