Studies on Sulfur in Alfalfa

sulfur content of alfalfa grown on a low-sulfur soil more than doubled by application of gypsum in tests near Delhi

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Alfalfa protein is relatively low in the sulfur-containing amino acids, and the alfalfa's nutritive value may thereby be limited. This has been indicated at several laboratories in biological assays—feeding tests with small animals. Increasing the sulfur content of alfalfa, therefore, may improve its value as a feed.

It has been demonstrated that an application of sulfur-containing fertilizers to soils in some areas will increase crop yields. Legumes have generally shown the greatest increases. Analysis of the plant material has revealed that the percentage of total sulfur in the plant was increased when sufficient sulfur was applied. It has not been conclusively demonstrated that sulfur fertilization increases the content of protein sulfur or other unoxidized forms; the sulfur taken up by the plant—in excess of that needed for growth—may remain as sulfate in the form in which it was taken.

A number of soils in California have been found to give responses to sulfur applications when assayed by greenhouse pot tests. This may not mean that treating these soils in the field would give the same results. A deficiency in the soil might be masked by sulfur from sources other than the soil itself—in the irrigation water or brought down by rainfall. Some soil deficiencies that have been attributed to lack of phosphorus may actually have been cases of sulfur deficiency. If poor crop growth was corrected by an application of single superphosphate, the benefit may have been due to the gypsum contained in this material.

The present study was made to determine whether alfalfa grown on a sulfur-deficient soil would differ in chemical composition from that grown on the same soil to which sulfur-containing fertilizer had been applied. A sandy soil near Delhi was selected. Exploratory tests indicated that the yield of alfalfa could be approximately doubled by applying 200 pounds of gypsum per acre, and that an additional application of treble superphosphate did not produce any further significant increase in yield or increase the phosphorus content of the alfalfa.

In the second year of the study, plots 10′ by 100′ were laid out on a two-year-old stand of alfalfa and treated in triplicate: *1*, 200 pounds of gypsum per acre, *2*, 400 pounds, and *3*, no fertilizer. The materials were applied as a top dressing in February. The plots were harvested at approximately 1/10 bloom. A swath 1/200 acre in area was cut down the center of each plot for yield measurements. Samples were taken at random for moisture determination and chemical analysis.

Five successive cuttings were taken from the plots. The average dry weight yields are given in the upper graph on this page.

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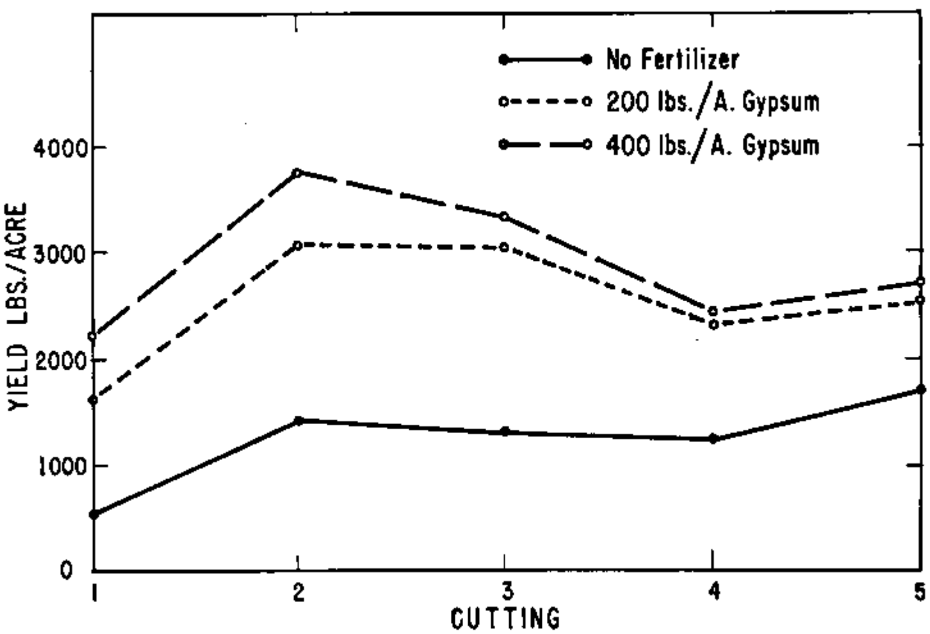
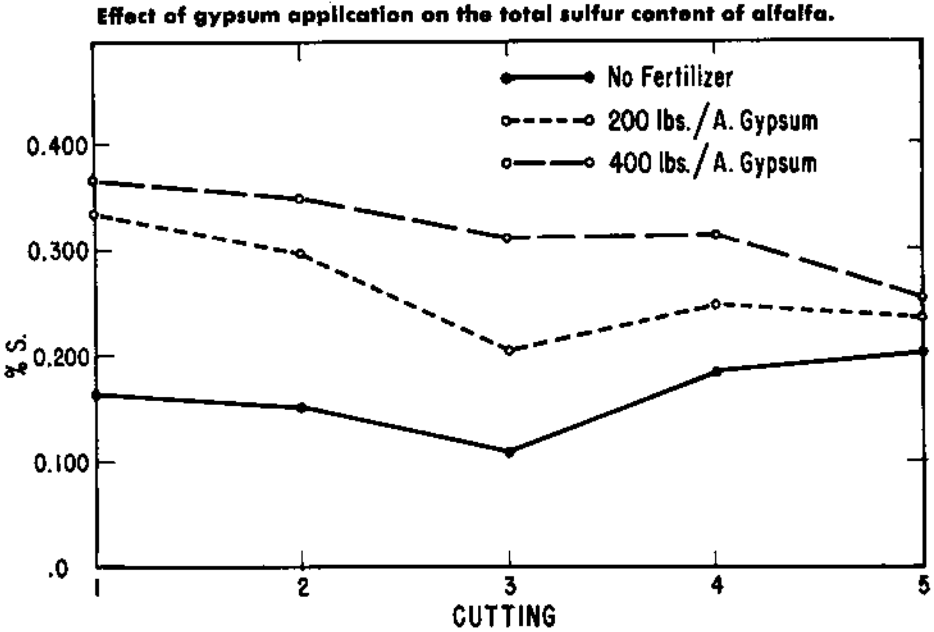
Effect of gypsum application on yield of alfalfa. Delhi—1952.



Effect of gypsum application on the total sulfur content of alfalfa.



ALFALFA

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The increase in yield from the 200-pound application was very similar to that obtained the previous year. The 400-pound application appeared to give some benefit over the 200-pound application—especially in the early part of the year. With each cutting, the yield difference between the fertilized and unfertilized alfalfa became progressively less. Perhaps a split application on this soil would further increase total yield.

The total sulfur content of each of the five cuttings is shown in the lower graph on page 9.

The seasonal pattern of variation in composition was very similar to the results obtained the previous year on this soil. If sulfur in a soil is inadequate, the total sulfur content of hay is at a minimum in midsummer. This is attributed to a more rapid rise of growth during this period, which increases the demand for materials used in growth. Root uptake presumably is not able to meet this demand. After a heavy application of gypsum, on the other hand, the sulfur content of alfalfa grown in the same soil reaches a minimum at the end of the season.

Nearly 50% of the 200-pound gypsum application was removed in the five cuttings of hay. This value was calculated as the difference between the computed sulfur in hay from the fertilized plots and that in hay from the unfertilized checks. The total sulfur removed per acre in the hay from the 200-pound-per-acre plots was about 32 pounds compared with about 10 pounds in that from the unfertilized plots. Converted to calcium sulfate—gypsum—these values become 136 pounds and 42 pounds. The alfalfa receiving the heavier application of gypsum removed sulfur equivalent in terms of calcium sulfate to nearly 200 pounds per acre more than the unfertilized.

Most of the difference in the total sulfur content between the fertilized and unfertilized hay could be accounted for as sulfate sulfur. The lower supply of sulfur in the unfertilized soil, however, also depressed the percentage of protein sulfur in the plant. This effect was of greatest magnitude in the hay cut in midsummer, when the stress imposed by the lack of sulfur was at a maximum. The protein sulfur content was about 0.11% in hay from the unfertilized plots compared with about 0.17% in hay from the fertilized plots.

The average percentage of protein was slightly higher in the five cuttings of fertilized alfalfa than in the unfertilized. The first cutting accounted for practically all of the difference. Fertilized hay of this cutting contained about 24% total crude protein compared with about 17% in the unfertilized. Were this a depression of protein synthesis imposed by a lack of sulfur, the effect logically should be accentuated in midseason, when total sulfur content is at a minimum. This, however, was not the case. The unfertilized alfalfa varied little in protein content from cutting to cutting. The higher value for the fertilized hay would seem more likely to be the result of accumulation. During the slower growth rate of early spring, the fertilized alfalfa presumably was taking up—or fixing—more nitrogen than needed for growth. Chemical analysis revealed that the fertilized hay from the first cutting contained a higher proportion of nonprotein nitrogen than did the unfertilized.

Certain other analyses were made to determine whether the percentage of other elements might differ in the fertilized and the unfertilized alfalfa. No appreciable differences were found in the levels of manganese, iron, and nitrate in the samples from the third cutting.

While the composition of forages as revealed by chemical analysis are helpful in assessing their nutritive value, the final answer can only be obtained by actual feeding tests. Lamb feeding trials are being conducted to learn whether the animal benefits from the higher percentage of sulfur in the fertilized alfalfa and whether there are other differences in the fertilized and unfertilized alfalfa that affect its feeding value.

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WEEVIL

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for control of the adults are not suggested as this pest is not consistently damaging over a wide enough area to warrant preventative control measures. If it does become necessary to control the larvae, the field in question should be examined in order to determine whether the pea aphid or the yellow clover aphid—or both—are abundant enough to cause damage.

Usually, spray applications are preferred to dusts.

Preliminary data indicate that chemical control applications should be made when the weevil population first reaches 20 to 25 larvae per 180° sweep of the standard insect net. Population samples should be taken at several places throughout the field and the counts averaged. Usually, the most heavy populations are encountered on the edges of a field and if other areas are not sampled a mistaken impression of potential damage may be obtained.

Although many insecticides will give effective control, those listed in the accompanying table at the dosages indicated have given the most promising results.

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PEARS

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was also toxic to the leaf miners, and only a few larvae reached maturity. It does not, however, possess enough residual value to prevent some buildup between applications. Since so few miners developed in the plot, parasitism was not a factor.

Evaluation of the effect of the materials on codling moth was made by taking fruit counts at harvest. Two pickings were made in the orchard, and at each picking 2,000 fruits per treatment were selected at random and examined for codling moth entries and stings. Mealybug and stink bug were also present in the orchard, and fruit damage resulting from these two pests was recorded.

The lower table on page 10 shows the harvest fruit counts. To summarize the results, all materials with the exception of lead arsenate showed less than 0.5% worms at harvest.

Diazinon was the only material that completely controlled the mealybug, and not a single infested fruit was noted.

There was less stink bug damage in the Diazinon plot, but since this insect can fly so readily from plot to plot, it is difficult to determine if the material was actually killing the bugs. The material may have killed stink bug by contact during the June 29 application, but one would not expect any marked residual effect from that period until harvest.

Work will be continued on codling moth control the coming season, especially with Diazinon and Ryania. Both of these materials may eventually find a place in the codling moth control program, and they will be especially valuable if the codling moth should develop resistance to DDT.

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