



## **Using Calcium Sulfate in Alfalfa Production**

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Alfalfa is a crop with a high nutrient demand, yet many producers often neglect this crop when it comes to proper nutrition.

Establishing the crop and land costs usually account for over 70% of the cost of producing alfalfa. Fertilization and soil amendments comprise less than 10% of the total cost. Proper use of plant nutrients and soil amendments can return twice to three times the initial investment. Not only is yield impacted by proper nutrition, but also quality and stand longevity.

Total nutrient requirements for 8 ton/A alfalfa are shown below.

<u>Nutrient</u>	<u>lb/A</u>
Nitrogen*	432
Phosphorus (P <sub>2</sub> O <sub>5</sub> )	96
Potassium	360
Calcium	224
Magnesium	56
Sulfur	50
Manganese	1

\*The majority of nitrogen is attained through nitrogen fixation.

Soil testing should be done prior to alfalfa establishment to assure proper nutrient balance and soil pH.

### Why Calcium Sulfate?

#### As a Sulfur Source

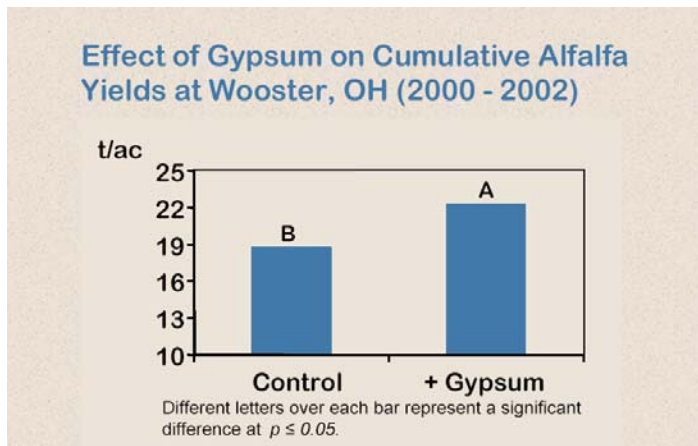
As the chart previously shown reflects, alfalfa has a high consumption of both calcium and sulfur. Providing your sulfur needs as calcium sulfate is your least expensive source of plant available sulfate sulfur and it will not acidify your soil as do most other sulfur sources.

Alfalfa has been shown to be very responsive to sulfur. In 163 tests in eleven states where sulfur rates were compared to no sulfur the alfalfa with sulfur out-yielded that without sulfur by 1.1

tons per acre. Yield responses in severely deficient soils can be as great as 300%, however, typical yield responses are 15-25%. High yielding alfalfa will be the most responsive.

In recent studies at Utah State, yield increases of .5 ton/A were observed. The yield was maximized at the 100 lb/A of sulfur rate. Other recent studies at the University of Wisconsin reports alfalfa yield responses of 20% even on heavier textured soils.

Research at Ohio State has shown that gypsum can give responses for several years. Their response has been an average of 1 ton/A each of the three years after the initial application as is shown in the following graph.



Iowa State research has also shown that alfalfa is responsive to calcium sulfate. Consistent with other data on alfalfa these results indicate a yield increase of about 1 ton per acre whether you are in a low yielding environment or a little higher yielding environment.

<u>Treatment</u>	<u>Location</u>				
	<u>Wadena</u>	<u>Waucoma</u>	<u>Nashua</u>	<u>Waukon</u>	<u>West Union</u>
Untreated	1.32	1.85	6.73	1.39	.78
Gypsum*	2.92	3.24	7.14	3.58	1.07

\*Gypsum was applied in April at Nashua location and in May at other locations; 2006.

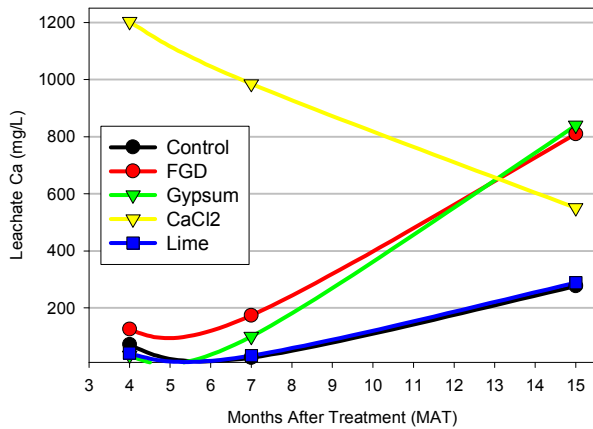
### Manganese Availability Improved

Most alfalfa is produced on soils with near neutral pH or higher. These soils can have reduced manganese availability. Studies have shown that by applying calcium sulfate to the soil an increase in manganese uptake occurs by the alfalfa plant. Both sulfur and manganese will increase the amino acid, methionine. Sulfur will also increase the amino acid, cystine in alfalfa. Cystine and Methionine are both essential amino acids in proteins and beneficial in animal nutrition.

Both zinc and iron availability has been improved with the use of calcium sulfate as well.

### As a Calcium Source

Using calcium sulfate also provides a calcium source that is 200 times more water soluble than calcium from limestone and can be more plant available than even some of the exchangeable calcium. The following chart shows how water soluble calcium is increased in a clay soil.



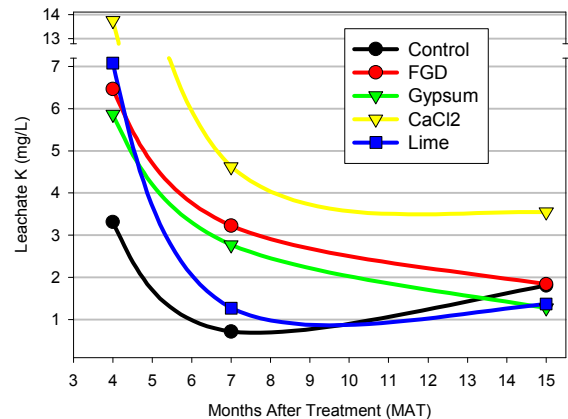
Calcium is taken up by alfalfa from the soil at quantities only second to that of potassium. Although it is generally assumed that if the pH is near neutral that calcium availability is adequate, there are other considerations. First, calcium is an immobile nutrient in the plant and since it is required for cell division and elongation, deficiencies first appear at root tips and other growing points. Secondly, Alfalfa is a high water use crop. As alfalfa depletes water from the soil profile and the soil dries, calcium precipitates into less available forms. Since nearly three fourths of

the calcium uptake is through mass flow, calcium stress can occur under drier soil conditions. Because gypsum is more mobile than lime or exchangeable calcium, the calcium levels will increase at lower depths. This also improves root growth at the lower depths which in turn will increase moisture use and moisture efficiency from the subsoils.

### Added Benefits

#### *Soluble Potassium is Elevated*

As the chart that follows shows the level of potassium in the leachate of a clay soil is increased as a result of the addition of gypsum. This not only occurs in the surface soil, but can occur throughout the top two feet. Since potassium is required in large quantities this improvement in potassium availability can have a large impact on yield both short term and long term.



#### *Infiltration is Improved*

It has been well documented that calcium sulfate improves water infiltration and soil structure. Water infiltration is critical to high yields since alfalfa is such a high use crop. Soil structure is important to sustain the heavy weight of the equipment used during harvesting alfalfa.

#### *Offsets Effects of Sodium*

Where alfalfa is produced cattle are often a part of the farming operation. Consequently manure applications which contain some sodium are sometimes made to the soil prior to alfalfa production. Calcium sulfate will help in offsetting the ill effects of sodium.

## **PRO CAL 40**

Pro Cal 40 is a premium grade calcium sulfate dihydrate produced as a result of processing of corn sugars.

The chemical analysis of PRO CAL 40 on a dry basis is 17% sulfur and 22% calcium. For alfalfa production, general recommendations are to apply 1000 to 2000 pounds per acre. This rate of application should last 3 years or more.



Pro Cal 40 applied to alfalfa in early spring at 1000#/A.

## **Economics**

Pro Cal 40 at a rate of 1000#/A would cost about \$22/A applied. If the total cost of the product was considered toward the sulfur the cost for sulfur would be about .14/lb. Compare this with most other sulfur sources costing greater than .50/lb.

If you realize a reasonable yield response of 1 ton/acre and you can market alfalfa hay for \$80/ton you would nearly quadruple your money the first year of application. Remember that 1/2 ton/acre of gypsum should last about 2 years meaning that for no additional cost you will be reaping an additional \$80/A the next year.

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