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Applying Gypsum in the Fall

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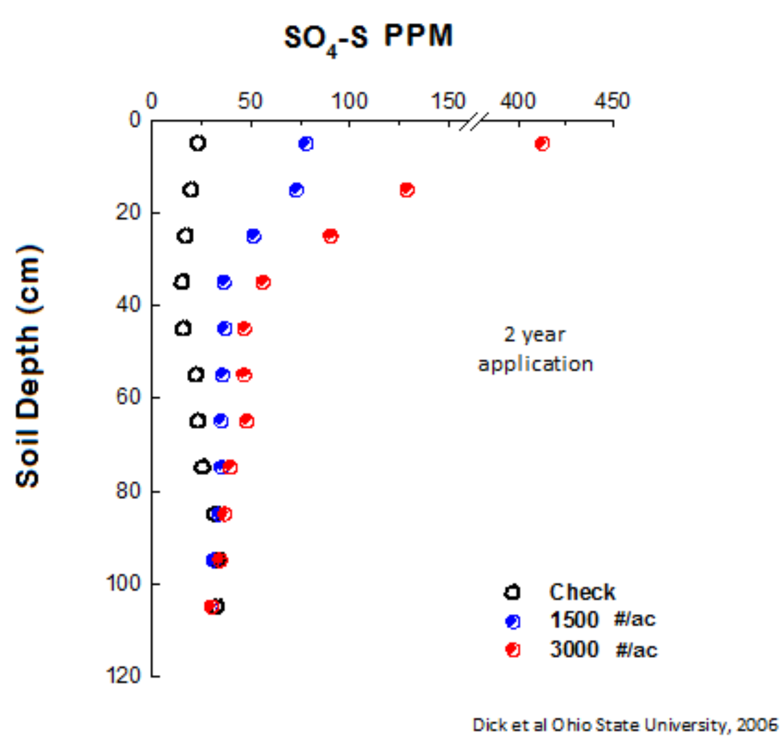
Many growers are applying gypsum in the fall to improve soil structure and supply sulfur and calcium for the next crop. As rain droplets contact gypsum-treated soil, the gypsum molecules dissolve and begin to move slowly into the soil profile*. Recently, there have been questions about whether the sulfur in fall-applied gypsum is available to spring crops.

In my twelve years of observing crop response to gypsum applications, the answer has been obvious -- YES. Our customers typically apply gypsum in the fall after harvest. Improved crop vigor and increased yields for corn, soybeans, alfalfa and wheat are common during the next growing season. I am convinced that a big reason for this early response is the availability of sulfate sulfur from gypsum applications to sulfur-deficient environments.

My personal observations are backed by university research studies. Research conducted at The Ohio State University's School of Environment & Natural Resources has shown that sulfur from gypsum applied at typical rates remains present in the upper soil profile for several years after application. The study documented sulfate-sulfur levels of 75-420 PPM in the upper profile of a Blount soil six months after completing a second annual application of 0, 1,500 or 3,000 #/ac gypsum[1]. See chart below.

Soil Sulfate Sulfur Levels 6 months after Gypsum Application



Other studies provide additional evidence, including an older study in North Carolina documenting the presence of sulfate sulfur in a silty clay loam soil 200 days after application.[2]

Here are 5 important points to consider:

1. Gypsum doesn't dissolve all at once or move though all soils at the same rate. Gypsum solubility is impacted by many factors including the source (mined, FGD, processed wallboard etc.), particle size distribution and the environment surrounding the material once it is applied (including the amount of dissolved minerals in the surrounding water). Gypsum movement into the soil profile is also influenced by many factors including soil texture (the amounts of sand, silt and clay) Water conducts through sand 137 times faster than through clay as shown by the table in the footnotes**[3].

   Other factors affecting gypsum movement through the soil include the amount of organic matter, the surface soil structure, the presence of residue, the presence of compaction or fragipan layers, the soil's moisture condition, the timing and volume of rainfall and others.

   - Loose sandy soils generally allow for rapid movement of water or nutrients. These soils are rated as having rapid vertical hydraulic conductivity.[3] Therefore, rainfall tends to leach mobile nutrients more rapidly in sandy soils making it more important to apply these nutrients in the spring closer to crop establishment. These soils are not common in most of Ohio.
   - Heavier textured soils containing more clay, silt and organic matter tend to have slower movement of water and nutrients into the soil profile. These soils are rated as having moderately slow to slow vertical hydraulic conductivity[3]. Fall applications of gypsum to soils with high clay, silt and organic matter positions calcium and sulfate sulfur to slowly make their journey downward through the soil. These are the soils common to Ohio.

2. Crop nutrient needs vary depending on the type of plant but most agricultural crops require between 30 to 70 lbs per acre sulfur. Most farmers apply gypsum at about 1 ton/acre, depending on soil density, to improve soil physical and chemical properties. The 1 ton rate delivers about 400# of calcium and about 320# of sulfur in the sulfate form. That means there is adequate sulfur available for crop nutrition as well as soil amendment.

3. Plants can only utilize sulfur in the sulfate form, which is the form supplied by gypsum. That is why we characterize the sulfate in gypsum as being available. No conversion is necessary. On the other hand, elemental sulfur must be converted to sulfate before plants can use it and this process takes place very slowly. Timing is dependent upon many application and environmental factors. It is difficult to know whether enough fall applied elemental sulfur will be converted into sulfate sulfur by springtime. Also, in the long-term, elemental sulfur transformation to sulfate creates acid and can reduce soil pH.

4. Gypsum is cost-effective. Pound by pound, gypsum supplies sulfur at a lower price than elemental sulfur. At current retail pricing, sulfur costs are:
   - Gypsum $0.11/#sulfur
   - Elemental Sulfur $0.66/#sulfur

5. Gypsum does more than supply sulfur. Fall treatments of gypsum to tight clay soils applied according to recommendations can be expected to provide adequate sulfate sulfur and calcium for both supplying nutrition to the following spring-planted crop, as well as amending soil structure. Gypsum contributes to a variety of improvements in soil quality beyond fertility, including increasing water infiltration, and dramatically reducing the loss of topsoil and vital nutrients. Gypsum can also be used to mitigate aluminum toxicity and repair sodic soils.

For more information, visit www.gypsoil.com.

Footnotes

[*] Gypsum solubility is roughly 0.35 ounce per gallon (oz./gal) at room temperature. However, the actual solubility depends on the chemistry of the soil water, including dissolved minerals such as carbonates and sulfates.

** Table

Representative Values of Saturated Hydraulic Conductivity of Different Soil Textures[3]

Texture	Saturated Hydraulic Conductivity, *K* (m/yr)
Sand	5.55 x 10^{3}
Loamy sand	4.93 x 10^{3}
Sandy loam	1.09 x 10^{3}
Silty loam	2.27 x 10^{2}
Loam	2.19 x 10^{2}
Sandy clay loam	1.99 x 10^{2}
Silty clay loam	5.36 x 10^{1}
Clay loam	7.73 x 10^{1}
Sandy clay	6.84 x 10^{1}
Silty clay	3.21 x 10^{1}
Clay	4.05 x 10^{1}

Source: Clapp and Hornberger (1978).

References

1. Improved Soil Quality and Increased Carbon Credits Through the Use of FGD Gypsum to Enhance No-Tillage Crop Production, Dick et al, April 28, 2006, Ohio State University unpublished report.

2. “Leaching Losses of Sulfur During Winter Months When Applied as Gypsum, Elemental S or Prilled S”, Rhue and Kamprath July 1973, *Agronomy Journal*, Vol 65, No. 4, p 603-605.

3. “Representative Values of Saturated Hydraulic Conductivity of Different Soil Textures” Clapp R.B. and Hornberger G.M. (1978). *Empirical equation for some soil hydraulic properties*. Water Resour. Res., 14(4): 601-604.