From the Ground Up

Soil Solutions, LLC · 303 Lamp Kastner Drive · Holstein, IA 51025

January 2007

Effects of Gypsum can be Long Term

How often do I need to apply gypsum? Will higher rates last longer? Is it better to apply smaller amounts more often? These are questions that we get almost weekly. Answers to these questions depend upon soil properties and environmental conditions (moisture received), however, we will give you some information that will show that the effects of gypsum applications can last for several years.

Since the greatest loss of gypsum is by leaching, it is reasonable to note that in heavier soils the affects of gypsum will last longer. Most of the applications in our area are to offset the effects of sodium or high magnesium levels in soils. These are almost always in soils that are of silt loam texture or heavier.

In a 1997 study to evaluate soil properties from applications of gypsum in 1981 and 1982, it was determined that both corn and alfalfa yields were still improved after nearly 15 years from the time of the application. Alfalfa yields were increased by 1.7 tons even 15 years after the initial applications. The greatest yield differences were noted in the second and third cuttings. This was most likely due to the extraction of greater quantities of water from subsoil depths in the gypsum treatments due to better root growth. Corn yields were improved 30 bushels per acre even 15 years after the initial application. Rates of gypsum applied were 4.5 ton/acre.

Sixteen years after a surface application, exchangeable magnesium levels were also greatly reduced in soils to a depth of 30 inches showing that the calcium displaced the magnesium and transferred the magnesium to lower depths. As expected calcium levels were increased even to the 40 inch depth. The electrical conductivity was increased through the top 40 inches as well as the sulfur level.

Dr. Norton at the National Soil Tilth Laboratory has also researched this topic in depth. His results suggest that the dissolution rate of gypsum is 35# of gypsum for each inch of precipitation received during the growing season. This would equate to one ton of gypsum dissolving over about a three year period in most of our area. By applying gypsum on schedule each three or four years we will continue to enhance our yield benefits and soil properties. We would prefer that heavier rates be applied the first year and then lesser rates in later years. Our experience has shown that yield responses are best when the recommended rates are used and in the long run it is less expensive. One of our satisfied clients recently commented that the reason he didn't get responses from gypsum previously was that he did not use as high of rates as we recommended.

Should we plant soybeans earlier?

Soybean producers in most of our marketing area were pleasantly surprised by the yields of the soybeans this year. Most attribute this to getting rain in August. This is true. Soybeans need moisture during the seed filling stage and can have the greatest affect on yield. I had some producers also tell me that their earlier planted soybeans did not benefit as much from these rains as the later planted soybeans. This may make you consider planting soybeans later this coming year. But think this over. Here are a few things to consider. According to Dr. Jim Specht, University of Nebraska, soybeans produce a node every 4 days until the R5 stage (seed is 1/8" long in the pod at one of the four uppermost nodes on the main stem). If you want to increase the number of nodes per plant you need to plant earlier, however he recommends not planting any earlier than 14 days prior to the last ever spring frost date for your area. If your risk tolerance is high you can go earlier than this. If the soybean plant is stressed it will still produce a node every 4 days, but the internodes will be shorter. This is actually preferred and may be why it appears that when soybeans are stressed during their vegetative stages they yield more. The more nodes the more potential pods produced since pods are only produced at the nodes. And each node can potentially produce a branch with more potential to produce nodes and pods.

If irrigating soybeans be certain that you irrigate soybeans during the R3-R4 stage (pod is ½ inch long on one of the four uppermost nodes on the main stem) regardless of forecast. If you are on dryland acres it is important to store moisture for this stage by decreasing the amount of evaporation from the soil. Also planting earlier will result in you reaching this stage a few days sooner and could increase the yield potential.

If you think you did not benefit from the August rains because you planted too early, you may want to consider a little longer season variety and keep you planting date the same or even plant a little earlier. Remember there are many things to consider though when making a variety change and be certain all of these are considered.

Many growers today don't feel that soybean yields have kept pace with corn yields and they are probably correct, however, the yield potential with soybean varieties today is 3.5 bushels/acre per incremental inch of seasonal water. Older varieties like Williams 92 produced 2 bushels/acre per inch of seasonal water. This means that if we have 20" of seasonal water either stored in our soil profile, rainfall or through irrigation that we should be able to grow 70 bushel/acre soybeans with today's varieties.

Gypsum improves availability of Potassium and other nutrients

Numerous studies have shown increases in nutrient uptake by plants where gypsum has been used. Most of this is attributed to better soil structure, increased root growth and improved water availability. But a recent study where gypsum treated soil was tested 134 days after treatment revealed that gypsum applications can increase alter the water extractable nutrient levels in soils. **Water extractable potassium was increased by 62% on average when comparing 36 different soils.** This is explained by calcium displacing potassium on the exchange sites increasing the amount of soil solution potassium. The **ammonium acetate test also indicated an increase in potassium availability**, however, the Mehlich 3 test showed no differences. Magnesium concentrations were also increased three-fold in the water extract with the gypsum vs. the control. This is also as expected since calcium will also displace magnesium on the exchange sites. **The ammonium acetate and Mehlich 3 tests revealed significantly lower magnesium levels after the gypsum treatment.** This is to be expected since magnesium is fairly mobile and some of the solution magnesium was probably leached.

Logically, the **calcium and sulfur concentrations were greatly increased with the gypsum** addition regardless of extraction procedure or extractant used. This is to be expected since gypsum contains 22% calcium and 17% sulfur.

In 18 of the 36 soils there was a marked increase in water extractable nitrates. There were no deductions or assumptions made regarding these results.

Most interesting were the results with phosphorus. The level of water extractable phosphorus was 69% lower in the gypsum treated soil. This agrees with other research that showed that phosphorus runoff from fields is reduced with the use of gypsum. Conversely, the Mehlich 3 extraction, using ICP detection, of the soils provided a different result. **On average the Mehlich 3 phosphorus test was 31% higher with the gypsum treatment than the control.** Does this mean that gypsum can decrease the amount of water soluble phosphorus while yet increasing the plant available phosphorus? Or does it mean that the general usage of the term "available phosphorus" is not correct for different soil tests? I think both statements are probably correct.

Below are soil results from a couple of locations where we applied PRO CAL 40 this past spring. Samples were taken in the fall/winter of 2005 and then re-sampled this fall. Results reveal results similar to what was described in the research above. In these fields, sodium and magnesium are causing yield limitations and you can see that the PRO CAL 40 was able to improve these situations. Both farmers commented on how much

better the crops yielded this year and how much better the ammonia applicator pulled through this soil this fall.

Location		*K*	*Mg*	*Na*	*Ca*	*pH*
Humboldt, NE	*Before*	*181*	*1218*	*790*	*1421*	*7.6*
	After	*282*	*975*	*173*	*2748*	*6.0*
North Bend, NE	*Before*	*442*	*1047*	*577*	*1347*	*6.9*
	After	*323*	*316*	*47*	*1519*	*5.1*

We're busy but we'll get there

We have had a busy fall and winter so far. If you have ordered product and application and we have not gotten to you yet we apologize. We are working diligently to get as much done as possible and will get to your fields as soon as possible. Although it doesn't always work this way, we try to do all the fields in an area before we move on to the next. This saves costs and hopefully we are more efficient. We also try to do ridge-till fields and tilled gumbo soils when they are frozen. So far this winter we have had few days when the ground has been frozen.

Having said all of this, there is still plenty of time to get your product applied. Each year we have applied product even into May and we have seen yield responses as long as there is adequate moisture to activate the gypsum.

We wish you all a very safe and prosperous 2007!!