

CCPS IN AGRICULTURE

Gypsum Is A 'Win-Win' For Utilities and Agriculture

By Dan Zinkand



Ron Chamberlain, director of gypsum programs for Beneficial Reuse Management, and Indiana farmer Jack Maloney examine corn stalk from fields treated with gypsum.

More than 200 years ago Ben Franklin spread gypsum on his clover fields in Pennsylvania and saw amazing results. But because gypsum is expensive to mine and transport the practice virtually disappeared in American agriculture, except for certain specialty crops like peanuts and potatoes.

Now – thanks to the growing availability of flue gas desulfurization (FGD) gypsum and a undeniable buzz in the agricultural industry – gypsum application is quickly becoming an integral management practice for crop growers focused on improving soil quality, sustainability and profitability on their farms.

In fact, gypsum has captured headlines such as, “Farmers See Greener Fields with Gypsum Use,” “Gypsum Gains Ground,” and “Miracle Sulfur Source?” in leading farm magazines. Major articles have appeared recently in *Farm Journal*, *Hoard's Dairyman*, *Progressive Farmer*, and more farm papers, including a six-page December 2011 cover article in the American Society of Agronomy's *Crops and Soils*. A 2011 reader survey by *No-Till Farmer* reported that gypsum use among no-tillers has jumped 400 percent since 2008.

So if you've been thinking of byproduct gypsum as just an expensive disposal problem, think again. There's a growing agricultural market that's ready and waiting, and many compelling reasons for why this is happening.



Indiana farmer Rodney Rulon has been applying gypsum to his fields for seven years.



Wisconsin farmer Ken Ihlenfeld saw significant improvements to alfalfa crop yields after applying gypsum to fields.

GYPSUM HELPS SOIL

Using gypsum as a soil amendment can help farmers reverse the effects of compaction and other soil quality problems compounded by years of heavy equipment traffic and intensive farming systems. Concrete-like fields – often with tight clay soils – are hard to farm and nearly impermeable to moisture.

Gypsum helps improve the infiltration of rainfall into farm fields, says Dr. Darrell Norton, who spent years at the U.S. Department of Agriculture's National Soil Erosion Research Lab at West Lafayette, Indiana.

Water that infiltrates into the soil profile can be used by crops later in the growing season, Norton explains. Better infiltration reduces soil erosion and the movement of phosphorus that exists in soluble forms that can pollute bodies of water.

Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) dissolves with moisture into calcium and sulfate.

Increasing soluble calcium improves aggregate stability to set the stage for improved soil structure.

“Using gypsum as a soil amendment is a great ‘green’ story for the coal industry and agriculture,” says Dr. Norton. “This is why other researchers and I call this opportunity a ‘win-win’ for both industries.”

Applying gypsum to the soil protects its particles from breaking down when raindrops hit the surface of fields, Dr. Norton says. This happens through a physical-chemical reaction.

“There are few electrolytes in rainwater,” he says. “Gypsum is an electrolytic source which keeps the soil flocculated. That is, it keeps the clay particles clumped together or aggregated.”

Gypsum does more than improve the soil. It also contains calcium and sulfur. Since the advent of federal clean air regulations, technology has reduced the airborne deposition

of sulfur on fields by about 50 percent, Dr. Norton says. After nitrogen, phosphorus and potassium, sulfur is the nutrient most important to crop production.

“Growers used to get this important meso-nutrient for free,” Norton says, referring to sulfur. “In gypsum we have a very low-cost product that helps farmers produce more abundant and better quality food.”

CORN AND SOYBEAN FARMER BELIEVES

Since Rodney Rulon and his cousins, Roy and Ken Rulon, began using gypsum on their Indiana corn and soybean acres seven years ago, they've seen improved water infiltration and less runoff.

“We started using gypsum in our problem fields and then after seeing benefits there, started using it across all of our acres two years ago,” says Rulon, whose family farms about 5,800-acres. They hosted the 2012 Midwest Soil Improvement Symposium, a gypsum educational event co-sponsored

by the Rulons, GYPSOIL and the Conservation Technology Information Center on August 21.

While the Rulons have not specifically used gypsum to restore nutrients, Rodney Rulon says he's observed the benefits of boosting sulfur levels.

"In low sulfur conditions, I think you can see a yield boost immediately and directly," he says, referring to his corn crop. "In the last couple of years, the soybean fields where we have applied gypsum have been our best-yielding fields. These beans have more green color to them and they look better early on in the growing season."

Year in and year out, the direct yield benefits of applying gypsum can vary, Rulon says.

"In one year, the increased water infiltration may make a big difference, especially when it's dry," he says. "And in another year, when there's more moisture, you may not see as much of a difference. Using GYPSOIL is one of those things that we do to build the soil structure and tith over time."

STRONG TRACK RECORD

Fellow Indiana farmer Jack Maloney agrees applying gypsum to his fields is an integral part of a well-managed system that has increased his corn and soybean yields during the past 10 years.

Maloney began applying about 2,000 pounds of gypsum per acre every other year as advised by his agronomist Ron Chamberlain, who founded GYPSOIL and now works for its parent company Beneficial Reuse Management.

Maloney, who farms near Brownsburg, outside of Indianapolis, now applies 1,000 pounds of GYPSOIL every other year on his corn and soybean fields for a maintenance program.

He started applying gypsum because it allowed him to feed fields with the calcium and sulfur they need without altering the pH levels. Using gypsum to improve the soil structure and water infiltration is all part of an intricate system, Maloney says.

"All of the parts of the system need to be there: cover crops, no-till, sub-surface drainage, soil fertility, air and water management and gypsum. You can't just cherry pick and use one and expect great results."

This system helps create healthy root systems that not only hold the fertility in place and reduce erosion, but also enable crop roots to use the nutrients in the soil.

"Without the roots of the corn and soybeans and the cover crops that grow from fall until spring, the nutrients will go down through the soil and go out the sub-surface tile drains," Maloney says.

With gypsum in an integrated crop management system, farmers will increase their profits, Maloney says.

"My corn and soybean yields have increased every one of the past 10 years," he says. "Ten years ago, my corn yield with USDA

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Dr. Darrell Norton, formerly of the U.S. Department of Agriculture's National Soil Erosion Research Lab, is a leading proponent of gypsum use in agriculture.

was 165 bushels per acre. Now it's just under 200 bushels an acre."

To put that in perspective, at the prices many farmers saw in the fall of 2011, that 35-bushel-per-acre increase amounts to an additional \$210 more per acre in gross revenue.

GYPSUM BENEFITS ALFALFA, TOO

Ken Ihlenfeld of West Bend, Wisconsin, farms 2,500 acres, including 400 acres of alfalfa used for his 400-cow dairy operation. In early 2011 he spread one ton of gypsum per acre to alfalfa in test strips compared to no gypsum. Ihlenfeld harvested 0.6 ton of alfalfa more later in the summer where he spread the gypsum versus untreated land. He then applied gypsum to the rest of his alfalfa ground last fall.

"Gypsum is a win-win for us because it boost yields by correcting the sulfur deficiency and the calcium helps loosen up our compacted soils," says Ihlenfeld.

Expanding Market

While corn, soybeans and alfalfa are often associated just with the Midwest, these crops and others that benefit from gypsum are produced throughout the South, Southeast and Atlantic states. Corn and hay are grown in the Great Plains and the West, too. This widespread production bodes well for demand for using gypsum as a soil amendment, says Chamberlain.

"We are definitely seeing interest among farmers, universities and the U.S. Department of Agriculture beyond the Midwest for using gypsum," Chamberlain says. "This includes researchers in the South, the Southeast and the Mid-South. And USDA research is continuing to expand on how gypsum can help improve soil, crops, yields and profits throughout the country. Gypsum has the potential to help farmers improve their soil, yields and profits."

Dr. Leo Espinoza, a soil scientist with the University of Arkansas, has been studying the use of gypsum in the South, especially where fine particles of soil — silt — can "cement" over the soil when it rains. This "cementing" creates a crust on the surface.

Soil crusting can make it difficult for plants to emerge, Dr. Espinoza says. When crusted soil receives rainfall or irrigation, most of the water runs off, instead of soaking down into the soil where plants can use it for extended periods of time. Gypsum helps eliminate the crust and contributes to more moisture movement deeper into the soil profile which is important for southern crops like cotton.

Gypsum also has promising benefits for very acidic sub-soils in regions of the Mississippi River Delta, where high levels of aluminum become toxic to plant roots, resulting in a "chemically compacted" layer, Dr. Espinoza says. This layer,

referred to as a "fragipan," is found about 10-20 inches deep and hinders the growth of plant roots, he says.

Unlike lime, gypsum can move down the soil profile and alleviate the detrimental effect of high aluminum levels, Dr. Espinoza says. Some of his fieldwork has shown increased root depth and water infiltration in plots where gypsum was applied, compared to untreated plots.

GREAT FUTURE FOR GYP SUM

Dr. Norton says he believes the future looks good for the use of gypsum in agriculture because he believes farmers are more focused on soil quality than ever before.

Back in the mid-1990s, precision agriculture meant measuring and mapping yields in farms. But increasingly, it means the precision planting of seeds and placement and timing of nutrients, Norton notes.

"Farmers are using precision management of water, nutrients and crop genetics, and are also paying more attention to the soil," he says.

Gypsum has the potential to make a huge impact on improving soil and water quality, says Norton. "Using gypsum as a soil amendment is the most economical way to cut the non-point runoff-pollution of phosphorus," Norton says. "In fact, gypsum is by far the best way to reduce phosphorus runoff into bodies of water. This can also be done by co-applying gypsum with poultry litter or other animal manure."

Dr. Norton notes that the utility industry has sponsored a number of seminars on the use of gypsum as a soil amendment in agriculture. However, he believes the industry as a whole needs to wake up to the opportunity that agriculture presents as a viable market for byproduct gypsum.

"Gypsum can benefit the environment, farmers and the world's food supply," he says. "Landfilling gypsum not only potentially consumes productive farmland, it also locks away a valuable product." ❖

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