



WEATHERPROOF With Gypsum

Give chronically underperforming soils a boost.

STORY AND PHOTOS BY JOHN POCOCK

Everyone knows kids need calcium to build bones and maintain general overall health. Brian Maliszewski extends the same philosophy to soil. When paired with sulfur in gypsum, he believes calcium helps build strong soils that can adequately support ample air and water movement for healthy root growth.

That's particularly important when weather conditions threaten to stunt plant development, says Maliszewski, who operates a diversified crop and livestock operation

with his father, Bill, near Independence, Wis.

"Gypsum's main benefit for our farm is to improve soil structure and plant health, which in turn gives us better yields," he says. "For the cost, it gives us a good value for our economic return—about 10 to 20%."

Maliszewski credits a high-rate gypsum application for helping to open up soils that would otherwise be challenging for air and water to penetrate. As a result, he says problems with ponding, poor drainage and limited yields are beginning to diminish on the farm's heavy clay soils, as gypsum applications improve soil oxygen content, water infiltration and root growth.

CROP RESPONSE. "This is our third year applying it," says Maliszewski, whose fields are planted no-till, except where compaction zones occur. "The alfalfa response is immediately visible—darker green, healthier leaves and plants that are 6 to 8 inches taller," he says.

The visible response is less noticeable in corn and soybeans until subsequent years, he adds. "We put on 700 to 1,000 pounds per acre, which satisfies our calcium and sulfur needs. Gypsum contains calcium sulfate (16% sulfur, 20% calcium). The sulfur is a necessary crop nutrient for high yields, and the calcium is more of a soil amendment."

For farmers interested in applying gypsum for its nutrient value, an every-other-year application schedule is adequate, says Maliszewski, who helps market GYPSOIL-brand gypsum for Beneficial Reuse Management, Chicago, Ill. "If you are trying to improve soil nutrient and water uptake, it's best to apply it every year, especially on heavy soils," he advises.

Maliszewski says sulfur applications are becoming increasingly important to attain maximum yields. Strict air-quality laws have resulted in less sulfur being deposited from the atmosphere onto farm fields from coal-burning power plants, he points out. In addition, increased crop yields remove more sulfur from the soil than they did when yields were lower.

"Corn silage and alfalfa take away the most sulfur from the soil, about 40 to 50 pounds per acre per year, and corn for grain removes 20 to 30 pounds per acre per year," Maliszewski says. His crop rotation includes corn, soybeans, alfalfa and a cereal rye cover crop planted on highly erodible land after corn silage or soybean harvest.

MONEY MAKER OR MIRAGE? Fabian Fernandez, Extension soil nutrient specialist, University of ▶



Minnesota, agrees gypsum can be a good sulfur source to improve soil fertility.

“Most published research doesn’t support the idea that gypsum does anything to improve soil properties on productive farm fields throughout most of the Midwest,” he says. “However, gypsum can be a good-quality, relatively inexpensive source of sulfur, which can be helpful to increasing yields in fields where sulfur is deficient for high yields.”

Atmospheric sulfur deposits onto farm fields have been greatly reduced in recent years, due in large part to the Clean Air Act and its implementation, affirms Fernandez. “So, sulfur applications are starting to become more important for maintaining or increasing high yields on certain soils,” he says. “However, sulfur deficiency is more of a site-specific than a regional problem.”

SOILS RESPOND. He says soils most likely to benefit from gypsum include sandy soils with low organic matter and soils that tend to stay cool and wet early in the growing season, where mineralization occurs more slowly.

“So, soils with high clay content in a no-till system might be more likely to respond to sulfur,” Fernandez says. “However, soils that are high in organic matter and naturally have a lot of sulfur won’t be as responsive to additional applications.”

For most of the Midwest, where organic matter is

high, sulfur deficiency is not yet widespread.

“However, where sulfur is deficient, the intensity of the response is much greater than it was 30 years ago,” he says.

Outside the Midwest, published research does show gypsum can be useful in reclaiming sodic (high-sodium) soils, Fernandez adds. “In parts of the western U.S., where petroleum extraction or poor water quality from irrigation has been a factor, gypsum can play a very positive role in increasing crop production,” he says.

“In these soils, gypsum can improve water infiltration.” **SULFUR DEFICIENCY.** Regardless of location, on either sandy or poorly draining soils, farmers should watch the crop early for signs of sulfur deficiency. “Sulfur deficiency shows up early in the growing season and looks very similar to nitrogen (N) deficiency, with leaves taking on a light green color instead of dark green,” he says.

“However, with sulfur deficiency, the light green leaves are on the top of the plant, where the newer leaves are growing. With N deficiency, it’s just the opposite—the light green leaves are the older leaves near the bottom of the plant.”

Fernandez recommends testing leaves from plants ▶

Brian Maliszewski, Independence, Wis., credits gypsum for helping to improve water infiltration and reduce runoff on clay soils and hilly terrain.

that are growing well with those that aren't. "Soil tests for sulfur can also be done during the season to compare areas where the crops are dark green and doing well with areas where they are light green and doing poorly," he points out.

Both soil and tissue tests for sulfur should be used as a diagnostic tool only—to compare good and bad areas of the field, advises Fernandez. "You can then integrate that information with other factors to determine if a sulfur application is needed," he says.

SOIL AMENDMENT ADVANTAGES. Although not universally accepted, gypsum applied specifically for soil amendment

this situation, the calcium and sulfate in gypsum move down and improve the subsoil environment by displacing and then tying up toxic aluminum. This allows roots to grow better and explore more of the soil volume for water and nutrients."

Gypsum's ability to improve water infiltration rates, soil structure and water quality has become steadily apparent to Joe Nester, owner/consultant, Nester Ag, LLC, Bryan, Ohio, while providing agronomic advice to customers over the last 20 years. "Many fields in the area are within the western Lake Erie basin," says Nester. "These are really tight, heavy clay soils that are overburdened

with magnesium. The gypsum helps leach this magnesium down through the soil profile."

Nester's advice on gypsum applications has been helpful for reducing the variability in soil quality and yields within fields for Les Seiler, who farms with his brother, Jerry, near Fayette, in the northwest corner of Ohio. His crop rotation includes corn, soybeans and a cover crop blend planted after wheat.

SOIL IMPROVEMENTS. "Our drainage is working better in soils where we have applied gypsum," says Seiler, who has practiced no-till since 1986 and has blanket-applied gypsum

(a non-GYPSOIL brand) for the last five years. "I haven't seen a lot of crusting, like we used to see, and I haven't had to replant anything for the last 3 to 4 years—and I credit the gypsum for that."

Gypsum's yield-boosting abilities became evident while harvesting a winter wheat field in 2013 where the spreader had run out of product prior to planting, notes Seiler.

"The yield benefit was clear on this field, because we knew exactly where we ran out of gypsum during our application," he says. "The yields were in a range of 82 to 100 bushels per acre where we applied gypsum and only 68 to 72 bushels per acre where we didn't."

From his experience with the product, Seiler says the soil improvements from the gypsum are closely tied to its yield benefits, making gypsum well worth the cost. "We put on about a one ton per acre application, ►



Farmers can pick up gypsum at multiple locations along the Mississippi River, like this one, in Winona, Minn., where it's barged upriver from coal-burning power plants in southern locations.

purposes is a growing trend, especially in no-till situations on clay soils, says Warren Dick, soil

scientist at The Ohio State University. "Gypsum improves water infiltration and creation of stable aggregates (improved soil structure for water holding capacity)," he says. "However, our database isn't strong. We need more data on what soils to apply it on, at what rates and how often to apply it."

In the southeastern U.S., and in other places where the subsoil may be acidic, gypsum can be helpful. "Some soils where lime is on the surface can still have acid in the subsurface that restricts root growth," he explains. "In



The GYPSOIL-brand gypsum Maliszewski uses has the consistency of baking powder. A finer consistency makes application timing more important to avoid leaching.

which contains about 300 pounds of sulfur,” he says. “In the past, the cost for gypsum has been about \$30 to

\$36 per ton, including trucking, plus another \$3 to \$5 per ton to spread.”

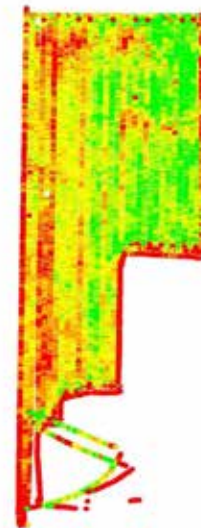
Transportation costs are higher to bring gypsum to western Wisconsin, says Maliszewski. “The first year we used gypsum, we had to truck it from a power plant near Milwaukee,” he says. “Now, it’s barged up the Mississippi River at several locations. It’s about 40 miles for us to pick it up in Winona, Minn., or we can also pick it up in La Crosse, Wis.”

Maliszewski says he uses a walking floor semitrailer dump truck to transport the gypsum himself. “Area gypsum prices range between \$40 and \$60 per ton, and spreading costs add another \$6 to \$7 per acre,”

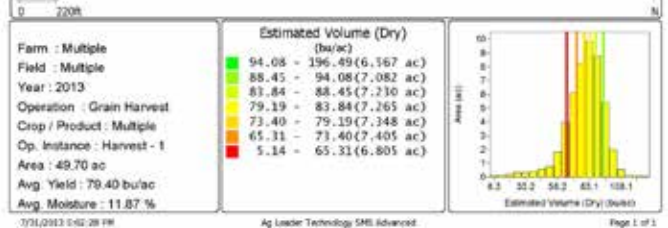
he says. “Costs are higher further north, since the product is coming from southern states; and spreading costs are higher here because of the hillier country and smaller field sizes.”

Still, gypsum prices have been coming down now that it’s being shipped by barge, and more farmers are interested in using it, says Maliszewski. He sees that trend continuing in the future. ●

Grain Harvest 2013



Yield maps helped Les Seiler see the benefits of gypsum in a wheat field where the fertilizer spreader ran out of gypsum.



Time Application To Avoid Leaching

The best time to apply gypsum is when it’s most likely to be used by a crop and not lost, says Fabian Fernandez, Extension soil nutrient specialist, University of Minnesota.

“The sulfur in gypsum is somewhat soluble,” he says. “So, it’s best to apply gypsum in the spring, otherwise a lot of the sulfur might leach out and be gone by the time spring comes.”

However, cropping practices and soil types also make a difference, says Warren Dick, soil scientist at The Ohio State University. “Applications can be done any time of year for hay,” he says. “For corn and soybeans, applications can be made in the fall. However, on sandy soils, it may leach out by spring. Gypsum is not as leachable as some fertilizers, like nitrogen, but it is still moderately soluble.”

Fernandez points out the type of gypsum product can

also make a difference. “The finer the material, the sooner it will release into the environment,” he says. “A coarser material may delay the release of sulfur in the gypsum.”

For alfalfa, a gypsum application after the first cutting often works best so that following cuttings benefit from the sulfur, says Brian Maliszewski, Independence, Wis. “We try to apply it when it is both convenient and has the least chance to leach,” he says. “For corn and beans, if time allows, fall spreading works well; otherwise, we apply it in the spring, before planting.”

Farmers who plant winter wheat often apply gypsum in the fall, just prior to planting. Winter gypsum applications are also possible, if field conditions are favorable and runoff is not a concern, depending on state and regulatory requirements.

Gypsum Helps Keep Water Clear

Applications help keep phosphorus in the field.

BY JOHN POCOCK

An ongoing water-quality study points to an environmental advantage to using gypsum that goes beyond soil health, says Warren Dick, an Ohio State University (OSU) soil scientist.

OSU/USDA research is seeking to determine if gypsum applications on farm fields in northwest Ohio help reduce pollution in water draining from farm fields into the Maumee River and eventually into Lake Erie. In the past, scientists have suspected nonpoint source pollution from farm fertilizers, particularly phosphorus (P), might be the cause of massive algae blooms on Lake Erie.

“The water samples we’ve collected show a tremendous difference,” says Dick, who is conducting the study through a grant from the USDA’s Natural Resources Conservation Service. “The visual look of the water is quite striking with the samples from the gypsum fields showing less sediment. This, in turn, results in less loss in phosphorus.”

OSU researchers and area farm cooperators obtained their first water samples from tile drains in November 2012, six to seven months after the gypsum was applied. The results showed much cleaner water draining from fields spread with 1 ton per acre of calcium sulfate dehydrate (gypsum) compared with fields that received no gypsum application, Dick explains.

“In 2012 and 2013, we collected 58 samples, and the average reduction in soluble P from fields applied with gypsum has been 62%,” he reports.

PHOSPHORUS PERFORMANCE. Many farms in the area utilize no-till to help prevent soil erosion, Dick notes. “However, for no-till, the high P levels on the soil surface may be contributing to the algae blooms and other water-quality problems in Lake Erie and other watersheds,” he says. “What we’re finding is that the gypsum applications keep the P on the field so that it doesn’t get in the water. It keeps P where you want it without tying up the P so plants can still use it.”

The gypsum being used for the study is a flue-gas derivative produced from coal-burning power plants, called fluidized gas desulfurization (FGD) gypsum. The gypsum has been used by some local farmers for many years as a source for sulfur fertilizer and also a soil amendment to help improve water infiltration, he adds.

GYPSUM RESULTS. Joe Nester, owner/consultant at Nester Ag, LLC, in Bryan, Ohio, says gypsum



PHOTO: JOHN POCOCK

applications are helping to keep the area’s clay soils from dispersing during rainfall events. “You can really see a huge difference in the clear water coming from tiles beneath fields spread with gypsum and the turbid water coming from tiles beneath fields without the gypsum,” he explains. “The difference we’re seeing in the water visibility is still happening on plots that we applied with gypsum in April 2012 and haven’t applied gypsum since.”

As a result, Nester is recommending gypsum as a management tool farmers can use “to keep P in the fields where it belongs and prevent it from leaving in runoff water or tile water.” In addition, he says gypsum is a good sulfur fertilizer source that is increasingly necessary for farmers to apply to achieve high yields. ●