



Nutrient-laden runoff from farm fields is a major problem in many regions.

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## Could power plant waste help cut water pollution?

By Susan Cosier | Nov. 17, 2016 , 12:00 PM

**CAMPBELLSPORT, WISCONSIN**—When it rains, a river flows through a shed on Dan Johnson’s farm here. The runoff trickles through his crop fields, then beneath a small white structure where a pump sucks up small water samples. When the water fills a 20-liter jug, researchers collect it and test it for the presence of phosphorus.

The setup is part of an experiment aimed at testing an unusual water pollution control scheme that uses gypsum, a waste product from coal-fired power plants, to reduce nutrient runoff from farms.

Here in a heartland of U.S. agriculture, a growing number of farmers are spraying manure produced by animal feeding operations—which



To prevent such damage, researchers have long sought ways to keep nutrients from leaching from farm soils. And recently, they’ve taken a fresh look at using gypsum, a soft white or gray mineral also known as calcium sulfate dihydrate, to help keep phosphorous where it is wanted.

It’s an old concept. U.S. farmers have been treating fields with gypsum since George Washington was president. In part, that’s because sulfate in the gypsum binds with magnesium in the soil, helping the soil hold water. But pollution specialists are more interested in the calcium in the gypsum; it binds with phosphate in soil, forming a larger particle that resists being washed away.

Fertilizer companies once routinely mixed gypsum into their products, but that practice faded. And because the mineral traditionally came from mines, shipping was prohibitively expensive. “Somewhere in that shuffle we forgot about gypsum,” says Francisco Arriaga, a soil scientist at the University of Wisconsin (UW) in Madison.

But researchers saw a possible comeback for gypsum as nutrient pollution problems grew and coal-fired power plants proliferated. Many plants are equipped with equipment—dubbed scrubbers—that use lime to remove pollutants. The chemical reactions involved produce a form of gypsum known as flue-gas desulfurization (FGD) gypsum. A lot of FGD gypsum ends up in landfills, but companies also use it to make wallboard and cement. In part, that’s because it is relatively cheap: A ton of mined gypsum can cost as much as \$140, whereas a ton of FGD gypsum costs \$38.

Farmers are also allowed to use FGD gypsum on their fields, and over the past decade scientists have begun research projects in seven states examining how it affects crops and soils. Here in Wisconsin, Dan Johnson’s farm is one of three study sites selected by Arriaga and other UW researchers. They are working in cooperation with the Sand County Foundation, a nonprofit based in Madison, and We Energies, an energy company that runs a coal-fired power plant just 160 kilometers away in Milwaukee, Wisconsin.

On Johnson's farm, the potential for polluted runoff from steep slopes is high, making it an ideal study site, says Greg Olson, the field projects director for the Sand County Foundation. The project is of particular interest to Olson's group because of growing concern about polluted runoff creating oxygen-poor dead zones in the Great Lakes.

In 2014, Johnson started applying gypsum, obtained from a We Energies facility just 10 kilometers from his farm, to about 4 hectares. (The treatment lasts 2 to 3 years.) "We're doing a chemistry experiment in the soil," Olson says. Gypsum not only can make phosphorus particles "less mobile," but increase the amount of water available to crops and reduce runoff.

Preliminary results—which Arriaga will present at a Soil Science Society of America conference this month—suggest gypsum is helping keep



grow. (Now that power plants emit less sulfur, which used to fall back to land in the form of acid precipitation and dust, some soils are deficient in that nutrient.)

Still, FGD gypsum may have some downsides. For one, if heavy rains wash gypsum into waterways, it could liberate phosphorus stored in river sediments, adding the nutrient to the water column. (Heavier rains are one anticipated effect of climate change in the Midwest.)

Another other issue is gypsum's availability. Coal-fired power plants are shuttering thanks in part to stricter emissions laws and low natural gas prices. And as the plants close, they will stop producing gypsum. "In 20 to 30 years time, gypsum will again be in short supply and farmers will be scrambling," predicts soil scientist Malcolm Sumner, emeritus faculty at the University of Georgia in Athens. Until then, researchers say they will continue trying to understand where FGD gypsum might be helpful in curbing polluted runoff.

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