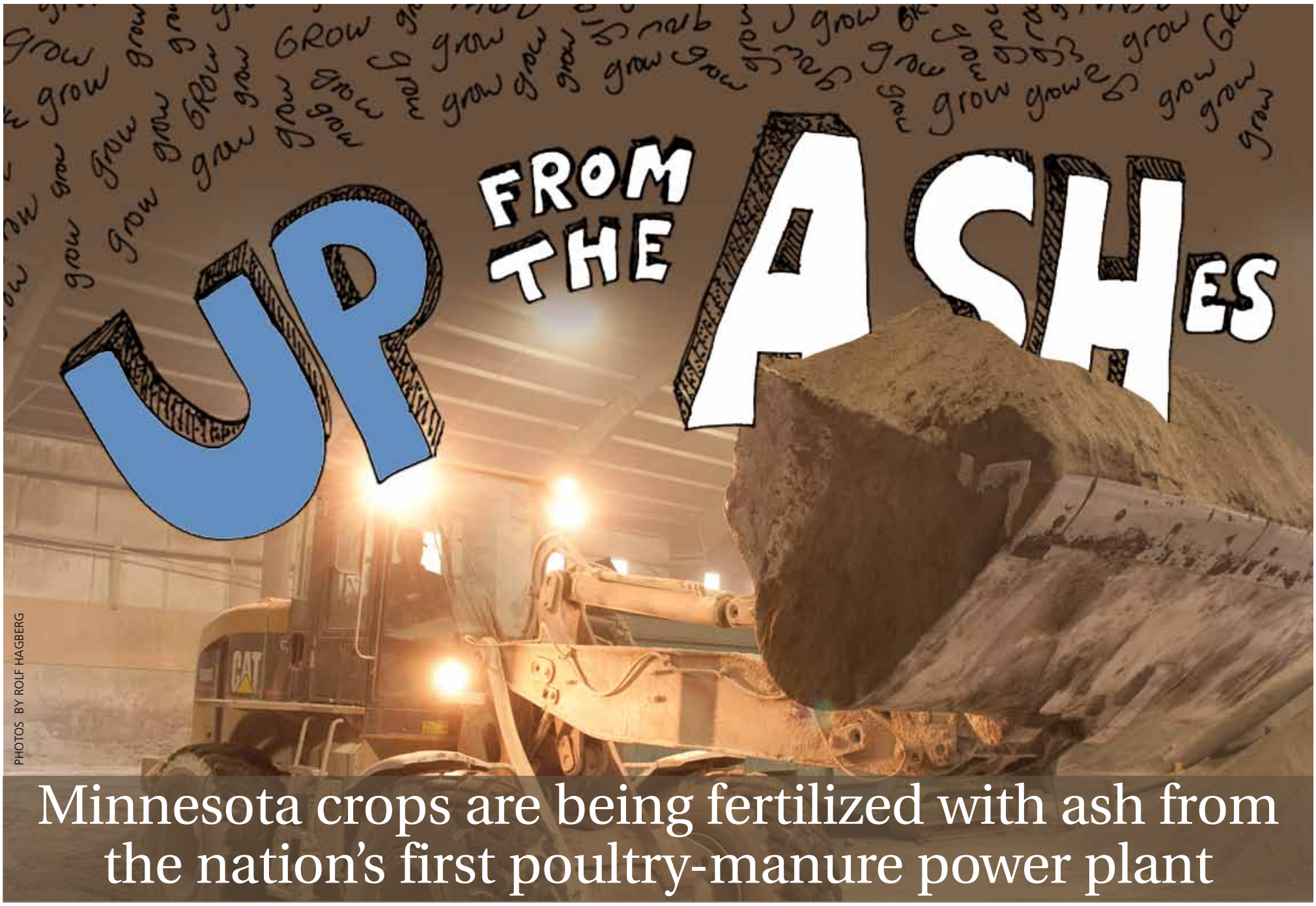
AG INNOVATION NEWS

The newspaper of the Agricultural Utilization Research Institute

JAN-MAR 2011

ASHES TO SOIL

PAGE 6-7



PHOTOS BY ROLF HAGBERG

Minnesota crops are being fertilized with ash from the nation's first poultry-manure power plant

Steve Miller, general manager of North American Fertilizer LLC, holds expansion plans for the company's Benson, Minn. facility. Demand is exceeding supply for NAF's ash fertilizer, generated by the nearby Fibrominn plant, which burns poultry manure to produce electricity.

BY LIZ MORRISON

Benson, Minn. — The phosphate, potash and sulfur in NAFmicro fertilizer aren't mined overseas — they're Minnesota grown.

North American Fertilizer LLC sells 110,000 tons a year of ash fertilizer derived from incinerated poultry manure. The ashes come from Fibrominn in Benson, Minn., a 55-megawatt electricity plant fired by a half-million tons of turkey and chicken litter. The leftover ash is a good source of essential crop nutrients.

The $5 million NAF facility was built in 2007 by a group of Minnesota farmers and entrepreneurs. AURI helped the group test ash fertilizer in University of Minnesota field trials. AURI was also involved in early planning and feasibility studies for Fibrominn.

At a time when U.S. fertilizer imports are on the rise, NAFmicro represents more than $10 million in retail sales of locally-grown, renewable fertilizer.

NAFmicro has been a hit with farmers, says Steve Miller, NAF general manager. "Everything we get from Fibrominn, we've sold. And demand exceeds our supply."

Creating opportunity

Minnesota's biomass energy industry is just getting started, says Al Doering, director of AURI's coproducts lab in Waseca. As this new energy sector develops, large quantities of biomass ashes will become available, he says, opening the door for new uses and enterprises. "NAF is a perfect example. They are building a new business around this renewable product. This is what economic development and job creation are all about."

NAF employs five full-time workers and three seasonal workers, and also contracts for trucking services to ship fertilizer between its warehouses in Benson and Olivia. The company is just finishing up a $1.8 million expansion, which will increase its fertilizer storage capacity to 100,000 tons. The additional warehouse space is needed to accommodate an increasing volume of ashes from Fibrominn, Miller says.

Nutrient-rich ash

One hundred truckloads of poultry litter roll into the Fibrominn power plant daily. The mixture of turkey and chicken manure, bedding materials and other biomass is burned in a custom boiler to generate high-pressure steam. The steam drives a turbine, generating renewable electricity for Xcel Energy.

A 500-foot-long overhead conveyor transfers warm ashes from Fibrominn directly to the NAF fertilizer plant next door. There, the ashes — which look like fine, gray sand — are screened, sprayed with water for better handling, and stored in cavernous warehouses.

The nitrogen in the poultry manure is consumed during combustion, Miller explains, but the minerals in the manure remain. In addition to phosphorus and potassium — primary crop nutrients — the ashes contain other important nutrients, including sulfur, zinc, copper, magnesium and boron.

Unlike commercial fertilizers, "NAFmicro fertilizer is not a blend," Miller says. Every particle contains primary, secondary and micro nutrients, which eliminates the need for mixing and allows more uniform application, he says. "We call it 'fertilizer for dummies.' Everything you need is in there."

This past fall, more than 75,000 tons of NAFmicro fertilizer were spread on central Minnesota farm fields to feed next season's corn, soybeans, alfalfa, wheat and sugar beets. Another 30,000 to 40,000 tons will be applied in the spring. In total, roughly 150,000 acres of central Minnesota cropland will benefit from NAF's renewable fertilizer, Miller says.

NAFmicro is distributed by nine farm-supply retailers in Minnesota, Iowa and South Dakota. The retailers pick up the ash from the warehouse and deliver it directly to fields, where it is applied with GPS-guided spinner spreader rigs and later incorporated into the soil through cultivation.

Because NAFmicro has a low nutrient density, the application rate is quite high — about 1,300 pounds per acre, compared to around 300 pounds per acre for a conventional dry-fertilizer blend. Although that raises transportation and application costs, it also means you get dense, uniform coverage, Miller says. "Fertilizer particles are spaced very close together, so crop root systems can easily come into contact with it."

Currently, NAF prices the fertilizer at a discount, compared to conventional P and K, Miller says. "The higher application and trucking costs are also factored into the wholesale price." As farmers come to appreciate the advantages of NAFmicro, the ash fertilizer could command a premium, he says. NAF is also pursuing high-value specialty fertilizer markets, such as gardens and golf courses.

Grower acceptance good

Brad Aaseth is manager of Bird Island Soil Service Center in Bird Island, Minn., which sells about a third of NAF's annual output. The 240-member grower cooperative also owns a stake in the fertilizer company.

"Demand for NAFmicro is very good," Aaseth says. "It's been a well-received product with lots of repeat customers. We committed our entire allocation by August. I had to turn down some requests."

NAFmicro has no nitrogen to leach into surface waters when crops aren't growing, so it can be safely applied in the fall — an advantage for many farmers, Aaseth says. Sugar beet producers, who must limit nitrogen to maintain sugar quality, also like the ash fertilizer, he says. Two years of research by Southern Minnesota Beet Sugar Cooperative confirmed that NAFmicro produced revenues comparable to a conventional fertilizer program. "We've applied quite a bit of it ahead of sugar beets this fall."

As for performance, "we haven't seen any disadvantages," Aaseth says. "It performs about the same as commercial fertilizer. Long term, the sulfur and other micronutrients might be an advantage." ■

Ash CAN!

'U' trials test the fertilizer value of biofuel industry ashes

BY LIZ MORRISON

Ashes from two types of incinerated biomass are a good alternative to conventional fertilizer, according to recent University of Minnesota research.

The nutrient content of ashes varies by the feedstock and combustion method. AURI sponsored trials in 2008 and 2009, which compared the fertilizer value of three types of biofuel ashes on corn:

- combusted poultry-manure ashes from the Fibrominn power plant in Benson, Minn.
- combusted corn syrup ashes from the Corn Plus ethanol plant in Winnebago, Minn.
- gasified corn cob and wood chip ashes, or biochar, from the Chippewa Valley Ethanol Company in Benson.

The trials were performed at the University of Minnesota's Southern Research and Outreach Center in Waseca — on soils that are low in phosphorus.

Biochar ashes, which have very low amounts of crop nutrients, had no agronomic value for corn production, says U of M soil scientist Jeffrey Vetsch, who led the research. But both types of combustion ashes proved to be good sources of phosphorus (P) and potassium (K).

In 2008, Vetsch compared two rates of commercial and ash fertilizers — a low rate that supplied 80 pounds/acre of total P, and a higher rate that supplied 240 pounds/acre of total P. The lower rate of poultry-manure ash did not perform as well as the commercial fertilizer or the corn syrup ash, Vetsch says. That's because not all of the P in poultry manure ash is immediately available to plants, he says.

But at the high er P rate, there was no significant yield difference between any of the fertilizers, Vetsch found.

About 60 percent of the total P and K in poultry manure ash is available to plants the first year, says Steve Miller, manager of North American Fertilizer in Benson, which markets the poultry manure ash as NAFmicro. The fertilizer is priced based on first-year nutrient availability, he adds. As with manure, additional P and K may become available to plants in subsequent years as a result of biological activity in the soil, Vetsch says, although that is not yet certain.

In 2009, Vetsch looked at how the ash fertilizers affected second-year corn yields. No additional P or K was added. Results were similar to the previous year. Vetsch continued the poultry manure ash trials in 2010 at three Minnesota locations.

NAFmicro fertilizer was applied at the recommended rate of 1,330 pounds of ash/acre, which supplied 80 pounds of immediately available phosphorus — a typical rate for a corn and soybean rotation. Preliminary results indicate that NAFmicro performed just as well as commercial fertilizer, Vetsch says. The trials will be repeated next year. ■

Ash from biomass incinerated by plants that produce ethanol and heat were tested for their fertilizer value at the U of M Southern Research and Outreach Center in Waseca. Studies show the ash fertilizer delivers as much available phosphorous to soils as commercial fertilizer.

SOLD OUT

Corn Plus ash fertilizer is a hit with farmers

BY LIZ MORRISON

Corn Plus — a 40-million-gallon corn ethanol plant that runs on biomass power — sells out of its renewable ash fertilizer a year or more in advance.

"The product is really popular," says plant manager Matt Rynearson. "There's definitely a market for the ash."

The Winnebago, Minn., ethanol maker generates most of its energy needs by burning corn solubles, an ethanol byproduct that is usually sold as livestock feed. Corn Plus sends 80,000 gallons a day of syrup, as it's called, to its fluidized bed reactor, as fuel. The fine, flour-like ashes left after combustion are pelletized for easier handling and sold as fertilizer.

Corn Plus produces about 7,000 tons of ash fertilizer granules a year. The ashes contain phosphorus, potassium and sulfur, but not nitrogen, which is consumed during fermentation. AURI-sponsored research trials at the University of Minnesota found that Corn Plus's 0-14-15-4 ash performed as well as commercial fertilizer at both low and high application rates.

A group of local farmers contract for all the plant's ash, Rynearson says. The growers apply it to their own cropland and sell the excess to other farmers. The granulated product is applied with conventional spinner spreaders.

Corn Plus receives a percentage of ash fertilizer sales, Rynearson says, but the company is not really out to make a big profit from the ash. "The environmental benefits are more important to us. We're trying to be green." ■