2 Tools Help Cut Nitrogen Costs (Editorial courtesy of Corn & Soybean Digest)

Leaf-reading sensors and data-modeled prescription services are saving fertilizer costs and nitrate loss.
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Think different

"If we could predict and control the weather, we could manage nitrogen perfectly," says Cliff Snyder, nitrogen program director, International Plant Nutrition Institute. "Until then, 30-70% of our applied nitrogen may not be taken up and will go to waste."

Three crop-canopy sensors use reflected light from foliage to calculate variable-rate sidedress N rates in real time: GreenSeeker (Trimble Navigation), OptRx (Ag Leader Technology), and Topcon (Topcon Positioning Systems).

Oklahoma farmer Brent Rendel exceeded his 100-bushel corn-yield average by 50% with just 75 pounds of nitrogen per acre. His Trimble GreenSeeker canopy sensors saved him $16,250 in sidedress nitrogen on corn by identifying no need for sidedress nitrogen for all his corn (at $25 per acre).

Perfect growing-season weather in 2014 helped him tremendously, but the sensor helped him capitalize on it. "Nitrogen can be mineralized from the soil from the biomass at a greater rate than applied and last year was one of those years,"Rendel says. "The timing of our moisture was perfect: we didn't have a wet spring, and we did not have nitrogen losses from excessive mid-summer heat. So all the nitrogen we put down was there and available to the crop."

"Most years are not this exceptional, but the technology allowed me to realize we were in that kind of year while I could still take advantage of it," Rendel says.

Ten years of using this sensor technology has increased his profits by $10 per acre on average by accurately identifying in-season nitrogen needs, he says. They also show him how weather and growing conditions affect nitrogen needs.

Rendel sidedresses at V8-9 with a Hagie toolbar and onboard canopy sensor. This real-time technology bounces two light wavelengths off the crop-foliage canopy back to a sensor, which assesses nitrogen needs and instantly translates a variable-rate nitrogen prescription on-the-go to the sidedress applicator.

"Optimal nitrogen rates vary widely from year to year, field to field and from place to place within a field," says Peter Scharf, University of Missouri plant science professor. "Canopy reflectance to diagnose and treat this variation in real time is a promising approach." (Watch a related video.)

Canopy sensor technology varies the sidedress nitrogen application rate based on sidedresser-mounted or cab-mounted crop foliage sensors. Darker green leaves and taller plants reflect certain light wavelengths differently than lighter-colored leaves. When a sensor-fitted nitrogen applicator crosses lighter-green plants, it increases nitrogen rates by comparing it to a high-nitrogen reference "yardstick."

"In 15 years you will all be using sensors," predicted Dave Franzen, North Dakota State University Extension soil specialist, at the December 2014 Conservation Tillage Conference in Fargo.

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Strip-tested tools

There are also several new technologies for in-season nitrogen-rate determination.

Jefferson, Iowa, no-tiller David Ausberger compared two different systems: the OptRx crop-canopy nitrogen sensor and the 360 Commander. The results were summarized by the Iowa Soybean Association On-Farm network (read the full report).

Ausberger alternated field passes across the 65-acre field, sidedressing **fertilizer** based on sensor readings from the OptRx and prescription-nitrogen rates from the 360 Commander (not an optical sensor, but rather a tool that delivers a VR prescription application based on data modeling by field zone). He sidedressed 32% urea ammonium nitrate (UAN) at V5-V6, which was 60% of his total nitrogen application. The rates ranged from 20 to 150 pounds nitrogen per acre, but most were around 60 pounds.

For the OptRx sensor, Ausberger established an nitrogen-rich reference strip/benchmark for each hybrid and field that defined the minimum and maximum sidedress rates.

Then, the OptRx automatically changed the sidedress-nitrogen application rate based on its red, red-edge and near-infrared light wavelengths, which bounce off the corn foliage to assess crop health and nitrogen needs on-the-go. Each wavelength works best at different growth stages to indicate plant vigor and biomass. The red-edge light band is most important when leaves begin to cover the rows, Franzen says.

In the other alternating strips, he relied on the 360 Commander to apply variable-rate nitrogen based on field management zones.

The two technologies were equally effective in determining Ausberger's nitrogen sidedress rates, and his yields were also the same between systems.

Pros and cons

Ausberger likes certain aspects of each in-season, nitrogen-rate prescription tool.

"I like that the OptRx is a one-time expense," he says. In contrast, the 360 Commander is a yearly, per-acre subscription.

Ausberger found it a challenge to keep up with the wide rate swings of the OptRx system. "Some of the very high and very low rates resulted from my pump and controller not responding quickly enough to changes as I drove through the field," he says. Next year he'll upgrade his valve controller system to better respond to the sensor.

"This isn't a 'set it and forget it' system," Ausberger says of the OptRx. "You need to have your crystal ball working alongside your Ag Leader software and hardware." As conditions change, the operator should change how he sets the OptRx parameters, such as minimum, maximum and target pounds of N per acre. Otherwise, "You can use this technology to very accurately misapply your nutrients," Ausberger warns.

"I like the idea of 360 Commander tracking what happens in my field through the year," Ausberger says, noting that it did not have the wild nitrogen-rate swings of the OptRx system. The system delivers more information than just the nitrogen prescription, constantly updating a zone's estimated nitrogen use based on each zone's limiting factor such as slope, soil type, rainfall, variety and previous nitrogen applications. "I'm interested to see what 360 Yield Center refinements are planned for 2015," he says.

Both tools appeal to Ausberger's efficiency mindset, both financially and environmentally. In 31 years, he and his father, Bob, have never tilled their lower-quality Clarion, Nicollet and Webster silty loam soils. As the national American Soybean Association's 2014 Conservation Legacy Award winner, Ausberger was nationally recognized for marrying soil conservation with profitable farming.

Sensor use with manure

By David Hest

Depending on the weather, organic matter in soils can provide a broad range of nitrogen to the crops. Adding variable applications of manure to the mix only increases the challenge of determining the right nitrogen rate.

That's why Dave Hammen, a swine and crop producer near Harper in southeastern Iowa, began experimenting with a crop canopy sensor on his farm in 2013. In 2014, he continued using the sensor for sidedress applications. He also enrolled in an Iowa On-Farm Network trial to help broaden his understanding of the sensor tool.

“In 2013, results from the OptRx sensor were super and the payback was tremendous,” he says. “In 2014, the results were less noticeable. If it also helps me become a better environmental steward, then to me it is enough of a benefit to keep using it.”

Improving environmental stewardship is critical, he says. “If we don’t take it on ourselves, we will be forced to become better stewards of the land,” he says. “And nitrogen management will be up there on the list as high as anything.”

In 2013, Hammen used the OptRx sensor to handle an especially vexing challenge. As part of his manure management program, he had varied manure application rates from 0 to 3,500 gallons per acre based on phosphorus needs. That left him with the potential for large variations in nitrogen, and no maps to guide him, as he doesn’t have as-applied mapping on his manure spreaders.

On variably manured fields, which also received a base rate of anhydrous ammonia pre-plant, he set the OptRx system to sidedress a rate of zero to 50 pounds of N. “Where I hadn’t put on hog manure, it put on 15 gallons (50 pounds of actual N), and where I had applied hog manure, it applied zero,” he says. “All the corn looked green, but when you looked at the vegetative index on the monitor, you could very quickly pick up the areas that didn’t have the hog manure.”

In 2014, with consistent manure applications on his fields, the OptRx N application range was less extreme. His On-Farm Network trial field was typical. It compared a variable-rate, OptRx-driven sidedress application with his standard side-dress rate of 60 pounds of N per acre. The OptRx system applied 39 pounds per acre on average, saving $10 to 11 per acre.

Yields between the OptRx and standard rates in 2014 were statistically identical at about 240 bushels per acre, his best yield ever on that field. End-of-season stalk nitrate tests showed nitrate levels were low to very low, indicating the crop might have benefited from more N in what turned out to be Hammen’s best-ever corn crop.

“With stalk nitrate tests that low, the question is, should we have put on even more N?” Hammen asks. “If we had known the size crop we were going to raise, we should have bumped the N rate. But in the spirit of doing a good job of N management, we would have had a hard time justifying that.”

For 2015, Hammen plans to use OptRx sensor to drive sidedress N applications on all his corn acres. He’ll use the same home-built toolbar applicator he’s used the past two seasons, which has about 3 feet of ground clearance. Long-term, he may consider adding high-clearance application equipment, as well as buying his own sensor system. “If I see results like the last two years, it will justify owning my own system,” he says.

« Not plug and play

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