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New technology and products are causing farmers to give starter fertilizer another look.

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MARCH ISSUE

Get A Good Start

Fertilizers placed near the seed can accelerate plant growth and turbocharge yield potential.

BY JOHN POCOCK

Ready, set, grow ... with starter fertilizer. That's the strategy Dave Nelson, of Fort Dodge, Iowa, takes at planting. Like a sprinter coming out of the starting blocks, Nelson wants his corn seedlings poised and ready for growth right from the seed chute.

"We're trying to give every seed the opportunity to have the most productive growing environment possible," says Nelson, who farms with his father, Gary, about an hour's drive northwest of Des Moines. "We'd never done much with starter applications until last spring, because we have fairly rich soils and didn't think we needed it. However, newer technology and application products are showing a better payoff, especially in corn following corn."

Historically, starter fertilizer use has been more common among farmers in more northern corn-growing regions. However, Fabian Fernandez, University of Illinois Extension soil fertility specialist, has seen the popularity of starter and "pop-up" fertilizer growing across a broader landscape.

"Any soils that tend to hold water, or clay-type soils that stay cooler in the spring, would also likely benefit from a starter fertilizer application," Fernandez says. Starter fertilizers generally involve at-planting placement of a small supply of nutrients near the seed in a 2 x 2

New technology advancements led Dave Nelson to transition to more efficient planter-applied fertilizer applications. PHOTOS: BOB ELBERT

band (2 inches deep and 2 inches to the side of the seedbed). "Pop-up" types of starters get placed in the seed furrow so seedling roots can rapidly reach the nutrient source. These fertilizers are not intended to supply all nutrients needed by the crop. Their primary purpose is to provide an accessible nutrient source for root and plant growth when adverse conditions occur soon after planting.

VARIABLE RATE. The Nelsons use a Precision Planting 20/20 SeedSense monitor with RowFlow to control starter dispersal. "It not only controls variable-rate seeding but also variable-rate applications of liquid fertilizer," Dave Nelson says. Strip-till helps protect soil from erosion, conserve soil moisture and apply nutrients where most needed.

"The controller shuts off liquid fertilizer applications two rows at a time to prevent overlap," he says. "With this technology, we know the savings are there for us instantly."

Attachments from Totally Tubular allow application of starter in-furrow at or behind the closing wheels on each side of the seed zone with the mere turn of two valves. "The planter-applied starter fertilizer is a liquid 6-24-6 product that goes on with a disc blade in the furrow at about a 6-gallon-per-acre rate," Nelson says. "The Totally Tubular tubes behind the closing wheels allow me to dribble liquid N [nitrogen] beside the seed trench."

After success with starter fertilizer last spring, the father-son duo decided to trade in their 24-row planter for a 32-row John Deere DB80 center-fill planter. "The new planter gives us 600 more gallons of liquid fertilizer capacity on the planter in addition to the two 400-gallon CAT side tanks that we have," Nelson says. "The extra capacity will help so that we don't have to stop for refills as much."

Nelson's goal is to continually stay ahead of the curve and proactively champion best-management plant-nutrient practices. "At some point, the EPA may decide to regulate how and when farmers can apply crop nutrients. We feel our new application system is much less vulnerable to nutrient loss, especially on the nitrogen side, than simply applying everything in the fall," he says. "We're trying to variably apply the appropriate N rate based on each field's fertility level."

CORN-ON-CORN CONSIDERATIONS. Nelson wants to continue transitioning the farm to fewer fall anhydrous ammonia applications toward more efficient planter-applied and sidedress N applications. In the meantime, the farm still relies on a half-rate fall anhydrous application for corn following corn.

"Corn planted into bean stubble is less sensitive to the need for fall N," Nelson observes. "So, when planting corn into bean stubble, we skip the fall anhydrous application, apply the starter fertilizer and supplement the balance with sidedress N."

In addition to using their Totally Tubular equipment to disperse starter fertilizer, the Nelsons also use the in-furrow attachment to apply a liquid insecticide at planting in corn following corn. "This lets us get N into the seed zone for early plant growth, and it also allows us to put on Capture insecticide for rootworm control," Nelson says.

Recently, farms in the Fort Dodge area have been experiencing more pressure from insects like corn rootworms than in the past, predominately where corn follows corn, says Larry Eekhoff, agronomist with New Cooperative, Inc., in Duncombe, Iowa. University entomologists generally prefer crop or trait rotation rather than layering strategies, but the economics have favored corn.

"This part of Iowa has a lot of acres in continuous corn, and resistant traits alone are not fully controlling rootworms," he says. "Currently, there is a big push for starter fertilizer use here due to the ability to put down a liquid insecticide with it. We're seeing some big yield increases by doing so."

ADDED BENEFITS. In addition to the payoff from traditional starter fertilizers, farmers in the area are also seeing a response to starter fertilizers that include zinc, says Eekhoff, who works with Nelson on both insect- and nutrient-management practices. "With the increased price per bushel of corn, there's an increased push to get the most yield per acre, and it's important to get the crop ▶

PHOTO: BOB ELBERT

growing well right from the start," Eekhoff says. "You never want to have a bad day in crop growth, and early seedling growth is highly responsive to zinc in deficient soils."

Nelson plans to continue side-by-side comparisons for various starter products that look promising for future use. "In our business, if you're not moving ahead, you're falling behind," he says. "Our goal is to have no status quo in our operation."

Still, a return on investment needs to be factored in when considering adding more products into the mix, Nelson explains. "It already costs about $30 per acre to apply 6-24-6 with Capture insecticide," he says. "We have to evaluate each dollar spent to see if it is paying us back. If we add a micronutrient and a growth promoter, it would boost our input costs up to $40 to 45 per acre."

BEST-CASE STARTER SCENARIOS. Farmers need to be cautious because, in some circumstances, starter fertilizers only provide an aesthetic benefit—the crop looks better but doesn't necessarily yield better, Fernandez points out. "In a nutshell, University of Illinois studies from the recent past show starter fertilizer provides the most benefit in a low-fertility situation when spring starts wet and cool," he says. "Fields with dense crop residue or fields planted to corn following corn could also respond better to a starter fertilizer application, because those are more challenging environments for establishing a good stand."

Dave Franzen, North Dakota State University Extension soil specialist, confirms the use of starter is generally profitable in northern growing regions most years. "In North Dakota, research shows significant improvements to corn yields from using starter fertilizer," Franzen says. "The biggest yield increase that I've seen in North Dakota research is a 30-bushel-per-acre increase. The lowest is zero. Normally, it's about a 5- to 10-bushel yield boost."

He encourages farmers to use soil tests to select the right starter. "The most common starter fertilizer for corn in North Dakota is ammonium polyphosphate [APP, 10-34-0], except where potassium [K] levels are low," he says. "In that case, corn growers typically use a starter with K, such as a 6-18-6 or 7-21-7."

Starter fertilizer improves yields by stimulating early growth, Franzen adds. "Most years, using any starter is better than using no starter in North Dakota. Using a 2 x 2 band works best because it won't cause seed damage; but not everyone is set up with the machinery to do that."

However, if Mother Nature provides an ideal growing season with a warm spring, then there's less benefit from using a starter. Franzen adds the only other nutrient that is generally applied with N, P (phosphorus) and K as a starter fertilizer in North Dakota is zinc. "North Dakota has a lot of acres that are deficient in zinc," he says. "Our soils are just naturally low in zinc, so we recommend its application in four crops, including corn."

Iron deficiency chlorosis (IDC) in soybeans is also a common problem in wetter soils in eastern North Dakota. "It's more likely to develop where pH is 7 or above due to iron uptake being decreased by bicarbonate ions," he says. "In these soils, a seed-placed, ortho-ortho EDDHA [iron Chelate] fertilizer like Soygreen can be helpful along with an IDC-tolerant soybean variety."

Fernandez says N and P are the two ingredients in starter fertilizer most likely to make a yield difference. "Potassium only has an effect if the soil is low for it," he says. "In Illinois, soils that tend to tie up phosphorus are less common than in other states. It's also pretty rare that farmers in Illinois will see deficiencies in micronutrients except in very sandy soils."

For information on micronutrient use and the relative value of higher-priced starter fertilizers, Franzen advises farmers to look at the Iowa State University nonconventional compendium of soil amendments and additives at: **www.agronext.iastate.edu/soilfertility/nutrienttopics/addbyproducts.html.**

BENEFITS OUTWEIGH NEGATIVES. "The downside to starter fertilizer use is that it's more labor and work intensive, and it's sticky, corrosive material to work with," says Bill Briggs, of Canby, Minn. "Still, the benefits outweigh the downside by quite a bit," he adds. "We've tracked big improvements in what we've seen through the yield monitor all the way to our stand counts after using starter."

Briggs owns a planter together with a neighbor, Wayne Pederson. About six years ago, they built a cart with two 750-gallon tanks to pull behind their planter when planting corn. "We use 10-34-0 in-furrow with the seed using a stainless-steel drop tube and dribble 28% N on top of the soil 2 inches to the side of the seed," Briggs says. "A Honda 25-hp motor runs the hydraulic pump."

The liquid N application helps hold the crop until Briggs sidedresses anhydrous ammonia. "We're at a constant 7-gallon-per-acre rate on our 28% N application," he says. "That's been a pretty good standard for ▶

us, and it's fairly reasonably priced, at about $350 to 400 per ton."

Briggs farms mostly yellow clay soils that tend to hold water, so fall anhydrous ammonia applications haven't proven effective in the past. "We don't usually have the time or the right conditions to fall-apply anhydrous," he says.

In 2011, Briggs started to vary application rates based on soils using a Case IH AFS Pro 600 control monitor and an OmniSTAR HP/XP GPS guidance system. "We vary the rates on 10-34-0 between 4 to 7 gallons per acre, but the average is about 4.5 gallons per acre," he says. "Our low-fertility fields get a higher rate, but at $700 per ton, it gets too cost prohibitive past the 4.5-gallon-per-acre rate on a lot of fields. Even on the low-fertility soils, there's not as much bang for the buck above 6 gallons per acre."

Briggs relies on 2.5-acre grid soil samples to vary rates. "We have very rolling ground—the fertility on the hilltops differs from the side hills, which differs from the bottom ground," he says. "So, it pays to vary the rates here."

Overall, though, starter fertilizer use is all about efficiency. "The goal is to maximize production with minimal fertilizer cost," Briggs says. "That's our main reason for using it." ●

Dean Ahlbrecht (left) reviews a history of yield maps with crop consultant Curt Burns.

PHOTO: TOM DODGE

Tap into **Precision Starter**

Curt Burns, a Stewart, Minn.–based independent crop adviser, has been working on variable-rate precision-applied starter fertilizers with clients since 2010. In the central part of Minnesota, Burns sees soil pH levels ranging from 7 or below to 8.2 or even higher—sometimes within a single 80-acre field. Crops on high pH ground need higher levels of phosphorus in the starter fertilizer because high pH soil levels tie up phosphorus in the soil, inhibiting plant uptake of the nutrient.

Burns' goal was to analyze his clients' grid map samples to see where added starter might be beneficial and then to determine if there was any yield benefit from the higher rates of starter. "We're dealing with excessively high pH levels in certain parts of the fields, and, in the last few years, we've noticed on our yield maps that we have significant yield drag in those areas," Burns says. "Phosphorus is the key because it is an important nutrient for early plant growth, which ultimately in the fall comes down to test weight, dry down and yield.

"Every time you have a high pH area, you have lower phosphorus readings," he continues. "You can broadcast thousands of pounds of phosphorus, but you'll have a hard time building it up in those high-pH areas. It takes a long, long time as opposed to direct injection into the seedbed."

Burns consulted his mentor and colleague, agronomist George Rehm of the University of Minnesota, and they decided to boost the levels of 10-34-0 starter fertilizer (ammonium polyphosphate) applied directly into the furrow in a "pop-up" practice according to various pH levels throughout the corn fields.

"We decided to jack up those high-pH areas with higher amounts of starter phosphorus so it wouldn't hurt the seed but would boost the benefit by making phosphorus more available to the young root systems," Burns explains. "If we did it right at planting time, in the furrow, there would be little opportunity for the phosphorus to be tied up in the soil and be available directly to the roots."

Burns first tried this "prescription" application in 2010 on a client's corn-on-corn operation, which provided an apples-to-apples comparison of 2010 yield results to 2009 yields. "From 2009 to 2010, we saw a 15-bushel advantage in these targeted areas by raising the 10-34-0 rates. The 2011 results were consistent with that advantage, as well." He went on to replicate those results with several other clients and today has 15 clients working with his prescription approach.

TRIAL RUN. Dean Ahlbrecht, a Burns client and corn, soybean and sugar beet farmer from Hector, Minn., was impressed enough seeing the yield results from other farms to try it in his corn fields last spring (2012). Ahlbrecht was one of Burns' earliest customers with grid sampling 20 years ago. Using his history of yield maps to see how pH levels were affecting yields, Burns and Ahlbrecht opted to try boosting starter fertilizer rates above the standard 5 gallons per acre in areas of 7.5 pH and higher.

"Our prescription varied the rates from 5 to 9 gallons," Burns explains. "We stayed with 5 gallons of 10-34-0 on pH of 7 or below [the level at which pH is considered neutral]. From 7.1 to 7.5, we went to 7 gallons. In areas at 7.6 and above we'd go to 9 gallons of 10-34-0 per acre." Ahlbrecht has maintained check areas of similar pH levels where starter was not increased for comparison. ▶

While some farmers are hesitant to invest in the added cost of fertilizer up front and the pumping/injection technology for the planter, Ahlbrecht believes the yield increases should significantly outweigh the initial startup costs.

"My thing was basically, what can I do in these high-pH areas to boost my yields?" Ahlbrecht says. "When you come in with variable rates and put that starter fertilizer on the seed in areas where you need it most, it makes sense that the benefit will be there."

PLANTER MODIFICATIONS. The plumbing system Ahlbrecht installed on his planter consists of a variable-rate hydraulic fertilizer pump, electromagnetic flow meter and hosing down to the injection system on the planter gangs, which are spaced for 22-inch rows. He explains the two keys to this system are having an electromagnetic meter that can change the flow rate quickly on-the-go and hose orifices large enough to handle the various pressures for 5 to 7 to 9 gallons on the fly.

"If you're planting 5 miles per hour, and you want to put on 9 gallons, this setup gets up to 65 pounds of pressure, which is a lot," Ahlbrecht says. "Coming back across the field, I might want to put on 5 gallons at 4 miles per hour, which is only 10 pounds of pressure. It's crucial that a system is capable of handling that range.

"I think you can take any field out there, and if you decided to just put on a flat rate of, say, 7 gallons of starter, you'd spend much more money than investing in variable rate," Ahlbrecht adds. "Sure, the 'Mr. Tightwad' in me only wants to spend money on 5 gallons of starter, but after watching this with my neighbors over three seasons, I know 5 gallons just isn't enough for those high-pH areas."

– By Tom Dodge

Pop-up **PRECAUTIONS**

More farmers are applying "pop-up" starters directly into the furrow at planting. While this instant-access-to-fertilizer option can provide impressive results with increased yields—particularly in marginal high-pH soils—precision and caution must be used to avoid damage to seedlings.

Dan Kaiser, Extension soil fertility specialist at the University of Minnesota, says there are several precautions to take into account for specific, targeted areas of a field.

All fertilizers contain salt, which can bind up water in the soil away from young root systems. They can even draw vital moisture out of that root system—a crucial consideration in dry conditions. Higher pH levels are prevalent in drier, sandier soils, the exact place where you might want to ramp up levels of starter phosphorus. So proper amounts of starter and placement of the fertilizer is vital.

Added urea, which sometimes is used to boost nitrogen levels, poses the highest risk to potential crop damage. Kaiser's research has also found that ammonium thiosulfates (ATS) in starter fertilizers can pose a threat to the crop in drier conditions, too. While low rates of ATS may not seriously reduce stand in loamy soils, plant growth is reduced when soil moisture is near field capacity. Sandy soils have about half of the available water-holding capacity of loam, and the crop damage threat can be at least two times greater.

Kaiser adds monitoring crops is important, but when damage is noticed after emergence, it's too late to rectify the problem short of trying to replant those areas. If damage occurs, cutting rates of starter fertilizers may be a viable option, though eliminating the practice of starter fertilizer there may be the best alternative.

Adding Boron to the nutrient list in a starter prescription is not highly recommended because it can do more harm to plants than either nitrogen or sulfur levels.

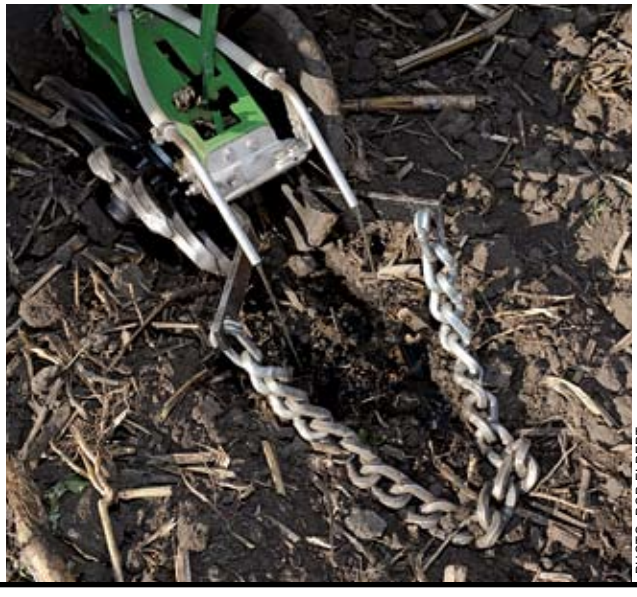
"In our experience," Kaiser says, "damage from starter will occur at the initial outset of emergence; therefore, by the time you see the damage, there is no way to correct it."

He adds adequate moisture will alleviate many of the problems with starter fertilizer. The more rainfall during the early growing season, the lower the risk and the more flexibility that can be applied.

"Any placement with at least 1 inch of soil between seed and the fertilizer band will provide far less of a risk because the first roots to emerge do not need to grow through the fertilizer band," Kaiser says. "That doesn't mean there is no risk for damage, but the risk is far less. There is not a 100% safe source of fertilizer for 'pop-up' placement, so knowing these risks is important to ensure the best possible outcome and even emergence after planting."

Careful monitoring and analysis of grid samples are also crucial to a successful prescription starter fertilizer program.

– By Tom Dodge



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