NO-TILL FARMER

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Special No-Till Management Report No. 37

Strip-Till Solutions For Better Results

Today's high diesel fuel and fertilizer prices, as well as the need to better protect soils and manage moisture, require a more innovative, precision approach to farming.

By No-Till Farmer Editors

Strip-Till Farmer
The No.1 Source For Strip-Till Practices And Equipment

Strip-Till Strategies

Bringing You Strategies to Strip-Till Successfully

By Darrell Bruggink, Executive Editor

If all farmers were no-tilling, that would likely be utopia, but the editors of *No-Till Farmer* have never held the position that, "Pure no-till is the only way." While we likely would argue, "No-till is the best way," we like to see farmers moving in the direction of no-till. Strip-till fits that proposition.

Our 4th annual No-Till Practices survey in 2012 revealed that 17% of our readers are using strip-till on their farms. Interest in strip-till remains strong, as that number is up from 13% when we conducted our first-ever no-till survey in 2009.

Considering that 31% of our readers conduct minimum tillage and even another 3% still use the moldboard plow, certainly strip-till could be a practice that helps bring these farmers closer to a no-till situation.

The Midwestern version of strip-till appears to have been around for 30 years. *No-Till Farmer* has been there since the beginning covering the techniques and strategies of the practice.

This latest special report highlights some of the best tips found within the pages of both our newsletter and the *Conservation Tillage Guide* magazine in the past several years. We'd like to thank Environmental Tillage Systems for its support in making this report possible so that we can pull all the best ideas and practices into an easy-to-reference report.

In This Special Report:

TECHNIQUES & STRATEGIES

STRIP-TILL SETUPS

NUTRIENT PLACEMENT

ALTERNATIVE SYSTEMS

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How To Steer Clear Of Fall Strip-Till Gaffes

Manufacturers share the most common errors producers make when strip-tilling in the field — and explain how to avoid them.

By Mark Moore

Strip-till remains an up-and-coming practice being used by more growers each season. But because it's a new technique for many farmers — and one that requires a high degree of management — it's easy to make mistakes.

Many growers want to make the change to strip-till quickly and easily. However, transitioning requires upfront research to fully understand the practice and determine how quickly your objectives can be met.

The editors of *No-Till Farmer* recently asked a number of strip-tillage equipment manufacturers to share their experiences on what farmers do wrong when first adopting strip-tillage. We identified several key mistakes and share opinions on how to correct them — or avoid them altogether.

MISTAKE #1

Not Understanding The Equipment

No Fit-All Solution. Growers need to understand strip-till equipment is unique because it may function flawlessly in mellow soils that break and crumble in textbook fashion. However, the strip-till unit may need to function as a primary tillage tool in hard, compacted soils that are wet, rock and stone infested and nearly impossible to break into manageable pieces, says Gary Wallander, product support coordinator for Brillion Farm Equipment.

Add 200-bushel-plus corn residue or 60-bushel bean residue and things get very interesting.

"It's situations like this that beg strip-tillers to set their expectation level where they are comfortable," Wallander says. "In most cases, there is not a generic strip-till machine that will work in all conditions all of the time."

Vince Tomlonovic, general manager of Hiniker Company, agrees that producers must be careful to make the necessary adjustments based on conditions.

"Seldom does one setting fit all conditions," he says.

Horsepower Needs Key. Producers also make the mistake of being underpowered when using a strip-till implement.

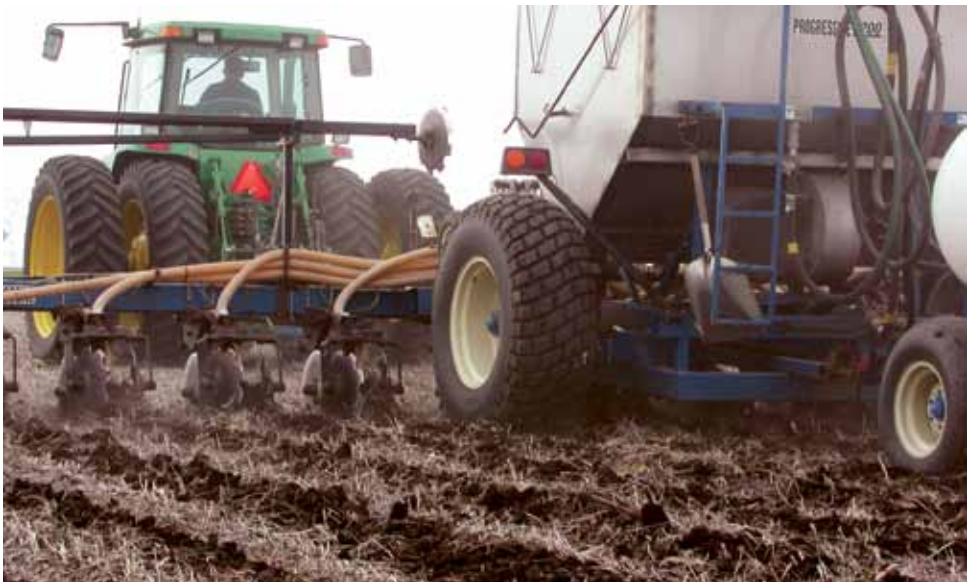
"Strip-till implements, pulled at the proper depth, require 20 to 30 horsepower per shank. A grower who believes his row width must be consistent from strip-till to planter to harvest and tries to pull a 12-row tool 8 inches deep at 5 mph with a 200-horsepower tractor can find all kinds of troubles," says Mike Petersen, agronomist at Orthman. "As a result, we see a lot of broken-down tractors, too much slippage, high fuel consumption, reduced pulling speed, cloddy conditions, poor seedbed and headaches galore."

While each of the strip-till tools on the market today have a recommended power need to pull each shank in the ground, Petersen adds it's critical that you know your soil types.

"Sandy soils will require approximately 20 horsepower per shank unless the soil is seriously compacted," he says. "The heavier the texture, we know our tool will require 30 horsepower per shank. Studies have shown that in sandy clay loam soils, up to 4,000 pounds of force is required to push the shank into the ground and pull it at depths greater than 12 inches. Multiply that across 12 rows and there is a need for lots of horses up front to get the job done.

"It's also well known that after 2 years of strip-tilling, farmers have seen a decrease in power needs because of the soil becoming more mellow, increased worm action, more residues and improved moisture conditions."

Determine Strip-Till Goals. Richard Follmer, owner and engineer of Progressive Farm Products, says farmers can make



AVOID THE TRAIN. Mounting a dry fertilizer hopper on the strip-till tool bar eliminates one thing that you'll need to pull. You should avoid the "train" of a tractor, dry or liquid fertilizer cart, strip-till toolbar and anhydrous nurse cart.

strip-tilling very easy or very hard, depending on the equipment.

"Farmers need to think about what they want to accomplish and how they want to accomplish it," Follmer says. "When buying equipment for strip-till, the farmer needs to decide what fertilizer he's going to place in the strips — dry or liquid — and whether he is going to apply anhydrous ammonia at the same time and how he will do that."

One concept a farmer should avoid is pulling a "train," Follmer says. This "train" would consist of the tractor, pull-between dry or liquid, a toolbar and nurse tank and would have a length of 100-plus feet.

"Unless you have a winch on your toolbar, how do you back this "train" up to hook up to the nurse tank? What do you do when you get into a tight corner? How do you back into a corner?" Follmer says. "What the farmer needs to do is purchase a bar with dry or liquid equipment mounted right on the toolbar, is moved around like a two-wheeled cart and can be backed up and hooked up to a nurse tank by just the driver."

Poor Setups. Rob Zemenchik, ag engineer with Case IH, says he often sees equipment not set up with the necessary attachments to handle different residue, down pressure and agronomic requirements.

"Residue managers, if necessary, should be on the planter, not the strip-till unit. Overly exposing the berm to weather over the winter can lead to berm erosion, leaving fields flat and losing the warm-up and dry-down benefits of strip-till," he says.

Also, he sees a lot of farmers not correctly matching their strip-till components.

"Tractor horsepower and configuration, monitoring systems, planters and other implements need to interact well with the strip-till machine," Zemenchik says. "For example, picking 'cheaper' strip-till machines or converting old bars to reduce the cost of transition from conventional tillage may provide less draft, but often gives up shank-depth consistency and holding power, leading to inconsistent field output, fertilizer placement when simultaneously root zone banding and planting depths."

Take Time To Adjust. Farmers know the importance of evaluating the performance of their combines to achieve proper operation. Experienced strip-tillers know the need to give similar focus to their strip-till applicator since they perform many key operations in one pass, says Steve Drissel, tillage marketing manager for John Deere.

"Many times, strip-till machines are set and adjusted at the farm site, but the settings may not get the attention in the field that they deserve," Drissel says. "Producers will spend hours, even days adjusting their combines — which is important. They need to spend a little time looking at their machines in operation within the field."

The consequences of not properly setting the machine means residue will not flow through the machine properly, nutrients will not be placed at proper depths and the machine will pull too hard or easy. It can lead to seedbed inconsistencies and a berm that's too tall or too flat.

"It can be very difficult for the operator to see all of the components from the cab of the tractor and the operation of the tool; therefore, it's very important that a person on the ground view the machine while it's at proper speed and depth," Drissel adds.

> "Strip-till implements require 20 to 30 horsepower per shank..."

"Some things to watch for include being level front to rear and side to side, the front coulters cutting the residue, observing the row cleaners moving residue, the closing discs moving soil, the baskets sizing clods and the firming of the berm. Make only one adjustment at a time and observe that adjustment in operation.

"It's important to understand that making one adjustment can have an impact on another area of the machine, so some settings may need to be re-checked after all adjustments are made."

Maintain Suggested Speeds. Nick Jensen, vice president of marketing for Thurston Mfg., says farmers often don't stay within recommended operating speeds.

"Most farm implements come with a recommended operating speed, and most operators tend to ignore the recommended operating speed," Jensen says. "If you do this with a strip-till applicator, no part of the strip-till implement will run properly."

If you run too slowly, coulters will not have the proper rotational speed on the blade to cut correctly, Jensen says. Residue management tools will not sweep residue out of the row; shanks will not fracture and stir the soil optimally; disc closers will not fill and hill the furrow properly; and baskets will not break up clods and level correctly.

Jensen says that if you run too fast, residue management tools may throw residue into neighboring rows. Fertilizer may not be evenly distributed throughout the row or may be placed unevenly within the row if the distribution system cannot keep up.

"Operate the machine at the manufacturers' recommended operating speed and make sure you have a tractor with enough horsepower to pull it at the recommended operating speed without cheating on depth," Jensen says. "If you're unable to complete your strip-till in the fall without exceeding the recommended operating speed, consider a strip-till implement with a wider swath width, running multiple strip-till implements or finishing in the spring."

Think Systems Approach. Dean Carstens, president of Twin Diamond, says farmers must not think of strip-till as another tillage method.

"The consequences of thinking that all strip-till is just another piece of metal will deprive the farmer of the true profit potential," he says.

The most common mistake made by farmers is assuming any strip-till machine will go through anything, Carstens says.

"Trash management behind the combine is extremely critical," he adds. "Uneven distribution of residue creates nightmares for the strip-till and planter operators. Avoid hairpinning of residue by investing in a chopper/spreader for your combine."

Mistakes Trying To Match. Mark Bauer, founder of Environmental Tillage Systems, cautions farmers that it's not necessary to try to match the strip-till machine to the size of their planter.

"Trying to match a 12-row planter with a 12-row strip-till machine can result in a mismatch, if the tractor is not large enough to handle the size of the strip-till machine," he says. "This can result in not achieving the proper depth of tillage. Also, this can result in limiting the tractor's ability to handle the strip-till machine in less-than-favorable conditions, such as an early snowfall."

Derek Allensworth, manager with Yetter Mfg., says strip-till equipment design is different and must be set for desired results.

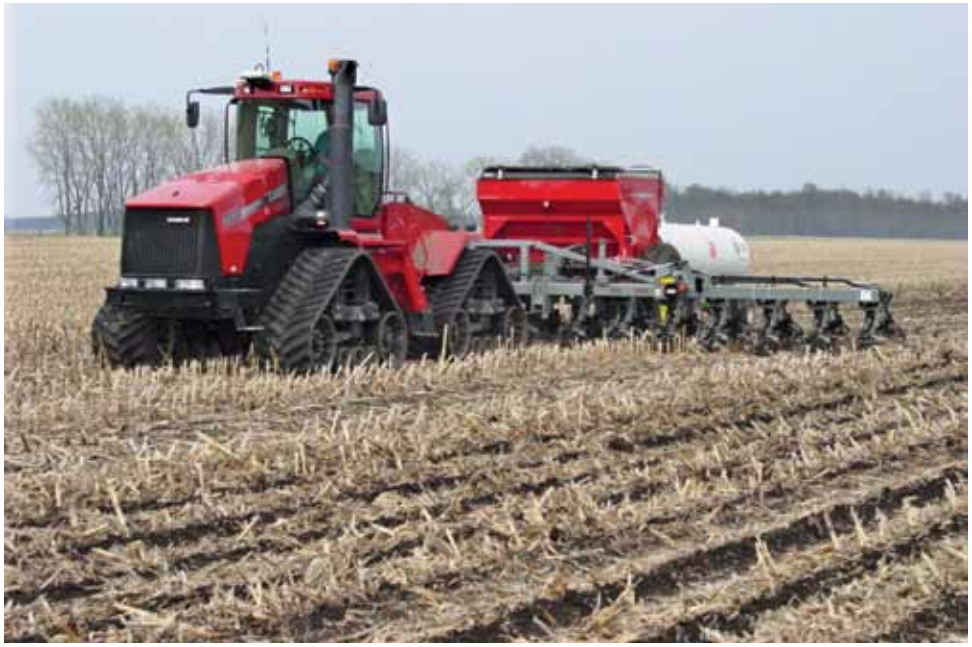


PHOTO COURTESY OF HINIKER

DON'T BE TOO FINE. The soil in your fall strips should be coarse so it can stand up to the weather. Cap the strip-till zone with a 4- to 5-inch mound of chunky, rough soil. Rapid snow melt can lead to erosion with soil that's too coarse.

"Depending on soil types, field conditions, fall or spring strip-till, crop rotations, speed, depth, desired strip width or height, fertilizer being placed or type of knife being used, these all are items the farmer needs to consider when setting the equipment for the desired strip or berm," he says.

MISTAKE #2

Not Investing In A Guidance System

"When a grower decides to go to strip-till, they need to consider incorporating a quality guidance system into the program," Wallander says. "This is a major investment, but the payback will be generous.

"Many growers who started out without a guidance system have later wished they had done it sooner."

Stripping Requires Accuracy. Proper GPS precision guidance is necessary to fertilize, strip-till and return to the same rows next spring, Orthman's Petersen adds.

"We've seen research that found the placement of fertility has great implications on growth and yield," Petersen says. "In Oklahoma, Nebraska and Colorado, separate projects found that planting 8 inches off of center from where fertilizer was placed caused diminished stands and a 30-bushel drop in continuous-corn yields.

"In high-residue conditions, if residue blows around and covers the strip, it becomes difficult to see where to drive the tractor and planter. Seeding can be a great headache for growers without GPS repeatable guidance.

"Top-quality GPS guidance has become a powerful ally for the grower. Being able to come back onto a line where strip-tilling was done and the fertilizer was placed and wanting to turn the soil into a top-notch seedbed is what strip-tillers need at planting time."

Embrace Precision Technology. Jensen adds that some producers are using row markers instead of GPS with field-mapping capabilities.

"Yield loss from missing the center of the strip-tilled row when planting has shown to be more dramatic than some might think," Jensen says. "Yield loss can begin to occur when the seed is planted as little as 2 inches off center in a strip-tilled row and increases from there.

"Being off the row will affect germination, plant stand and root development. It can put unnecessary stress on a young plant during critical times of development."

Moving to strip-till means it's time to embrace technology like RTK.

"That will enable users to match their 12-row planter with an eight-row or a six-row strip-till machine," Bauer says. "Users should focus on matching their strip-till machine to the horsepower of their tractor, rather than to the size of their planter."

MISTAKE #3

Failure To Consider Soil Conditions

"Numerous customers are of the belief that all soil types and conditions will work the same," Wallander says. "This is one area where equipment can come into the equation. Strip-till machines need to be versatile so different conditions can be met."

Know Compaction. Petersen says farmers may not take into account the depth of the common compaction layer. They may run the strip-till implement too shallow and not alleviate compaction.

"Compaction limits intake of water, downward water movement, root development, drainage of the surface and yield," Petersen says. "Farmers need to dig observation holes in several areas of a field to determine where the compaction zone occurs, how thick it is, what depth the compaction zone's bottom is and knowing what tool to use to alleviate the problem.

"When that is determined, adjust the shank to get under the compacted zone and shatter it; however, you don't want to do that to the point you cause it to explode and roll in front of the shank and cause huge clods, gaps and fissures. That can dry out soil and create cavities that may cave in the soil, creating a rough seedbed that is up and down and rolling like a roller coaster. When tilled to the correct depth, the seedbed will turn out mellow after the winter."

Manage Residue Properly. Follmer says that when strip-tilling in continuous corn, farmers should lay out the new strips between the old corn rows rather than trying to go back on top of the old rows.

"This reduces plugging of the row units. Also, driving on top of last year's corn rows reduces compaction," he says.

Drissel says residue management must be correct for every piece of equipment from the combine all the way to the in-crop spray applications.

"Farmers may experience residue flow complications in areas of the field where the stalks were not managed properly by the header or residue was not evenly spread from the rear of the combine," he says. "It should be verified that the combine is operating at the proper ground speed compared to the speed of the corn head.

"Knife rolls or fluted rolls, the rear chopper and the spreader should have worn

parts replaced and be operating correctly."

Avoid Wet Conditions. Farmers may also try to strip-till in poor conditions, trying to complete work before winter sets in.

"If the soil is too wet, any strip-till applicator can cause sidewall smearing," Jensen says. "The additional soil compaction effects from sidewall smear and pulling heavy equipment over wet soil will likely negate any gains in yield from strip-tilling.

"If compaction layers exist in the soil profile, you will rarely see any advantage to strip-till. Soil compaction must be alleviated for strip-till to work, so don't cause compaction by strip-tilling in wet soil."

Tony Randall, national sales manager for Redball, says farmers should remember that strip-till is a tillage pass. Sometimes, he says, no tillage is better for the soil than working too wet.

"If fall strip-tillage is being done, you almost always have a large window left to complete the strip-till pass, so let the soil dry," he says.

Don't Be Too Fine. Bauer says farmers also sometimes leave the soil texture too fine in the fall.

"After fall tillage, the soil should be coarse," he says. "The zone should be capped by a 4- to 5-inch mound of chunky, rough soil. The coarse soil texture is needed to handle the weather.

"Rapid snow melt when the ground is still frozen can result in erosion in the zone when soil has been worked to a fine texture and matted down. Further, if containment coulters leave a consistent cut down the side of the zone, a runoff channel can form, resulting in increased water erosion."

Allensworth says farmers are accustomed to field tillage in less-than-ideal situations.

"With strip-till, remember that you are making next year's seedbed, and this is not the field where you will be making two or three passes next spring," he says.

MISTAKE #4

Poor Fertility Management

Farmers who apply all nitrogen with a fall strip-till operation increase the odds of leaching nitrogen out the bottom of the soil profile or beyond the reach of roots.

"That's a potential waste of thousands of dollars when fertilizer is lost beyond what the growing crop can access. Each implement pass in the field adds cost and with fertilizer, it's expensive," Peterson says. "This is an issue for those who want to apply large quantities of anhydrous in the fall.

"With nitrogen costing $1,100 per ton, applying single shots at 200 pounds per acre is courting disaster and monetary loss."

Splitting the amounts, something akin to spoon-feeding the crop, will provide the best bottom line. This allows the farmer to see through some tissue, leaf or soil sampling that a lump sum of 250 pounds of nitrogen wasn't needed and saves money.

Applying smaller doses of nitrogen and feeding the crop in increments allows the grower to exercise fertilizer options—anhydrous vs. varying formulations of liquid, nitrogen with sulfur compounds, nitrogen with phosphates, stable low-salt nitrogen formulas and slow-release nitrogen compounds. Petersen says this can enhance the grower's opportunities to decrease cost, become more crop efficient, potentially use less products and usually grow a healthier plant.

> "Users should focus on matching their strip-till machine to the horsepower of their tractor…"

Carstens says a serious mistake is planting over strips that have had too much ammonia applied. The consequence is loss of stand.

"The opinions on the maximum amount of anhydrous to be applied are as varied as stars in the sky," he says. "The general rule of thumb is the higher the ammonia rates, the higher the risks. To avoid loss of stand, we suggest split-applying nitrogen."

For example, Carstens says consider strip-tilling 90 to 120 pounds of anhydrous with 6 to 9 gallons of 10-34-0. The duel application will create a smaller diffusion band of anhydrous. Use a higher nitrogen starter (2-by-2-inch placement or 2-inch with dribble) like a 30-10-0-5 liquid starter.

Sidedress additional anhydrous ammonia or 28-0-0-5, or foliar feed a slow-release nitrogen when Roundup is applied. By split-applying the nitrogen, considerable reductions in nitrogen can be taken."

Randall says farmers also make the mistake of applying anhydrous too early.

"In fall strip-till, the window is there to wait for soil temperatures to cool before applying anhydrous," he says. "If applied too early, expensive nitrogen might be lost. This is no different than fall-applied nitrogen using a standard toolbar system."

According to Follmer, many farmers are applying only anhydrous in their strips and broadcasting phosphorus and potassium.

"When doing this, they miss out on the real savings of applying P and K in the strip. You can usually reduce P and K rates in half. At the cost of P and K, a farmer can pay for a strip-till toolbar very quickly," Follmer says.

Bauer says applying phosphorus and potassium and other nutrients in the fall and distributing fertilizer evenly throughout the zone allows the phosphorus and potassium to be processed by the microbial action in the soil.

"In addition, applying P and K in the spring can burn the seed from contact with P and K oxides from heavy salt fertilizers," Bauer explains. "As much as a 40% higher utilization of nutrients can be available for plants, leading to higher overall yields. This can be more important in low-fertility soils."

Some farmers are not even using a fertilizer program with strip-till.

"A primary advantage of strip-till is being able to place fertilizer in the root zone while creating a seedbed in a one-pass operation," Jensen says. "If you're not currently placing fertilizer with your strip-till applicator, you are missing out on roughly half of the advantages of using strip-till."

Talk with a local agronomist or other strip-tillers that have experience with fertilizer placement in your area to find out what has worked well for them, Jensen says. Then talk to your equipment dealer to see what fertilizer application options are available on your strip-till implement.

Carstens says a common mistake is assuming the fertility programs used in past practices are the same used in strip-tilling.

"Not understanding the program could lead to over- or under-application of fertilizer, poor timing and other adverse effects," he says. "The key to successful strip-tilling is to know where the fertilizer goes and when, what and how much to apply."

Spring Stripping Strategies

With last-minute changes being made in crop rotations and expansion of continuous corn acres, spring strip-tilling is gaining momentum.

By Frank Lessiter, Editor

If you happen to think that strip-tilling is mainly a fall practice, guess again.

More growers are seeing major benefits by strip-tilling in the spring. They cite cropping flexibility, slashed fertilizer costs, reduced winter erosion and the ability to deal with changing weather conditions as some of the advantages of strip-tilling in the spring.

While many growers prefer to strip-till in late fall, others see distinct advantages to waiting until spring. What it really boils down to is what you feel is best for your own soil conditions and crop mix.

Yet one thing is for sure: we'll see extensive strip-tilling across the Corn Belt this spring.

Jim Basset finds a number of no-tillers switched last year to strip-till with continuous corn.

"Strip-tillers are happier coming from a no-till experience because they are already used to having heavy residue laying on top of the soil," says the head of Dawn Equipment Co. in Sycamore, Ill.

He says crop rotation can hold the key to the timing of a strip-till pass. With northern wheat fields that will be planted to corn, Basset prefers to strip-till in the fall to eliminate excessive residue moisture. With corn going into soybean stubble, he sees no significant differences between fall and spring strip-tilling. But with high-yielding continuous corn in the Corn Belt, he recommends strip-tilling in the spring, often as early as mid-March in central Illinois.

"Running through fields in the fall just to have it done doesn't make sense with so much chaff coming out of the combine," he says. "The quality of a fall-built strip is often not as good as a spring strip.

"You can build a blacker strip in the spring because you don't have to worry about residue blowing back over the strip in the winter, which often leads to excessive moisture in the berm and impacts soil settling. Plus, you don't have to worry about costly losses of fall-applied nitrogen."

Basset says spring stripping is a valuable option for many corn growers. Another advantage it provides is the added flexibility for your cropping program.

"With continuous corn, you have to clean the residue off the strip," Basset says. "With the tremendous amount of biomass that can be produced with corn yields upward of 240 bushels, some farmers think they have to bury the residue.

SPRING-BUILT BERMS. Veteran strip-tillers often recommend running the strip-till rig at a shallower depth in the spring to avoid working wet soils.

"When they bury trash with tillage, it seems to suck much of the nitrogen out of the ground. Instead, all you have to do is scoop the residue to the side of the row areas to make strip-till work."

Randall Reeder recommends running the strip-till rig at a shallower depth in the spring to avoid working wet soils.

"Most growers strip-till in the fall and let natural weathering settle the soil structure over the winter," says the Ohio State University ag engineer. "With spring strip-tilling, you can't take advantage of freeze-thaw cycles, and big clods produced while stripping can dry like chunks of concrete. It's difficult to turn into a good seedbed."

Spring Preference

Kurt Afdahl prefers to strip-till darker soils in the spring. "With spring strip-tilling of these soils, we find soil temperatures at planting are 5 degrees warmer than with strips made in the fall," says the Hammond, Wis., grower. "When we have fall stripped, the berms are fairly hard by spring, while spring-built strips are mellower and provide a much nicer seedbed.

"On some heavy clay soils, we strip in the fall and again in the spring. These clay soils don't dry out quickly enough in the spring if we don't fall strip them. When re-stripping in the spring, we run much shallower and faster."

Several *No-Till Farmer* readers credit spring strip-tilling with sharply reducing soil compaction concerns caused by spreading manure in the winter months. Others are convinced that spring stripping reduces erosion by leaving the ground covered with undisturbed residue over the winter.

Jerry Crew maintains the major benefit of strip-tilling in the spring is providing more extensive wintertime corn stalk decomposition, especially on highly erodible ground. Yet the Webb, Iowa, grower says a lack of time is the major drawback of waiting until spring.

With continuous corn, he strip-tills between the old rows and applies 100 pounds of nitrogen in the strips. Later, he sidedresses nitrogen along the strips based on nitrate tests.

"With spring stripping, the residue has settled and the strips have less residue at planting time," he says. "Fall strip-tilling tends to leave more residue in the strips

TIMING IS CRITICAL. In the spring, it's extremely important to strip-till at a time when you can fully capitalize on anticipated rains to provide needed moisture for top corn yields.

because of winter winds. I use urea in the strips and haven't had any problems with leaf burn because I've gotten 1 inch or more rain prior to planting."

Jon Patterson says waiting until spring allows him to make early spring manure applications and provides better residue flow through the planter. The Auburn, N.Y., grower also applies a burndown herbicide at the same time.

Shane Meier is building a strip-till rig out of an old 12-row cultivator equipped with floating row cleaners that he also uses to apply 8 to 10 gallons per acre of 28% liquid nitrogen. The grower from Columbus, Ind., has strip-tilled only once in the spring but recognizes the importance of moving residue away from the strip. However, he's found compaction can be a concern when using a knife to move wet dirt in the spring.

Mike Reichart strip-tills in the spring only when he doesn't get all the acres covered in the fall or decides in late winter to expand corn acres.

"I've done spring strip-till for a neighbor for several years and a few times for myself," says the grower from Tallula, Ill. "In the spring, we use 28% nitrogen rather than anhydrous ammonia with N–Serve in the fall."

Floyd Koerner, Laingsburg, Mich., says spring strip-tilling is his only option. By the time harvest is completed, his ground is normally wet or covered with snow.

Spring Drawbacks

Reichart doesn't see any benefits to waiting until spring to strip-till. This is because compaction from working wet soils and leaving tractor or fertilizer cart wheeltrack ruts can be more of a concern.

"After you do spring strips, you really need a rain before you plant," he says. "If you can get in the field and strip before April 1 in our area, you have more time to wait for rain. But you run the risk of the ground drying out before planting, which can cause poor germination and growth.

"If you wait until it's time to plant to put down the strips, you run the risk of being delayed by rain. By strip-tilling in the fall, the ground is ready to plant earlier in the spring. If the ground is dry enough in April to put down strips, you should be planting corn on those fall strips instead of putting nitrogen down in spring strips."

> "When we strip in the spring, we have to wait longer to get in the field..."

When Reichart knows he'll build spring strips, none of the ground is touched in the fall. By spring, old corn stalks decay enough that his strip-till rig has no trouble going down between the old rows.

Afdahl adds that his ground dries out more quickly in the spring when berms are built in the fall.

"When we strip in the spring, we have to wait longer to get in the field," he says.

Reichart hasn't tried injecting anhydrous in the spring because his fertilizer dealer is concerned about seed burn.

Patterson says timing is a major concern. "Soils dry out and seed-to-soil contact is not as good if the planter is running over the ground more than an hour after the strips are built," he says. "Another concern with spring work is that a strip-till machine that requires immediate repairs can keep you from planting."

Best Ground For Stripping

Afdahl witnessed a big boost in yields when he shifted from conventional to no-tilled soybeans. He saw another big yield jump when he started strip-tilling beans.

"We get the same yield response whether we fall or spring strip-till fields going into soybeans, so we can do it at either time," he says. "However, we get the best corn yields when we strip-till fields in the spring. The darker soils warm up faster.

With the need to spread manure from a 1,000-cow dairy operation, Patterson finds lighter, well-drained soils work best when spring stripping for corn or soybeans.

"Heavier soils tend to come out in big chunks or cut slices," says Patterson, who uses an Unverferth ripper stripper with a parabolic shank that runs 9 to 12 inches deep in the spring and deeper in the fall."

Koerner relies on row cleaners to avoid hairpinning residue with spring strips.

"Strip-tilling in the spring warms the soil, aerates the seedbed area and provides smooth, tilled soil in the row area that improves uniformity with both seeding depth and plant spacing," he says.

Fall Vs. Spring

Afdahl says most of his strip-tilled fields have been ripped 20 to 22 inches deep at least three times. In these fields, he strip-tills every year unless compaction becomes a problem.

"On our tighter soils, we drive slower and don't run the knives as deep to avoid lumps and chunks that are undesirable for planting," he says.

Koerner says spring stripping lets him get full value from fall-seeded cover crops. Stripping in the spring into warmer, properly aerated soils lets him band fertilizer without losing costly fall-applied nitrogen. Thanks to the cover-crop nutrient bonus, he's reduced fertilizer needs by 40%.

He believes it's important to use rolling baskets on the unit in the spring to smooth out the berms for more efficient planting.

"It's important to avoid using too big of a point on your strip-till units in the spring because they often pull up more wet soil than the hillers and baskets can handle," Koerner says. "Small points run 8 to 12 inches deep and work well for us.

"Our berms are about 4 inches high after the planter has seeded the crop. We try to build 8-inch-wide berms with lots of loose soil, which helps keep the biomass between the rows undisturbed and able to soak up available moisture."

Like Koerner, Meier also prefers to strip-till in the spring to get the full potential of fall-seeded cover crops. He seeds them after soybean or corn harvest with a no-till drill, or he broadcasts the seed and works it lightly into the soil with a Salford residue management tool.

He seeds ryegrass into standing soybeans around Sept. 1 and aerially seeds cereal rye in mid-August. Besides providing added winter erosion protection, cover crops sharply reduce fertilizer needs.

Major Learning Experience

Afdahl continuously finds new ways to improve the soil structure with strip-tilling.

"I don't have a lot of extra time in the spring, so I need to make the most of the time I have and get the best return from every acre," he says. "There are many strip-till toolbars with both good and bad ideas, so you need to take pieces from every unit to build one that fits your needs.

"We've tried many things, but strip-tilling has been the best investment I've ever made. I've spent twice as much money on modifications as I originally spent on the toolbar, but it has been money well-spent."

Meier finds highly erodible land is in better shape when it's covered with stalks over the winter prior to spring strip-tilling.

Koerner says the key is properly setting up your strip-till rig for spring use, properly sizing the berms, getting the right depth, adjusting the row cleaners and being able to keep the planter on the raised row.

"I prefer to strip-till in the same direction we plant, as this keeps stalks from getting tied up in the planter," he says.

After No-Till And Zone-Till, Farmer Settles On Spring Strip-Till

By Darrell Bruggink, Executive Editor

Jeff Reints has run the gamut of experiences when it comes to raising corn.

The Shell Rock, Iowa, corn-and-soybean grower moved away from full tillage in the mid-90s to no-till. Then, after a brief stint with zone-tillage, he made the move to strip-till and found for his farm operations that it offered the best benefits of the previous systems he had used.

Reints strip-tilled in the fall with a couple different shank machines for 10 years. But finally, in 2008, he decided to move from an eight- to 16-row system for increased acreage and didn't want to spend the money for the high-horsepower and the high draft load of a 16-row shank machine. He decided to go with Dawn strip-till units and now builds his berms in the spring.

"Basically, we build strips 4 hours to 4 days ahead of the planter, and we've seen excellent results with that system," Reints says. "Strip-till got us to where we had that nice fine, dry dirt on top, something a planter could function in.

"Now with the spring strip-till, we let the dirt gray off and dry a little bit. You have good moisture underneath and it makes an excellent trash-free seedbed to plant into, whether it's corn on soybeans or corn on corn."

Spring Gets The Edge

Reints runs about 2,000 acres with the help of his son Clay and employee Bruce Swinton. About two-thirds of his acreage is corn, with the remainder in soybeans. The east central Iowa farmer also custom farms another 1,600 acres.

Stripping in the fall requires a shank-style machine that needs more horsepower because you need to run deeper and build a bigger berm to make up for soil settling over the winter.

"In the spring, I don't like the shank style," Reints says. "You can leave a void underneath the seedbed. A lot of times, you're not leaving a long enough interval between stripping and planting so the ground can mellow, or a couple of rains can help take out the fluffiness of the shank-style berm. Running the coulter-type units really lends itself better to a spring-type machine because they don't build as tall of a berm. You have some berm there, but after a planter pass and a couple rains, you're pretty well back to a flat field."

Reints' toolbar setup includes a lead wavy coulter that runs straight to the row and is followed by a row cleaner. Behind them are two wavy coulters set at an angle to throw dirt at each other. They run 4 to 5 inches deep and mix soil and fertilizer into an 8-inch-wide berm.

Two gauge wheels follow that contain a swirl — sort of a rolling basket or firming basket — that helps firm the mound and pulverizes any little dirt clogs. A Montag fertilizer cart follows the strip-till toolbar and meters the potassium, phosphorus and nitrogen blend into the strip.

Cropping Flexibility

There are a number of reasons Reints has chosen to strip-till in the spring rather than the fall, including that it fits his supply of labor and workload better than rushing to strip-till after harvest before winter sets in. By waiting until the spring to strip-till, Reints says he leaves open the option of switching to more soybean acreage.

"This way, I have all winter and spring to plan my crop rotation," Reints says. "Every farmer is chasing the markets to determine the right corn-soybean ratio and which crop to plant. By waiting to strip-till in the spring, you can make that decision just before you plant.

"If you've got $3 corn and $12 soybeans, maybe you go to heavier soybean acreage or vice versa if the situation is switched."

Reints says he is not a fan of fall-applied ammonia. He only applied potassium and phosphorus when building berms in the fall.

"Our soils are a little too variable," Reints says for fall-applied nitrogen. "It might work on my dark, heavy soils, but on my lighter soils, it wouldn't work. By transitioning to spring strip-till, it allowed us to put on a third of our nitrogen right ahead of the planter as a dry urea product or some type of dry formulation and then we can sidedress the balance."

He applies 125 units of total nitrogen after beans and 170 units after corn. While he hasn't reduced his nitrogen rates in strip-till, he has taken down phosphorus and potassium rates.

"Since we're banding the fertilizer right where the root mass is going to form, we've reduced our P and K rate by about one-third of broadcast rates," Reints says. "We're soil testing every 2 to 4 years and have strip-tilled some fields for about 12 years. We're not seeing any decrease in soil test levels of P and K with that reduced rate approach."

Fertilizer is blown through a 2.5-inch delivery hose and into the center of the three coulters.

"It's just being well-mixed in that whole zone about 5 inches deep and 8 inches wide," Reints says. "There's really not a hot spot of fertilizer. People always wonder how you can plant right into that much fertilizer, but it's really mixed into moist soil instead of just being in one spot."

Less Erosion

Reints feels that stripping in the spring reduces the chances of erosion, especially where strips have to run up and down slopes.

"Conservation by saving soil is our No. 1 goal, yet you need to maintain the yield. Strip-tilling the corn really gives us that happy medium," he says. "You might see a little erosion occasionally on real steep slopes, but nothing like you would see from full-width tillage."

With Strip-Till, Hitting The Mark Makes The Difference

Repeating passes within RTK sub-inch accuracy has allowed farmers to place seed in the right location to make this tillage practice practical.

By Darrell Bruggink, Executive Editor

"Strip-till really comes down to whether you can repeat that pass…"

— Steve Cubbage

If you want to know just how important precision is to strip-till, Steve Cubbage has a pretty good answer. The ability, in recent years, to use technology to repeat passes in the same location time after time is what has made strip-till a viable production system, the Nevada, Mo., strip-tiller says.

"Strip-till really comes down to whether you can repeat that pass a week from now or a year from now," Cubbage says. "What we are concerned about and looking for is being able to put nutrients down in the fall or early spring and come back exactly in that same pass when we plant our corn.

"Strip-till was literally waiting for a bride to come walking through that door, and precision guidance is the perfect marriage partner for strip-till. There's no more guesswork."

The owner of Record Harvest, a precision ag consulting business, Cubbage has been working with precision ag products since the mid-1990s. But he didn't really start utilizing strip-till in his operation until 5 years ago.

"The reason it took us so long to adopt strip-till is that we never could figure out why people would strip-till without being able to come back and hit that mark," he says. "It seemed so hard to hit that mark after you put in those strips in the fall and then tried to drive the line on your own with the planter in the spring.

"This is why RTK and GPS has really been important. It has answered that question of how we come back and hit that strip time after time."

Speaking to attendees at the 2008 National No-Tillage Conference, Cubbage says his own experiences, and those of university researchers, show how important it is to plant in the same spot where you lay down fertilizer. He says the further you plant away from the location of your strip-tilled fertilizer, the further yields will fall off.

In 2007, the Irrigation Research Foundation in Yuma, Colo., secured corn yields of 187 bushels per acre when they planted directly into the center of strips. Yields slipped to 180 bushels per acre when they missed the mark by 4 inches,and fell dramatically to only 151 bushels per acre 8 inches away from the strip.

Meanwhile, on his own farm, Cubbage maintains trials of strip-tilled corn vs. conventionally tilled corn. On average, he's seeing a 10-bushel yield advantage.

"Basically, the difference between making $45 more per acre with strip-till and making nothing is a matter of inches," Cubbage says. "Being able to come back right in that strip is what we're able to do with this technology.

"From both our practical experience and university research, we've seen that strip-till without auto-guidance, and especially RTK auto-guidance, is like buying a car without wheels. You can rev up the engine, but you're not going anywhere."

Efficiency With Accuracy.

Cubbage says real-time kinematics, or RTK, is the ideal system to use for accuracy at the present moment because it allows you to come back within 1 inch of your previous pass.

While other systems like Wass, Coast Guard Beacon, SF2 and Omnistar XP are helpful to strip-till, Cubbage says that only RTK can help you truly repeat that pass across the field time after time.

In Cubbage's operation, they generally strip-till dry phosphorus and potassium along with anhydrous ammonia in the fall, or in the spring if conditions don't allow fall applications. Then they plant on those same RTK guidance lines.

Their John Deere 9320 pulls a DMI 5310 16-row strip-till applicator with a Raven anhydrous cold flow unit followed by a Flexi-Coil cart. The unit is equipped with Trimble RTK AutoSteer controlled by an Ag Leader Insight monitor. That not only controls the auto-steer unit, but also controls a three-part, variable-rate system for phosphorus, potassium and nitrogen.

The Flexi-Coil cart was actually a ground-driven cart that was modified and set up for strip-till using hydraulic motors. Mid-Tech valves control each bin's phosphorus and potassium output to the applicator.

"Through yield tests and yield monitors, we found that even when cutting fertilizer inputs by 20%, we are still increasing yield," Cubbage says. "And by switching from conventional tillage to strip-till, we are now the early birds to the field.

"We no longer worry about working weeds down in the spring, waiting on the

fertilizer truck from the co-op, waiting to apply fertilizer and then working that ground after it's applied. Strip-till takes that all away."

Cubbage says strip-till works perfectly on his clay-based soils because it conserves moisture and improves the root zone.

"We only have at best a foot of good topsoil before we hit that claypan," he says. "We feel strip-tilling and being in that root zone has greatly improved our root growth from what we saw in conventional tillage."

Strip-Till Benefits.

Cubbage lists five primary benefits of being able to repeat your passes accurately through strip-till with RTK.

1. Repeatability — "The value of being able to come back in the spring and plant in the same location as to where you put your fertilizer down in the fall is probably priceless," he says.

> "The difference between making $45 more per acre with strip-till and making nothing is a matter of inches…"

2. Two In One — "When we strip-till, we are actually managing for 2 crop years," Cubbage says "We are putting down fertilizer for corn in the current year and soybeans the following year all at one time. We can come back and use that same guidance line and hit that slot the next year when planting soybeans."

3. Mix And Match — Don't worry about having all your equipment the same width."It doesn't matter if you have 12 rows, 16 rows or even 13 rows," he says. "With RTK, there are no guess rows. We have a 16-row strip-till applicator, but our sidedress rig is actually a 13-shank DMI applicator. We use the same guidance lines. That's a big value when negotiating what equipment will work best for you."

4. Reduced Compaction — "We've almost developed an unseen tramline because we have been using the same guidance lines for the past 5 years."

5. Variable Rate — RTK sets the stage for variable-rate strip-till. "Strip-till and RTK are the first and second legs of the stool, and we see variable rate being the third leg of a complete strip-till system," Cubbage adds.

Place It Properly.

With today's higher-priced seed corn, putting seed in an environment where it can thrive makes a big difference, Cubbage says.

Doing that in a way that maintains residue as much as possible to protect against erosion also is important.

"As soils warm up, we see the root growth take off tremendously — especially in corn as compared to soybeans or cotton," Cubbage says. "The root zone created in strip-till, and having seed strategically placed in that strip, is important to how well those roots develop.

"With strip-till, you create a deeper zone where soil temperatures are warmer. Corn needs that warm soil because that's where the roots will head. We are putting a fertilizer band at a 4- to 5-inch depth and a second fertilizer band 9 to 11 inches deep."

Cubbage says accuracy will pay off, especially with today's costly inputs and the new technology in seed corn. That alone is a reason to use RTK with strip-till.

"You need RTK, but don't forget the variable-rate technology because of input costs," he says. "I think we are now starting to see why variable rate makes sense.

"Until it gets in your pocketbook, you probably won't adopt that technology. Now, with the prices we've seen, the technology is a lot cheaper than that Brinks truck worth of fertilizer you will need to make your crops grow."

7 Tips To Strip-Till Right The First Time

Tony Anderson

Tony Anderson says his Uncle Ewing gave him a good lesson about farming that every strip-tiller should adhere to.

"We were always in a hurry and he'd say, 'Boys, you never have time to do it right, but you always have time to do it over.' We have taken that to heart," says the strip-tiller from Washington Court House, Ohio.

The following are a few suggestions he had for attendees at the 2008 National No-Tillage Conference on how to make strip-till work right the first time.

1. When planting corn on corn, Anderson will delay making strips until spring. "The residue in the fall is a challenge for us," he says. "But the residue will disappear if you wait. We strip the ground in the spring and then spray it."
2. It's essential to keep your combine's corn header in good condition. "We need to get the consistency of that residue into lengths that will degrade faster and give us the opportunity to work it into that nice little mound that's 9 inches wide and 5 inches tall," Anderson says. "That allows it to mellow down over the spring and helps that mound better absorb those harsh spring rains."
3. Lightbars are a tremendous asset. "They allow us to get fields laid out in a straight line much quicker than what we've been able to do with mechanical markers," he says. "We recently invested in auto-steer on the big tractor, and we had it on the planter last spring." If using mechanical markers, Anderson recommends planting a wheat row right in the middle of the strip-till unit's drawbar and using that strip of wheat as a guide next spring when planting.
4. Anderson is moving to twin-row corn on strips. He says sub-inch RTK accuracy will be important to success. "It's enough of a challenge to maintain a single row on a 9-inch strip let alone two rows 7.5 inches wide on a 9-inch strip," he says.
5. He suggests strip-tilling at 6 mph or more. "It helps us get a better fracturing of the soil in the subregions of that upper strip," Anderson says.
6. Anderson says it's critical to have a large, heavy, mole knife that will last throughout the season and covering attachments that work the residue back in the strip.
7. The entry price into strip-till is expensive, so perhaps you can trade work with a neighbor who has a strip-till rig. "If you've got a bigger planter and your neighbor has a better strip-till bar, see if you can plant some acres for him. Or perhaps spray for him or harvest," Anderson says. "See if there's a way to enjoy some of the advantages he's experiencing."

— By Darrell Bruggink, Executive Editor

Strip-Tilled Soybeans May Have A Role

Using 30-inch rows in strips could lead to higher yields, lower seed cost, less disease and a boost in profitability.

By Dan Zinkand

While most of the attention in strip-till gets paid to corn, there are some growers who are successfully strip-tilling soybeans.

Veteran strip-tiller Jeff Reints of Shell Rock, Iowa, and more recent strip-tiller Bruce Wichmann of Fairfax, Minn., have each tried strip-tilling soybeans in the spring and say they are pleased with yields and profitability. Both of them created large test plots comparing spring strip-tilled soybeans with no-tilled soybeans.

Reints has been strip-tilling for 10 years, and 2009 was the first year he strip-tilled soybeans. He typically no-till drills soybeans on 10-inch spacings. He says no-till works well on fields with light, variable soils and on steep hillsides.

A combination of factors led him to see how spring strip-tilled beans would work.

Planting soybeans rather than drilling enabled Reints to reduce seed populations from 190,000 seeds per acre in drilled soybeans to 150,000 for strip-tilled soybeans in 30-inch rows. That saved $16 an acre.

Soybean diseases, especially white mold and sudden death syndrome, are becoming an increasing problem in drilled soybeans, so Reints felt the wider row widths would allow more air movement and reduce the likelihood of disease.

Pushing Soybean Yields

Reints keeps looking to push his soybean yields higher. While overall corn yields have increased about 30% the past 10 years from 160 bushels to about 205 to 215 bushels per acre, overall soybean yields have only risen about 10% from 50 bushels to 55 to 57 bushels per acre.

"Everybody is looking to try to get that little advantage in soybeans," Reints says. "We just are not getting that silver bullet to get soybean yields to the next level."

New varieties may do that, says Reints, a DeKalb and Asgrow dealer. But instead of waiting for the silver bullet, he put in a large soybean test plot in a 120-acre field of strip-tilled soybeans. He dedicated 10 to 15 acres comparing soybeans strip-tilled on 30-inch rows with those no-till drilled.

Overall, there were nine passes he compared, with three strip-tilled passes getting an application of 12-23-0-12s — a blend of DAP and AMS. (See Table 1 for results.)

Fertilizer Boosts Yields

Reints added fertilizer based on the recommendation of crop consultant John McGillicuddy, who said a low rate of fertilizer could help yields. He did not use potash because soybeans are sensitive to it when they germinate.

The most profitable plots were four strip-tilled passes, three with fertilizer applied in the strip. Here's a summary of the soybean experiment:

- No-till drilled soybeans (10-inch spacings) averaged 53.8 bushels per acre and netted $462.33 per acre.
- Strip-tilled 30-inch soybeans with no fertilizer averaged 55.7 bushels per acre and netted $474.82 per acre.
- Strip-tilled 30-inch soybeans with 19-23-0-12S averaged 57.4 bushels per acre and netted $482.30.

Previously, that 120-acre field had been planted to continuous corn. Reints says he could strip-till the field because his Dawn Pluribus units handle residue without plugging.

While he has strip-tilled for 10 years, it's only been since 2008 that he's used a strip-till unit with coulters instead of shanks.

"We had no problem with residue going through the strip-till rig going at an angle to the old corn rows," says Reints, adding he usually makes strips in the center of the old corn row in continuous corn.

Planting conditions were ideal, a marked contrast to the wet spring of 2008.

"The corn stalks were dry and there was nice soil moisture," Reints says. "The year 2008 was extremely wet for northeast Iowa."

After 3 years of continuous corn, the field had "a fair amount of residue. It was 200-bushel-plus corn in 2008," Reints says. "We do a fair amount of corn on corn.

"At this point, I'll probably do some more 30-inch strip-tilled soybeans on flatter, heavier ground."

Reints says he still likes no-till drilling soybeans on steeper slopes, lighter ground and fields with a variety of soils.

"These fields, I'll continue to use the no-till drill. I'm not ready to give up on no-till drilled soybeans," he says, adding that he likes being able to no-till soybeans at the end of April while he's planting corn. "We'll keep using the no-till drill while the strip-till unit and corn planter are running."

Keys To Stripped Soybeans

Making strip-till work in the spring for beans requires several things, Reints says.

He likes the mixing of the soil that occurs with the Pluribus's 3-coulter system with firming wheels that firm berms.

"It really mixes the fertilizer," Reints says. "You get a real good blending of fertilizer within that whole zone."

Strip-tilling with a shank instead of a coulter runs the risk of creating a "hot zone," which can burn seedlings, he says.

And using shanks in the spring can lead to air pockets under the seed.

Looking back at his 2009 experiment with strip-tilled soybeans compared to no-till drilled, Reints says he wishes he had the time to include no-till planted beans, too.

Table 1. Comparison Of No-Till Drilled Soybeans To Strip-Tilled 30-Inch Soybeans

(Results of three replicated trials)

Seeding Method	Fertilizer	Yield	Gross ($/Acre)	Fert. Cost	Seed Cost	Strip-Till Cost	Net ($/Acre)
Strip-Tilled 30-Inch Rows	19-23-0-12s	57.6	$575.85	$13.75	$60.00	$18.00	$484.10
Strip-Tilled 30-Inch Rows	None	56.4	$563.58	$0.00	$60.00	$18.00	$485.58
10-Inch No-Till Drill	None	55.3	$553.49	$0.00	$76.00	$0.00	$477.49
Strip-Tilled 30-Inch Rows	19-23-0-12s	56.9	$568.58	$13.75	$60.00	$18.00	$476.83
Strip-Tilled 30-Inch Rows	None	55.1	$551.15	$0.00	$60.00	$18.00	$473.15
10-Inch No-Till Drill	None	53.4	$533.71	$0.00	$76.00	$0.00	$457.71
Strip-Tilled 30-Inch Rows	19-23-0-12s	57.8	$577.72	$13.75	$60.00	$18.00	$485.97
Strip-Tilled 30-Inch Rows	None	55.7	$557.49	$0.00	$60.00	$18.00	$479.49
10-Inch No-Till Drill	None	54.2	$541.84	$0.00	$76.00	$0.00	$465.84

Trial Data Assumptions

- 18-46-0 cost $350/ton
- AMS (21-0-0-24) cost $200/ton
- Treated seed cost 40 cents per thousand
- 30-inch row seed populations @ 150,000
- 10-inch-row seed populations @ 190,000
- Strip-till pass cost $18
- Soybean market price @ $10 per bushel

"You have to have things dialed in just right," Reints says. "I love to learn. I love to keep experimenting, but there's a happy medium," he says.

Strip-Till Soybeans Win

In 2008, Wichmann decided to compare strip-till and no-till soybeans in an 80-acre field with half-mile-long rows. He chose two different Pioneer Hi-Bred soybean varieties, alternating eight rows of strip-till with eight rows of no-tilled soybeans. One was a 1.9 Y variety and the other a 1.8 Roundup Ready variety, Wichmann says.

In all, each variety had 32 rows of strip-tilled and no-tilled beans. Planting dates were the same for all four test plots, which were side by side the length of the field.

The strip-tilled 1.9s yielded 0.75 bushel more than the no-tilled, Wichmann says. But the strip-tilled 1.8 variety yielded 1.5 bushels per acre more than the no-tilled.

By early July 2008, strip-tilled beans had 3 inches more vegetative growth and greater root mass than no-tilled soybeans. At harvest, strip-tilled soybeans were 8 inches taller than the no-tilled soybeans.

However, the taller strip-tilled soybeans suffered lodging. Wichmann attributes that to the larger plant.

These strip-tilled soybeans netted $18 per acre more than the no-tilled soybeans, Wichmann says. He can strip-till 20 acres in an hour, using 0.4 gallons of diesel per acre.

A net profit of $18 per acre more for strip-tilled soybeans vs. no-tilled soybeans is significant for his farm, Wichmann says. In 2009, he grew 245 acres of beans, 225 acres of corn and 75 acres of spring wheat.

At January 2009 soybean prices and a rotation of 250 acres of corn and 250 acres of soybeans, Wichmann says his increased savings with strip-till is about $18,000 per year in fuel, fertilizer and corn drying.

That is compared to his previous mulch-till system of chopping stalks, V-ripping and two passes of spring tillage for soybeans; and one fall tillage pass and two spring tillage passes for corn. Now, he makes only one strip-till pass and saves two to three trips across the field.

Before strip-tilling, Wichmann used a broadcast application of 140-50-75 blend of incorporated fertilizer.

By banding with strip-till, he can reduce phosphorous and potash rates by 20%, and also saves a custom application charge. He sidedresses nitrogen by applying 120 units.

With no need for fall tillage, Wichmann can let the corn dry naturally longer, saving about 2% from a lower harvest moisture.

Manage Residue For Success

Wichmann says strip-tilling in the spring isn't bullet proof, but the biggest factor is residue management.

"The more residue you have, the more frustrations you can have making it work," Wichmann says.

The combination of heavy, sticky soils with lots of clay and a limited amount of time to plant lead to big challenges.

Some of the land Wichmann farms was considered unfarmable. In the 1850s, land surveyors reported Renville County was so filled with marshes and swamps that it probably wouldn't be fit for farming.

Decades of tiling and making drainage ditches converted marshes and swamps into productive farmland, but the challenges remain, says Wichmann.

Being a one-man operation, he's turned to strip-till to deal with a short planting window and heavy clay soils that don't warm up quickly. But he remains flexible, sometimes no-tilling beans into corn or corn into beans.

It's not uncommon to have frost in the ground on March 20 or later, Wichmann says. Less than 3 weeks later — April 11 — is the first date for crop insurance coverage for corn planting, he notes.

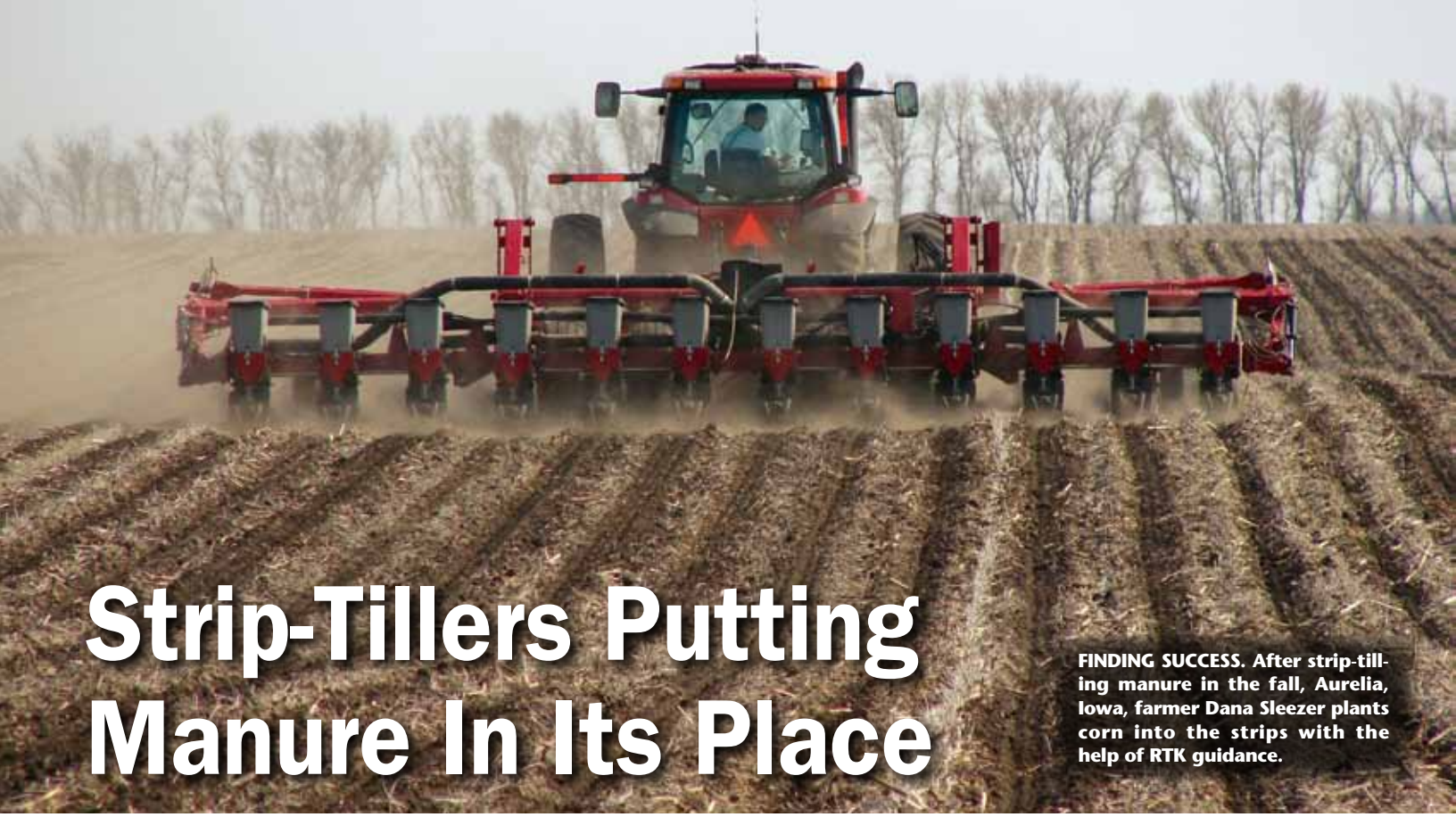
The optimum time to plant corn in his area is April 20 to 25, says Wichmann. Corn planted after April 25 begins losing its maximum potential yield, he says.

Wichmann says strip-till helps him get the quick warm-up of the black soil typical with conventional tillage, while conserving moisture and protecting the soil with residue similar to no-till. However, he says increasing levels of residue can be a problem.

After 3 years of strip-tilling, Wichmann was planting into heavy "residue windrows" that were 10 to 12 inches thick between the rows.

He says residue accumulates not only because *Bt* corn stalks don't break down as quickly as conventional hybrids, but also because they don't break down much in the fall. Before winter officially arrives in December, snow often covers fields, he says.

He says there are just 5 weeks for residue to break down before the ground freezes and snow and ice set in. There's little time in the spring for residue to deteriorate before planting needs to begin.



Strip-Tillers Putting Manure In Its Place

FINDING SUCCESS. After strip-tilling manure in the fall, Aurelia, Iowa, farmer Dana Sleezer plants corn into the strips with the help of RTK guidance.

Injecting manure into strips allows more efficient use of manure, increases yields and creates a positive public perception of farmers.

By Dan Zinkand

Strip-tilling and applying manure simultaneously may make as much sense as other dynamic duos in agriculture, like corn and soybeans, ham and eggs and "rain makes grain."

Combining these tasks can save the time and money of an extra trip, while reducing fertility costs, increasing yields and protecting the environment, say several farmers who have tried the practice.

A One-Pass System

Dana Sleezer started strip-tilling with manure years before many people talked about it, but that was a two-pass system.

"We had the cover discs on the back of the honey wagon," says the Aurelia, Iowa, corn and soybean grower, who also raises hogs farrow-to-finish. "We would go back with the strip-till machine after applying manure.

"We started with a conservation tillage/no-till/strip-till system to apply manure. We would put manure down with six cover discs, but we didn't get 100% coverage.

"Then we went to strip-till behind the manure tank, which took two passes. In the fall of 2006, we decided it made sense to do it at the same time."

Then Sleezer added six Ag Systems' strip-till row units with 30-inch spacings on the honey wagon. He currently has a 7,300-gallon Houle tank with a six-row toolbar, but will switch to a 9,500-gallon Houle tank with an eight-row toolbar.

Sleezer strip-tills and applies manure in the fall for first-year corn after soybeans and continuous corn. He runs a lot of half-mile-long rows with one round equaling 1 mile. He applies roughly 3,900 to 4,000 gallons per acre of finishing manure.

With gestation manure, he applies 7,800 to 8,000 gallons per acre in a half-mile pass because the nutrient value is not as high as the finishing manure.

"Because of that, we apply according to the analysis, which equals twice the rate for gestation manure compared to finishing manure," Sleezer says. "That's why the tank-to-row-unit ratio works so well."

Sleezer works hard to minimize compaction. When he makes a 1-mile round, he's not traveling over the same ground twice. He's making two side-by-side passes.

"We always start on the headland and end on the same headland," he says. "A lot of people will stop in the middle of the field, turn around and drive back," he says.

Finding A Working System

Building berms while applying manure is a work-in-progress.

"The system works great if you are able to do it," Sleezer says. "But I don't know

"The more I cut my manure application rates, the higher my corn yields are..."

— Mark Bauer

how it would work on contours. Our fields are gently rolling — 1% to 2% slope and mainly straight. We use RTK guidance. We just come back and plant right on top of the strips in the spring."

The biggest reason Sleezer switched to his current system of manure application was to get complete closure of the strip.

"We inject manure about 8 to 10 inches deep, so there is coverage and a better perception from the public. The odor is considerably lower than the system we previously used," Sleezer says. "The fields still have a lot of residue out there when we are done."

Everything is recorded when applying manure with an Ag Leader Insight monitor, which logs all the rates and locations. The Iowa Department of Natural Resources requires that he record all manure application data, including the location, section field, rate, building site and wind speed.

"We're really concerned about conservation practices," Sleezer says. "Our goal is to keep all the soil and the nutrients in the field where they can be used. All of our creeks have filter strips and we have grass waterways in the fields where water runs.

"We watch our return on investment and our commercial and hog manure fertilizer is a big part of that. We don't want to put any nutrients down where we could lose those assets."

In addition to the manure, he sprays 30 pounds of 28% nitrogen over the top. The last couple of springs, he says it's been cold and he doesn't think he got the nitrate conversion from the manure in the quantity he needed in the early part of the growing season.

"Due to cool soils, you have to get the trash out of the way when you plant and make the strip black, especially in corn-on-corn," Sleezer says. "If you don't, the corn doesn't emerge that evenly.

"I don't have residue managers on the honey wagon, but have them on the planter. When you make a black strip in the spring when planting, it attracts the sun and helps raise the soil temperature."

Strip-Till Manure Study

David Legvold, a Northfield, Minn., corn-and-soybean grower, turned to strip-tilling manure in 2006 to find a way to apply liquid hog manure while preserving crop residue.

Legvold wears another hat. As executive director of the Cannon River Water Partnership, Legvold wrote two successful applications for grants to the Minnesota Pollution Control Agency.

The grant money, along with in-kind contributions from local farmers, Monsanto seed representatives and equipment manufacturer Environmental Tillage Systems, supported two 3-year studies from 2005 to 2009, he says. These studies examined manure rates and yield response, application timing and the effect of strip-tilling with manure on water quality. *(See chart on page 17.)*

Legvold uses a Soil Warrior to make strips in the fall, placing all of the needed phosphate, potash and micronutrients in the strip. In the spring, he uses the Honey Warrior with its Mini Warrior ripple coulters to apply liquid hog manure in the strips. Then he returns and plants corn into the strips.

During the 3-year study, fall strip-till with 1,500 gallons per acre of manure applied in the spring out-yielded the land receiving 7,000 gallons of manure per acre. While the study ended in 2008, Legvold continued comparing rates and yield results in 2009.

"We got late-season rainfall in 2009 that allowed the nitrogen in the 7,000-gallon-per-acre trial to be converted to nitrate," Legvold says. "That corn yielded 229 bushels per acre, compared to 219 bushels per acre on the land that received 1,500 gallons per acre of manure in spring strip-till."

But it wasn't worth it economically to apply an additional 5,500 gallons of manure to increase yields 10 bushels per acre. He pays 3.6 cents per gallon for liquid manure, so the extra 5,500 gallons cost almost $200 per acre.

"Many farmers believe that they need to use enough manure to provide enough nitrogen for their corn," Legvold says. "Usually, that means you are way, way overapplying phosphorus. If it runs off your fields, phosphorus can grow algae. That's not a good thing to have in your lakes."

Better Public Perception

Strip-tilling manure not only protects lakes, rivers and streams, but also can help farmers with public perception, Legvold says.

In Minnesota, the law requires manure applied to fields to be incorporated within 24 hours.

When the Honey Warrior was being developed in 2006, about 100 people from an area water-quality advisory council attended a field day where Legvold farms. Manure had been applied earlier that day with the Honey Warrior.

"You never would have known they had just applied several thousand gallons of manure," Legvold says. "With the Honey Warrior, the manure is incorporated immediately. And if you give it a couple of hours for the field to dry, you can go back the same day and plant corn."

Legvold was getting an eight-row Mini Warrior this spring with 30-inch row spacing and a dry-fertilizer attachment. He'll pull it with a John Deere 4650 mechanical front-wheel-drive tractor. He'll use Trimble guidance.

Tips For Success

It takes several things to successfully strip-till manure into the residue that continuous corn produces, Legvold says.

"It takes a machine that doesn't drag a shank through the soil,

PHOTO COURTESY OF DAWN EQUIPMENT

WORK IN PROGRESS. Sheldon Stevermer, a Minnesota strip-tiller and hog farmer, strip-tilled manure last fall using Dawn Equipment's new Anhydra 6000 fertilizer coulter on the manure tanker. To make this practice work effectively, Stevermer says he will need to add RTK guidance on the tanker or wagon, a rate-control flow valve and a good distributor and chopper.

"As we learn what we are doing with the economics of strip-till and how to economically better manage the nutrients from manure, the environment benefits, too…"

because that smears the sides of the trench and creates sidewall compaction," he says. "The machine must be able to dependably move through high residue without plugging up. And you need a grinder distributor that evenly distributes manure so the inside and the outside rows get the same amount of manure."

The Honey Warrior uses two ripple coulters that move through the soil at about 7 to 8 mph.

"The manure is placed in that turbulent zone of soil so when the manure settles, it's nicely mixed together in the soil," he says.

Low-Disturbance Manure Placement

Sheldon Stevermer began strip-tilling in 2003 and strips almost all of his corn and soybeans. Stevermer farms with his brother, Chuck, and their parents, Ray and Margaret. They also raise hogs, which produce about 120 acres worth of manure each year.

Last fall, the Stevermers spent 4 days working with the staff of Dawn Equipment to fine-tune the company's new Anhydra 6000 fertilizer coulter for manure incorporation. They applied some manure from the 5,000-gallon tank at a 5-degree angle across soybean stubble, as well as on a bit of corn ground.

"That seemed to work pretty well because it left the field with low disturbance and should be easy to strip this spring," Stevermer says.

This spring, they will strip parallel to the field edges. Then they will plant their corn and soybeans using a 12-row John Deere 1760 planter with 30-inch row spacing. The planter has Dawn 1572 coulter-combo row cleaners.

"We were able to get the 6000 to do a nice job of putting up to 6,000 gallons per acre of gestation and farrowing manure into the ground with low disturbance," Stevermer says. "Nearly 90% of the manure was covered at that rate. At 2,500 to 3,000 gallons per acre, you couldn't even tell we had put manure on."

Stevermer says he went into the tests expecting to have an incorporator that would allow them to strip-till manure in 15-foot-wide swaths to match their 30-foot-wide strip-till applicator. He also planned to strip-till manure in the fall, then freshen the same zones in the spring with his Dawn Pluribus strip-till rig.

"After running it for a little bit, I quickly realized our goals were easier said than done," he says. "The large manure tank, which doesn't have implement steering, would slide down hills, essentially making the auto-steer on our tractor worthless.

"I had a very hard time consistently keeping 30 inches between the incorporator guess rows. I know we were running SF2 Deere guidance, but most of the error was coming from the tank moving horizontally."

Maintaining consistent application rates was a problem.

"We have a vacuum tank without any flow-control valving to control the manure application rate, so our rate was essentially a guess on the tank pressure and ground speed," Stevermer says. "We also didn't have an accurate distribution manifold with a chopper, so there were different rates between strips. Too much manure will affect germination and root development."

Stevermer says he needs several things to make a strip-till manure application system work:

- Auto-guidance on the tank to keep the injector in the correct location.
- A rate-control valve to keep the application rate consistent and to change as speeds vary.
- A chopper and good distributor.

"These three items aren't cheap and for our size of operation probably not practical economically," he adds.

Most farms already use some form of auto-guidance, he says.

"To strip-till manure, it would be best to have RTK, which can add significant cost," Stevermer says. "My guess is that a rate-control valve, chopper and distributor would cost around $30,000. This doesn't include the strip-till units, because we need some kind of injector anyway, whether strip-tilling manure or not.

"Let's take 25% of the $30,000 for our annual machinery cost, or $7,500. I'd say we need to have the equipment cost in the $5-per-acre range. To really justify it, we would need to cover about 1,500 acres. We have enough manure for 120 acres, so our equipment costs would be very high."

Stevermer puts that in perspective.

"Granted, we are essentially getting the fertilizer for nearly

Compaction, Mud Are Challenges For Strip-Tilled Manure

Strip-tilling manure involves a number of agronomic and engineering challenges. Mike Petersen, precision-tillage agronomist for Orthman Manufacturing Inc., says working in mud when the soil is wet can create pockets or trenches, which may allow manure to move off fields into tile drains and bodies of water.

"When you go out in fields when it's wet with an 8- to 30-ton manure wagon and a large, heavy tractor, compaction occurs," Petersen says.

Petersen's perspective about compaction comes from more than 30 years of working as a soil scientist for the Natural Resources Conservation Service. During those decades, Petersen dug more than 1,000 pits in farmers' fields, looking at root growth and how tillage systems affected compaction and yields.

"The rule of thumb is that for every ton of axle weight, we can drive compaction 1 inch down in the soil, especially in wet conditions," Petersen says. "If the manure wagon weighs 30 tons, the compaction can go 30 inches deep. Without any mechanical alleviation, I've found compaction remaining over 30 years.

"It creates a number of problems. Soil aggregate stability falls apart, and you suffer more erosion losses, crusting and ponding of soils."

Getting the soil to seal as the strips are created can be difficult. Even when the soil is not wet in the fall, the combination of the soil and liquid manure can create buildup on sealing discs or coulters, Petersen says.

Despite the challenges that farmers and strip-tillers, in particular, face applying liquid manure, technological innovation will make the practice easier and more effective.

"I know we can make it happen," Petersen says.

Strip-Till Corn And Manure Study

	7,000 Gal./A	1,500 Gal./A	Commercial Fertilizer (No Manure)
2006	168 bu./A	172	164
2007	160	180	167
2008	185	191	177
2009	229	219	21

In this study at Northfield, Minn., 7,000 gallons per acre of liquid hog manure was broadcast in the spring, and then tilled to incorporate it. Also, 1,500 gallons of manure per acre was strip-tilled in the spring back into strips made in the fall. Where commercial fertilizer and no manure was used, phosphate, potash and micronutrients were strip-tilled in the fall. In the spring, nitrogen was strip-tilled, followed by sidedressing when the corn was 12 inches tall.

free, so we can justify the higher machinery cost per acre," he says. "I think maybe a custom applicator may justify the additional equipment, but then I'm not sure if they would be able to tolerate the extra time required to do a satisfactory job."

For now, the Stevermers have opted to utilize a full-width, low-disturbance setup. Manure will be fanned on top and the incorporator will work it into the soil.

"We can either strip that a few weeks after application in the fall or in the following spring," he says. "I think strip-tilling manure can be done."

Making It Work

Minnesota strip-tiller and hog farmer Mark Bauer agrees with Stevermer. Bauer, the founder of Environmental Tillage Systems, began making the Soil Warrior and Honey Warrior for strip-till several years ago.

"The Honey Warrior evolved from the need I had as hog producer. I had a lot of hog manure and I wanted to put it in a zone. I was just looking to better manage my manure, which I see as a nutrient," Bauer says.

Applying manure and strip-tilling is a process of evolution, Bauer says, adding that everyone from the smaller to the mega producer is looking at it, but few realize it can be done.

Some farmers tell Bauer they want to change their farming practices to be more conservation minded, but manure hinders them.

"Others are just looking how to use the row units on the back of the manure tanks to incorporate manure," he says.

Much of the interest is coming from South Dakota, southern Minnesota and Iowa, where there are lots of hogs and dairy cows, Bauer says.

He and his wife, Sue, grow about 1,600 acres of corn and soybeans and lease out their hog barns. They apply the manure to their crop ground.

"I've been trying to figure out how to no-till and strip-till with manure for about 20 years." Bauer says. "I got tired of trying to modify other equipment, so I built my own machine.

"I have a wide variation of soils, ranging from sand and gravel to really heavy, mucky, cold soil."

SWEET SYSTEM. The HoneyWarrior from ETS is comprised of a chopper, distributor and row units that inject manure into the soil. It can be added onto manure wagons and tankers and allows operators to make strips and inject manure at the same time.

Bauer battled high residue, fought erosion on hills and ran into rocks. Worst of all, he fought the weather. All too often, the weather won, beating up his no-tilled corn.

"No-till seems to be so weather sensitive," Bauer says. "Certain years, I looked like a genius. Other years, I was forced to plant in marginal conditions. I built this machine to handle any condition. Most of the time we strip-till manure in early November and we try to do spring application in early April.

"I've been forced to apply in May at 2,000 gallons per acre and plant 2 days later and still have had good results."

Lower Rates, Higher Yields

On corn, Bauer applies 1,500 to 1,800 gallons per acre of hot finishing manure. With nursery manure on corn ground, he applies 2,500 to 3,000 gallons per acre. He also applies 50 to 70 units of commercial nitrogen.

Bauer will only apply manure to ground to be planted into soybeans if the soil tests low in phosphorus. On these fields, he fall applies no more than 1,500 gallons of manure per acre.

He has been surprised during the last few years by the results of lowering rates and its effects on corn yields.

"The more I cut my manure application rates, the higher my corn yields are," he says. "In the last 5 years, our corn yields are running about 18 bushels per acre over the county average.

"Corn yields range from 230 to 260 bushels per acre and soybeans 65 to 75 bushels per acre."

While farmers may look at strip-tilling and applying manure for many reasons, it's important to look at economics, Bauer says.

"How many bushels of corn can you sell from every acre you plant?" Bauer asks. "We're trending into exciting territory."

But there's good news on the environmental impact of strip-tilling manure, Bauer says. He points to research by Legvold and others that shows lower rates of manure increase corn yields.

On his farm, Bauer started by looking at the typical rate of applied manure and then cut it by 50% or more.

"It doesn't take that much manure to reach maximum economic return on corn," Bauer says. "Environmentally, it's a win-win. Farmers are environmentally sensitive, but the overall driving force in agriculture is economics.

"As we learn what we are doing with the economics of strip-till and how to economically better manage the nutrients from manure, the environment benefits, too."

Ingenious Toolbar Offers Great Capacity, Flexibility For Strip-Tiller

Shane Houck designed a 60-foot-wide, front-folding-frame toolbar for strip-tilling, planting corn and soybeans and sidedressing corn, too.

By Dan Zinkand

Just down the road from the machine shed of Pennville, Ind., strip-tiller Shane Houck, a tan boulder stands halfway between the edge of the cornfield and the county blacktop. Cut into the top of the rock is the inscription, "Houck Homestead Farm 1838."

The muted color of the rock mirrors the quiet personality of Houck who has designed durable, innovative equipment that has helped no-tillers and strip-tillers, alike.

Twenty years ago, Houck created a hitch that allowed no-tillers to run two John Deere 750 no-till drills side-by-side, seeding a 30-foot-wide swath instead of just 15 feet. More than 2,500 of Houck Hitches have been sold worldwide, he says. About 7 years ago, Houck starting making a front-folding frame for fall strip-till.

Houck started using conservation tillage in the 1980s. He ridge-tilled from the mid-1980s to 1990 and then began no-tilling corn and soybeans.

"We have tight soils with lots of clay and poor drainage," Houck says. "These soils tend to warm up slowly in the spring. And managing residue was a struggle."

Houck became interested in strip-tilling after seeing a farmer in the area use the practice. In the fall of 2003, Houck put 12 of Yetter Mfg. Co.'s row units on a toolbar

LARGE CAPACITY. When Shane Houck sets up his front-folding-frame, 60-foot-wide toolbar for strip-tilling in the fall, four tanks can each hold 6,000 pounds of dry fertilizer. Wide-gauge rubber tracks from Land Luvr support the 24,000-pound frame and heavy loads of dry or liquid fertilizer, and also minimize compaction.

MANAGING STRIPS. Last fall, Shane Houck upgraded the strip-till units to the new Yetter Mavericks with depth control. "We did about 500 acres with the vertical-tillage attachment," Houck says. "The strips looked pretty good and the corn planted well into the strips last spring."

and started strip-tilling. Within half a day, the toolbar bent in the tough, tight soil. Houck set out to build a tougher frame.

Over the next 5 years, Houck designed and built four front-folding toolbars. He made them 60 feet wide for productive capacity.

He put them on rubber tracks to minimize compaction. And he designed them so he could use one for planting corn and sidedressing corn and the other to plant narrow-row soybeans and for fall strip-tilling.

"Wil-Rich contacted me when I was in the process of building the fifth unit in Ohio," Houck recalls. "They probably saved me from getting into the manufacturing business. I licensed my design to Wil-Rich, who has taken it from there."

Today, Houck continues to use two of the front-folding frames that he made. With one, he strip-tills dry fertilizer in the fall on 24 rows on 30-inch spacings and then uses the frame to plant 48 rows of soybeans on 15-inch spacings.

With the other frame, Houck plants 24 rows of corn on 30-inch spacings and later sidedresses corn with liquid nitrogen.

Front-Folding Design

The frame is made with a 7-by-7-inch toolbar. It has three sections. The center is 15 feet wide and the wings are each 22½ feet wide.

For strip-tilling, planting corn and sidedressing corn on 30-inch row spacings, there are nine row units on each wing and six row units in the center

For the soybeans planted on 15-inch row spacings, there are 18 row units on each of the wings and 12 in the center.

Starting in the fall of 2008, Houck strip-tilled with the 60-foot-wide toolbar with 24 row units on 30-inch spacing. He applies a blend of dry nitrogen, phosphate, potash and micronutrients. Houck uses a flat rate of fertilizer.

Four tanks ride on the 60-foot-wide frame when Houck strip-tills in the fall. Each of the four tanks can hold 6,000 pounds of dry fertilizer or 75 bushels of soybeans.

"That's 24,000 pounds of fertilizer, and the frame with the tracks weighs 24,000 pounds," Houck says.

Minimize Compaction

Carrying this much weight could cause compaction, a problem that would make the tight, cold clay soils even more of a problem for crop emergence and development, Houck says.

"I decided to use wide-gauge, 120-inch Land Luvr rubber tracks for flotation on the toolbars," he says. "This gives me two sets of tracks on 24 rows, while using duals would have made four tracks and would have made more compaction."

There are rubber tires at each end of the wings for support.

"Tracks aren't cheap, so it was important to use the toolbar more than one time each year," Houck says. "We built the folding frame so we can interchange toolbars for strip-tilling and planting to get more use out of them," Houck says. "The toolbars have quick-attach brackets and can be switched over in 1 to 2 hours."

When fully loaded, the corn planter carries about 2,400 gallons of liquid fertilizer that weighs about 24,000 pounds and up to 75 bushels of corn, which weighs around 4,200 pounds.

The 24 row units for planting corn each weigh 250 pounds. When the frame is set up to plant 24 rows of corn, Houck uses a John Deere 8520T, which has 240 horsepower.

"It pulls easily and rolls right along," Houck says. "But strip-tilling is a different story. It takes more power. Last spring, I used a John Deere 9420, which has 420 horsepower. It takes about 400 horsepower to strip-till 24 rows with the Yetter Mavericks and mole knives.

"I don't want to go deeper than 6 or 8 inches when I'm strip-tilling. With a mole knife, I think you do a better job of getting the dry fertilizer down in the strips."

Starter Fertilizer

When planting corn, Houck applies 9 gallons of 10-34-0, 9 gallons of 28% liquid nitrogen and 1 quart of zinc per acre with the starter.

The amount of nitrogen Houck sidedresses depends on the field, but typically averages 150 pounds of actual nitrogen per acre. Between planting and sidedressing, he puts down a total of 190 to 200 pounds of nitrogen per acre.

"I wanted to put more starter fertilizer on my cornfields," Houck says. "I didn't know of any planter on the market that would allow you to carry more than 600 gallons of liquid fertilizer on a 24-row, 60-foot-wide frame.

"I wanted the ability to plant 100 to 125 acres of corn — applying about 20 gallons of liquid fertilizer per acre — without stopping to fill up. That takes a tank that will hold about 2,400 gallons."

For planting corn, Houck uses 24 John

"We built the folding frame so we can interchange toolbars for strip-tilling and planting to get more use out of them..." — Shane Houck

Deere XP row units on 30-inch spacings and a central fill system designed by Larry Pingry, a retired AGCO engineer who works for Van Tilburg Farms at Celina, Ohio. Van Tilburg Farms bought the second front-folding frame that Houck made.

Each row unit on Houck's corn planter has a single residue wheel, a John Deere single-disc fertilizer opener, a Keeton seed firmer and two Schlagel closing wheels in the back.

"We got a single Schlagel unit back in the 1990s, which we tried on the corn planter," Houck says. "When you went through a no-tilled field, the row looked perfect, so I put them on all of the rows of the corn planter. They run and crumble the soil.

"During one of the driest springs, I needed more down pressure to firm the furrow and to conserve moisture in the soil. Using the Schlagel closing wheels definitely does leave the soil loose."

Managing Residue

Houck is thinking about switching to two residue managers for each of the 24 row units when planting corn.

"We get so much ponding on our fields during the winter," he says, "then the residue floats onto the strips in the spring."

The biggest challenges Houck faces are drainage and residue.

"We chop and spread soybean residue in as wide a swath as we can on land we plant to corn," he says. "We are not growing any continuous corn because of the current residue-management challenges in our corn-soybean rotation."

Houck no-tills soybeans on 15-inch row spacings, switching from no-till drilling soybeans on 10-inch spacings from about 1990 to 1997.

"With RTK and auto-steer, you can split the old corn rows," Houck says. "We are never planting on top of the old corn rows with this method. That's a problem with drilling soybeans or even planting them on 10-inch rows.

"As for yields, I don't know if researchers have proven much of a difference between beans on 7½-inch spacings vs. 15-inch beans on our type of soybeans."

A fertilizer dealer uses variable-rate technology when broadcasting fertilizer before Houck plants soybeans.

"By broadcasting the fertilizer, we can correct any fertility problems in the fields," he says. "We feel it's best to spread the fertilizer all across the field on land that I plant to soybeans than just put it into strips where I planted corn."

He planted Monsanto's Roundup Ready 2 Yield soybeans last spring.

"We've tried to cut back to seeding only 165,000 beans per acre on 15-inch rows," Houck says. "On lighter soils, I'll plant up to 200,000 beans per acre. On these soils, the plants are not going to get as big.

"I do have maps that I could use for variable-rate seeding, but I didn't do that in the spring of 2010 because of a software problem. I did use variable-rate for planting corn. I plant higher populations on the better soils and lower populations on the poorer soils. The plant populations range from 28,000 to 36,000 seeds per acre."

Selecting Seed

When it comes to selecting corn hybrids and soybean varieties, Houck focuses first on yield potential.

"For our soils, I start looking at the emergence scores," he says. "Getting the plants out of the ground faster and good standability is important."

For many years, he saw little pressure from European corn borers and corn rootworms.

"We were probably a little bit slow to adopt hybrids with insect-resistant traits," he says. "Then we had a dry year, and we would have been better off to have *Bt* corn rootworm protection. Since we started using those hybrids, our yields have continued to get better.

"Over the past 3 to 5 years, our corn yields have averaged 165 bushels per acre and our soybeans 52 to 53 bushels."

Continuous Corn

In much of the Midwest, the rapid expansion of ethanol production led many no-tillers to grow more continuous corn.

Houck likes selling corn to the Poet ethanol plant 10 miles away, but hasn't been growing continuous corn.

"I might be more inclined to try it now that seed companies are going to have the refuge-in-a-bag option," Houck says, referring to the simplified system of managing refuge acres for biotech hybrids with corn borer and rootworm protection. "But you are really going to have to do a good job in the fall with residue.

"You need to clear the residue and build a nice berm. It's more difficult to grow corn-on-corn because you have more residue than when you are planting corn into soybean residue."

Strip-Till Lessons

After 7 years of strip-tilling, Houck has some clear-cut conclusions about what it takes to succeed.

"You need RTK GPS and auto-steer, especially if you have a big rig like my 60-foot-wide, front-folding frame," Houck says. "I started using RTK and auto-steer 6 years ago. Before we had the best signal from John Deere, we had auto-steer, but we didn't have repeatability without RTK."

Houck says he knows of a strip-tiller who didn't use auto-steer and instead relies on row markers on the corn planter. There are problems staying on the rows during the day and as it gets dark, that strip-tiller had a hard time seeing strips.

He didn't stop with just RTK and auto-steer. He uses John Deere's iGuide, which provides passive implement guidance.

"Using iGuide keeps the implement lined up with the tractor, and it helps keep the corn row more aligned with the strip-tilled row," Houck says.

Fall Strip-Till

Fall strip-till is a must, Houck says.

"Our tight clay soils have to dry out in the spring," he says. "By strip-tilling in the fall, the berms can settle during the winter.

QUICK CHANGE. Shane Houck designed a front-folding frame to interchange toolbars for strip-tilling and planting. The toolbars have quick-attach brackets and can be switched over in 1 to 2 hours.

The strips help me manage the residue for planting corn."

When Houck strip-tilled for the first time in the fall of 2003, he fertilized 12 rows on 30-inch spacings. Then he left a 60-foot-wide swath, where he had a custom applicator broadcast fertilizer. Corn on the strips with fertilizer yielded 9 bushels per acre more than those where fertilizer was broadcast.

"With the high price of fertilizer, being able to band fertilizer is more efficient," Houck says. "I'm happy now that we're running the subsoiler 6 to 7 inches deep when we strip-till in the fall so we can build a berm as high as we can.

"When it was really dry in the fall and we couldn't keep the mole knife deep enough, then some of the berms did invert. It was not bad. Just a row here and there."

Houck's learned other strip-till lessons, too. When he started strip-tilling, he thought part-time help could run the 12-row rig at harvest. But he changed his mind after he designed a 24-row rig.

"You have to have the right kind of operator," Houck says. "Basically, you are laying out the next year's corn rows when you strip-till in the fall."

What's Next?

The hitch Houck designed and the versatile front-folding frame have met with commercial success, but he's mum about what may be next.

In the meantime, Houck, his brother-in-law, Harvey Dehoff, and employee Eric Siegrist keep tinkering.

"Last fall, we upgraded the strip-till setup to the new Yetter Mavericks that have depth control," Houck says. "We did about 500 acres with the vertical-tillage attachment. The strips looked pretty good and the corn planted well into them.

"This year, we re-routed some hoses for dry fertilizer," Houck says. "It takes more air pressure for dry fertilizer and humidity is more of an issue than it is with seed."

North Dakotans Add Flexibility To Strip-Till Rig

By Mark Moore

When it comes to equipment, Eric Larson is all about maximizing his investment, no matter what the season. So when he began researching strip-till units, he wanted one that could run in both the spring and fall and adapt to changing conditions.

Larson and his brother, Carl, farm near Fullerton, N.D. Farming on the Corn Belt's northern edge can subject them to some challenging growing conditions, from delayed spring planting to fall harvests that can last until the next spring.

"The past two fall seasons, we had about 10 to 15 days to get the fall strips done," Eric Larson says. "The weather and other harvest duties can spread that over 3 to 4 weeks. We can freeze up any time after mid-October. When we go, we go hard."

Spring tasks can begin between April 1 and May 1, depending on field conditions. Flooding is always a concern, which also delays spring planting. They raise a crop rotation of corn, soybeans and pinto beans.

"We basically got into strip-till to accurately place fertilizer in the row where the corn is growing," Larson says. "There were two reasons for that. We apply a lot of fertilizer in the fall while we are harvesting because that saves time in the spring. We also have load restrictions on roads in the spring, so we can't always haul a lot of liquid fertilizer."

Fertilizer Flexibility

In the fall, Larson's 24-row, 30-inch Blu-Jet strip-till toolbar, which is outfitted with Raven anhydrous controls and ground-driven liquid pumps, applies 80 to 100 pounds of nitrogen per acre. The ground-driven pumps apply 10-34-0 in separate tubes behind the anhydrous tubes. Larson added a separate tank that injects N-Serve.

"We inject the N-Serve directly into the anhydrous stream to help keep the nitrogen from volatilizing," he says.

While Larson has noticed the benefits of strip-tilling — mainly an improvement in soil tilth — recent planting seasons have tested the unit.

"We wanted to use strip-till to conserve moisture, but the last 2 years have been exceedingly wet during planting," he says.

He's modified the unit to strip-till in the spring. He's experimenting with applying liquid fertilizer in the spring with the Blu-Jet strip-till rig.

"That's one nice thing about having the strip-till rig set up for liquid fertilizer," Larson says. "If we freeze up before finishing, we can strip-till in the spring prior to planting. We put the remaining nitrogen and phosphorus on in the spring depending on what our soil test tells us.

"In the spring, it can be up to 45 gallons of a mix of 28-0-0 and 10-34-0, along with micronutrients if the soil test shows a need."

This puts a lot of pressure on the planting operation in terms of productivity. Larson says it's difficult to quantify the amount of money saved or productivity gained using his current system.

"I like having fertilizer near the root zone vs. just spreading it," he says. "We have not seen any substantial gains in yield over conventional tillage, but we have in the past saved a tillage pass in the spring."

Larson is contemplating a pass over last fall's strips to fluff them up and place liquid fertilizer with the 2-by-2 system on the planter.

"That would add in the pass I was saving in the past," Larson says. "But then the planter is not having to fertilize as much."

Larson estimates modifications to the Blu-Jet unit cost $12,000.

"Many of the pieces we mounted on the strip-till rig were taken off of other implements," he says.

Simplifying Planting

Larson is looking at moving his spring fertilizer application away from the planter for one reason: simplicity. Concentrating on the planter alone can be difficult, and Larson wants to ensure that an operator has only one thing on his mind while planting.

"Running a planter is tough enough, and you need to make sure everything is being done right," he says. "I want this unit to stand alone and apply fertilizer ahead of the planter."

It also gets some weight off his planter. Meanwhile, a GPS unit ensures the planter accurately places the seed directly into the strips.

"That will help with seed placement," Larson says. "Liquid fertilizer adds a tremendous amount of weight. That can impact seed depth."

Modifications to the strip-till unit include two ground-driven wheels that power two pumps. Fertilizer runs from tanks mounted on the tractor and through the system. Each mole knife is metered with Redball units.

$5,000 Grant, Used Parts Lead To Homemade Strip-Till Rig

This 6-row, 30-inch unit drops dry fertilizer alongside the row and incorporates anhydrous ammonia in one pass for Iowa strip-tiller.

By Mark Moore

Having his own strip-till unit to put down pre-plant nitrogen, phosphorus and potassium for corn was an idea that always bubbled on the back burner for Fred Abels. The Holland, Iowa, no-tiller thought he could incorporate just such a home-built unit into his current no-till operation.

The real push came a couple of years ago when he applied for, and secured, a grant from the Iowa State University College of Agriculture and Life Sciences.

"I had received an e-mail from the Practical Farmers of Iowa on how to apply for the $5,000 grant," Abels says. "Winning that grant gave me the added incentive, so I got to work building my own unit."

One-Pass Fertilizer

Abels crops 300 acres of strip-tilled corn and no-tilled soybeans, Abels also has about 100 acres of pastureland where he rotationally grazes a 70-head cow/calf herd.

"I've been no-till since 1984," Abels says. "A neighbor uses a strip-till unit, but uses liquid starter fertilizer. I wanted to build a 6-row, 30-inch unit that would drop phosphorus and potassium along the rows, and incorporate anhydrous ammonia all in one pass."

So, in the fall of 2006, Abels got to work. He first needed to secure various pieces of equipment to build the entire unit. He found them in the classifieds.

Abels admits finding the right equipment was partially a matter of luck — he seemed to find exactly what he needed and within his pre-determined price range.

Built From Scratch

He pulled half the dry fertilizer units from a Kinze planter, and the other half from a John Deere planter. He married the two onto a 6-row, 30-inch frame.

Six feet behind the main frame of the planter is a 4-by-4 Case IH toolbar on which he mounted anhydrous knives. Three coulters per row incorporate fertilizer: one coulter runs down the row with two others 4 inches to the left and right.

Yetter row openers and a system of three coulters prepare the seedbed in the strip. He plants about a week or two after the strip-till pass.

Abels hired a neighbor to do the initial welding for the unit. He spent rainy days during the fall of 2006 in the shop assembling the unit and did a few test runs that fall to see how the unit worked.

His entire investment came to just over $5,000. And it's an investment that's drawn a significant amount of interest from other no-tillers, and has paid off on Abels' farm in helping boost his corn yields.

"In 2008, I had some of the best corn I've had in a long time. And that's after getting my corn planted around May 20," Abels says.

His farm averaged about 185 bushels per acre where yields typically run 150 to 160 bushels per acre.

Learning Experience

Abels' experience with his unit has come with a learning curve. He doesn't have a GPS guidance system on his tractor, so he relies on row markers and his own driving ability to stay on the rows.

"Last year, I finally got the hang of where to drive the tractor to keep the planter centered," he says.

Abels says that it's possible to use different dry fertilizer units, but that producers need to be careful to ensure the metering is matched.

"The first year, I had to monitor the units to make sure they were sending out the same amount of fertilizer," he says. "That was a challenge, but it was possible."

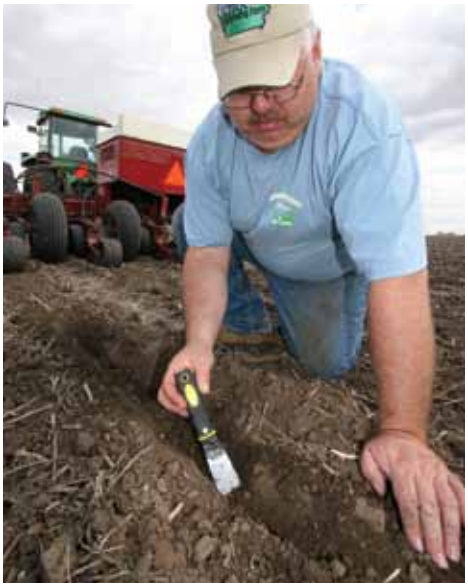
To make the job easier, Abels switched all the drive units to the same Kinze units.

Interest in his homemade unit has been strong. He first showed it at the Midwest Strip Tillage Expo in the fall of 2007. His toolbar was the only home-built unit there.

"A farmer from Nebraska called me one afternoon and was at my doorstep the next morning to look at the unit," Abels says. "There's definitely a lot of interest."

Abels has since upgraded his John Deere 4230 tractor to a larger 130 horsepower tractor, and will be able to pull the unit faster. He plants about 34,000 seeds per acre of 100- to 105-day maturity corn — all conventional.

"Getting the pieces was perhaps the most difficult part, but it seems that everything fell into place and I was able to secure what I needed," Abels says. "I would scour the classifieds and act quickly."



STUCK ON STRIPS. Fred Abels checks the placement of corn seed after planting into berms made less than 2 weeks earlier with a homemade, 6-row strip-till rig.

Environmental Tillage Systems

Zone of Opportunity

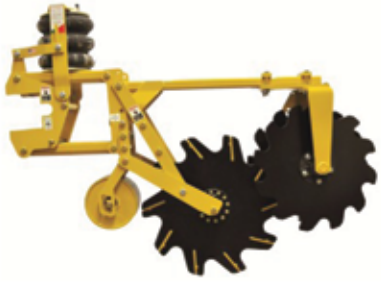
Zone of Profitability

Environmental Tillage Systems and our ***SoilWarrior®*** product line, are about serving leaders, doing things differently and doing things right. Customers around the Corn Belt and around the world are experiencing *ETS Zone Tillage®*. SoilWarrior's appeal is based on **productivity, profitability and performance**.

The SoilWarrior system takes the kinks out of traditional strip tillage systems. We've developed a new way of farming, unparalleled in field performance. Grab a cup of coffee and hang on for a quick read on "Winning in the Zone™."

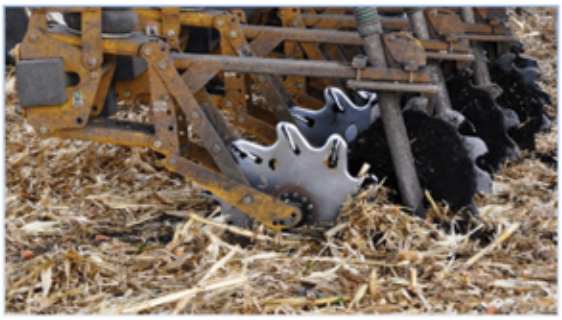
The Growth Zone™ and the SoilWarrior® Cog

SoilWarrior's patented 30 inch rolling cog is a cornerstone of the SoilWarrior system. The gentle rolling action of the SoilWarrior® Cog creates three primary agronomic effects, and a host of resulting benefits. SoilWarrior actions include: fertilizer application and blending, shattering compaction, as well as preparing an agronomically inviting planting/seed zone.



Fertilizer Application and Blending

The SoilWarrior system blends the fertilizer in the root zone. The rolling cog blends nutrients throughout a narrow vertical soil region within each row.



With the SoilWarrior approach, fertility in the root zone is highly available to the growing plant without wasting it outside the Growth Zone.

Nitrogen mixing prevents concentrated hot spots that occur with banding. Phosphorous and potassium are mixed throughout the root zone profile, preventing waste from being out of reach of the roots, and preventing deficiencies that occur with shallow placement. Since both P and K have limited movement after application, fertility mixing has been shown to be highly effective for growing plants.

The SoilWarrior system has multiple settings, configurations, and methods for fertilizer application. It's adaptable to liquid, dry, anhydrous ammonia, or manure. Nutrients can be applied, deep or shallow, providing, flexibility and adaptability for SoilWarrior users.

Soil Compaction

Soil compaction robs plants of moisture, fertility, and healthy root development. The SoilWarrior breaks up typical tillage compaction with the patented cog. There is a primary effect by breaking the tillage layer directly in the path of the cog, and a secondary effect fracturing compaction beyond the direct reach of the vibrating, rolling cog. Compaction shattering helps foster a Growth Zone compatible with healthy roots, healthy plants and enhanced water penetration.

Seed Placement

Consistent seed placement and predictable emergence are critical win factors. Conventional tillage methods can create great seedbeds, but result in over tilled soil. Besides being expensive, conventional tillage breaks down organic matter, reduces soil tilth, and causes increased exposure to wind and water erosion as well as water run-off - hence the need for strip-tillage. But not all strip-tillage systems are created equal.

Traditional shank-based strip-till systems can cause significant seedbed challenges. They are not finishing tools. Shanks can pull up clods, create air pockets, create slabbing and smearing in wet soils, and often lead to less than ideal planting conditions. The result can be inconsistent seed placement, inconsistent emergence, and in some cases a poor root zone for plants to grow into.

With the SoilWarrior and *ETS Zone Tillage®*, it's still about the rolling cog system. Cog tillage provides fertility blending and compaction removal, but it also is a great finishing tool. You can never predict exact soil conditions, but with great soil tilth, the use of the SoilWarrior system, and proper tillage conditions, our seedbeds are remarkable. A SoilWarrior in the field makes for happy farmers, but nothing brings joy to a farmer more than having a great seedbed to plant in.

The Rest Zone

Unlike common perceptions, extensive soil tillage and optimum soil health are not compatible. In order to maximize soil health, the SoilWarrior system minimizes the portion of the soil tilled each year. The soil Rest Zone™, the fallowed area between the rows, is left untilled for a conscious reason. In a 30" row plan, the Rest Zone is approximately two-thirds of the total row surface. The benefits to soil health of leaving the rest zone untilled include:

- Natural mulching of the soil between the rows
- Increased organic matter, microbial activity and soil tilth
- Reduced soil erosion and water runoff
- Reduced fertility loss from reduced soil loss and water run-off
- A fallowed, rested area for planting the following year
- When combined with moving rows each year, last year's roots remain intact spurring the enhanced organic matter, and fostering soil-healthy microbials

These are all key advantages over conventional tillage plans. When producers get adjusted to this mindset, they would not have it any other way.

SoilWarrior, Soil Fertility and Leadership

There are any number of reasons that SoilWarrior is the world leader in Zone Tillage™. We've already mentioned a few. Another great read on new technology is the leadership and integrity of those who support the system.

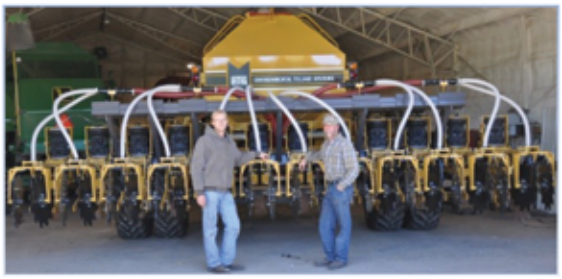
SoilWarrior and Puck Custom Enterprises

In addition to standard fertility programs, the ETS also works extensively with manure-based fertility programs. This is through a market partnership with **Ben and Kathy Puck of Puck Custom Enterprises**. Puck Custom Enterprises is a market leader in liquid manure handling equipment and custom manure application. Obviously manure is a key source of soil and crop nutrition.

Ben Puck and his son Jeremy Puck are not only customer manure applicators, but they also sell an extensive line of Puck Enterprises manure handling equipment to other manure applicators around the U.S. and around the globe.

Handling, delivery and incorporation of liquid manure are about reliability, and about high volume and reliable field incorporation. According to Ben Puck, the Puck Custom Enterprises system combined with the SoilWarrior tillage system is world class. "We have significant experience with ETS, and we believe the business relationship and product combination provides a valuable opportunity for our customers. We've been particularly impressed with the field incorporation and soil blending that we achieve through the use of ETS's HoneyWarrior® equipment."

With the combined PCE and SoilWarrior system, Puck is applying greater than 2,000 gallons of liquid per minute with excellent results. The natural fertilizer application combined with the low impact zone tillage system provides not only seamless manure incorporation, but also increases soil organic matter, creating excellent soil growing conditions.



Feeding Healthy Plants and Healthy Soil

Nothing is sound in the field without the right practices, the right inputs, and the right people. ETS works hand in hand with fertilizer companies, plant and soil fertility professionals, consulting agronomists, and leading producers on soil balance, soil water management, crop nutrients, soil health and yield enhancement programs.

ENVIRONMENTAL TILLAGE SYSTEMS

www.SoilWarrior.com
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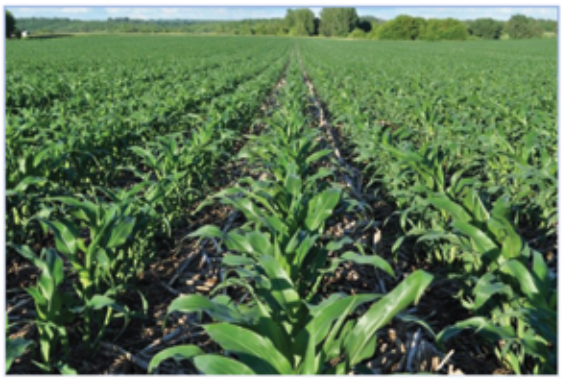
Midwestern BioAg

Bob Yanda and **Midwestern BioAg** are experts in plant health, yield and nutrition. Their program involves working with leading producers to put together their own plant and soil nutrient plans.

The approach goes far beyond soil tests. The goal is a unique formula of nutrients that is fit for your soils, your farm, your crops, your yield goals, and your growing conditions. He is a market partner for his customers, and a market partner with ETS.

According to Midwestern BioAg, there are two key measures to manage. You must do everything you can to maximize the plant vigor and photo-synthesis at the critical growth stages. You must also balance soil minerals to maximize the productivity and biological activity of your soils. Bob Yanda uses a balanced approach that helps you fine tune your soils not just for this year's crop, but for long term agronomic productivity.



As a part of his work, Bob explains to producers the details behind why limited tillage, effective fertilizer blending, proper plant and soil nutrition, breaking up compaction, and leaving an undisturbed soil rest zone are all critical to the yield, health and viability of your cropping operation.

Nurture the Soil, Not Just the Crop

Organic matter and microbial activity in the soil are critical elements of agronomic success. The benefits of high organic matter soil are too numerous to list, but they include better water storage and management, better nutrient availability, better soil tilth, and healthier, more productive plants.

The Midwestern BioAg process will help producers take their soils, one field at a time, through the process of increasing organic matter, converting organic matter to a usable asset for your crops, and translating that to yield and your bottom line.

Your soil is an asset. The more productivity you achieve from that asset, the better. Keeping a maximum level soil health and fitness is critical. Enhanced microbial activity and enhanced organic matter are a part of that process.

With Bob Yanda and Midwestern BioAg, you'll quickly understand the productivity increases to be gained through the conversion of organic matter. In order to convert the organic matter, you not only need to maintain an adequate soil Rest Zone™, but you also need a proper nutrient plan for your soil. Better nutrients. Better soils. Better yields. Better bottom line profits.

Midwestern BIOAG
BETTER FARMING THROUGH BETTER SOIL

www.MidwesternBioAg.com
800-327-6012

NEW DEBATE. Many strip-tillers believe banding phosphorus and potash (above) is the most efficient way to fertilize high-yielding corn and soybeans, but others question whether broadcasting the nutrients works just as well.

Banding Vs. Broadcasting: **Which Is Best For Strip-Till?**

There are pros and cons to both application methods, with nutrient availability, soil tests and even land ownership factoring into the debate.

By Dan Zinkand

Strip-tillers and agronomists agree about the need to maximize the use of fertilizer to produce high-yielding corn and soybean crops.

But when it comes to whether it's better to band or broadcast phosphate or potash in strip-till, they seem to be divided, nearly as much as debates about the color of farm machinery and the pros and cons of glyphosate-resistant cropping systems.

For example, the farm operations of Illinois strip-tiller Jeff Martin and Ohio strip-tiller Travis Harrison are similar. Both Martin and Harrison use large-capacity strip-till rigs — 12- and 16-row machines — to grow corn on soybeans on thousands of acres. Both want to maximize the efficiency of the fertilizer, grow high yields and protect the environment.

But Martin broadcasts phosphate and potash on about 5,500 tillable acres, mostly corn-on-corn. Harrison bands these fertilizers on about 4,500 acres, mostly in a corn-soybean rotation.

Conservation Tillage Guide interviewed several farmers and fertility experts about the issue of banding vs. broadcasting fertilizer in strip-till to understand why they take the approach they use or application method they promote.

Broadcasting Benefits

Martin and his son, Doug, of Martin Family Farms in Mt. Pulaski, Ill., switched from no-tilling corn to strip-tilling more than 15 years ago due to a dense mat of residue remaining from soybeans.

"We tried planting corn with and without coulters when we no-tilled, but the residue still prevented the soil from drying out," Jeff Martin says. "This did not make a good seedbed with or without the coulters. In a really dry spring, no-till corn would work, but we cannot count on having a really dry spring every year."

The large amounts of dense residue came from corn-on-corn, as well as beans.

"We switched to 30-inch-row beans and still have a solid residue mat in the spring," he says. "The residue doesn't allow soil to dry out for proper planting. In corn on corn, clearing a small strip moves residue away from where new seedlings emerge, which we feel is important."

The Martins strip-till in the fall because

they want to plant corn as soon as the fields are ready.

"Strip-tilling helps warm and dry out soil, which makes a good seedbed for planting," Martin says. "If soil conditions are good, we will plant corn after April 5."

They fall strip-till with a 16-row Deere 2510S on 30-inch spacings pulled by a Deere 9530 4-wheel-drive tractor and apply anhydrous on 80% of their land.

"Banding of phosphorus and potash reduces the fixation of phosphate and potash fertilizer into soil minerals and clay layers…" — Laura Gentry

On the rest of their corn acres, the Martins plant and then sidedress 28% liquid nitrogen, using a toolbar with thin anhydrous knives. The knives incorporate the nitrogen, but move very little soil.

When the Martins strip-till in the fall, they apply 170 to 200 pounds of anhydrous per acre, which works out to 0.9 pounds of nitrogen per bushel of corn.

"Our yield goal is 235 bushels per acre, which works out to 202 pounds of nitrogen per acre," Martin says.

Over the years, the Martins say they have listened to presentations at the National No-Tillage Conference about broadcasting vs. banding phosphate and potash. They follow the recommendations of University of Nebraska ag engineer Paul Jasa, who prefers broadcasting these nutrients. Martin says that according to Jasa, broadcast phosphate and potash will be available throughout the entire soil profile and not just in a band.

"Corn roots don't just grow in a narrow band after the seed germinates," Martin says. "That's why broadcasting, instead of banding, makes sense to me. If you band in strip-till, what happens to the nutrients needs of corn when the roots grow outside of that band during the growing season?"

More To Learn

Although he doesn't have scientific proof, Martin believes earthworms move phosphate and potash through the soil profile by recycling residue in their channels, making nutrients widely available.

The Martins have phosphate and potash custom-applied after they strip-till fields in the fall.

"We base our phosphate and potash applications on soil tests and do variable-rate applications according to soil tests," Martin says. "We try to keep levels at the university recommendations.

"Where we do not apply nitrogen in the fall, we run a Salford vertical-tillage tool over the ground in the fall and no-till the corn in the spring, followed by sidedressing."

When weighing the pros and cons of banding phosphate and potash, Martin focuses on the bottom line.

"It takes time, lots of horsepower and a dry fertilizer cart to band phosphate and potash in the fall," he says. "If there is a yield advantage with banding, what's the cost? As long as our yields are even with our neighbors — including those who strip-till and band fertilizer — then we feel we are on the right track."

Even so, Martin says he wants to learn more from onfarm testing about the pros and cons of banding vs. broadcasting phosphate and potash. But there are limits to the size of tests farmers can do, he says.

"It's hard to do side-by-side onfarm tests on a large scale because of the investment involved," he admits.

Benefits Of Banding

While the Martins broadcast phosphate and potash in their strip-till system, Harrison and his father, Gary, band 2 year's worth of phosphate and potash after harvesting soybeans.

The Harrisons think banding these fertilizers make the nutrients more available to plants during the growing season because they're in a strip below the soil surface, in line for roots of growing plants.

The Harrisons, who farm near Wayne, Ohio, have been strip-tiling for 6 years. They use 16- and 12-row Orthman 1tRIPr rigs, both with 30-inch spacings. The rigs have twin Valmar dry fertilizer boxes.

"With the twin bins, we can carry two different fertilizers and blend them, and we vary the application rate," Harrison says. "The rates really depend on the results of soil tests, and how much the previous crop removed.

"On average, we apply 240 pounds per acre of 0-0-62 and about 150 pounds per acre of 11-52-0."

The Valmar bins on the Orthman strip-till rig have a 60:40 split between phosphate and potash. The lead bin holds 3.2 tons, and the rear bin holds 4.8 tons of dry fertilizer, Harrison says.

They pull the 16-row 1tRIPr with a Case IH Quad Track with 535 horsepower and use a Cat MT 855 with about 450 horsepower to pull the 12-row strip-till rig.

The Harrisons normally try to place dry fertilizer 6 inches deep, Harrison says. But if it's a wet fall, they band it 4 inches deep.

A 2-Year Rate

The Harrisons apply 60 pounds of nitrogen — liquid AMS, 18-0-0-6 — pre-plant with a AGCO RoGator, 30 pounds in 2-by-2 placement with their corn planters and sidedress the rest.

In 2012, they'll be planting for the first time with a 24-row Deere 1770NT CCS with XP row units set to 30-inch spacings. They will continue to use a 16-row Deere 1770 NT with 3-bushel boxes to plant soybeans.

While the Harrisons have been banding a 2-year rate of phosphate and potash for their corn-soybean rotation, they're starting to change.

"Now, our focus is to apply phosphate and potash for what we need for the following year's crop of corn or soybeans instead of banding a 2-year rate," he says. "With this change, we will strip-till and band each fall, after harvesting corn and soybeans."

In fields going to soybeans, the Harrisons band dry fertilizer between the rows of the corn, and for corn they band nutrients on the old soybean rows they harvested that fall.

"By continually moving over 15 inches, we should be able to equalize the nutri-

CASE BY CASE. Brett Roberts, a state agronomist for the NRCS' Illinois office, says broadcasting is the best way for strip-tillers to apply phosphate and potash, but adds that banding makes sense in some instances.

ent levels in the field," Harrison says. "It will also give the old corn stalks and roots a chance to decompose, creating water channels similar to the burrows or holes that earthworms make.

"By applying phosphate and potash annually, instead of using a 2-year rate, we're reducing the fertilizer load and being environmentally responsible as well. I don't know if we'll see a big yield boost for soybeans, but it may happen."

Balancing The Options

Brett Roberts, a state agronomist for the NRCS' Illinois office, believes broadcasting is the best way for strip-tillers to apply phosphate and potash, but he adds that banding makes sense in some instances.

"It all depends on the soil-test level for phosphorus and potassium," Roberts says. "Typically, farmers are applying a 2-year maintenance rate in a corn-soybean rotation in the fall after they harvest soybeans. This saves time the following spring and saves on application costs by doing this every other year rather than every year."

Roberts says studies show there's a yield benefit to deep banding only if the soil tests for phosphorus and potassium are low.

Once the optimum level of these nutrients is reached, there is seldom a yield advantage for deep banding, he says.

"If soil test levels are optimum, there's virtually no benefit from deep-banding, regardless of tillage system," Roberts says. "It's a wash."

But he adds that other considerations may lead strip-tillers to band phosphate and potash.

"If you're cash-renting ground on a year-to-year basis and the soil tests for phosphorus and potassium are low, you may benefit from deep-banding," Roberts says. "But deep-banding also requires more equipment, including a dry fertilizer cart and a tractor with the horsepower to pull the strip-till rig and cart."

Farmers started talking about strip-till when they saw the benefit of no-tilling corn where anhydrous ammonia was applied in the fall, Roberts says.

"With good no-till soil structure, some of the applied phosphate and potash moves deeper than previously thought…" — Paul Jasa

"Farmers have always noticed that no-tilled corn looked better where it crossed the strips created by the anhydrous applicator," he says. "Many farmers decided to try no-tiling corn into the narrow strips created by the applicator. Prior to the availability of GPS and RTK on tractors, this task wasn't always that easy to do."

Roberts says the benefits of the "tillage effect" of strip-till — even without fall-applied phosphate and potash vs. no-till — are particularly evident in cool, wet soils in the northern Corn Belt. But he's skeptical about the "starter" response of applying phosphate and potash 6 inches or deeper in strip-till.

"With deep-banded phosphate and potash, you will not get an early season 'starter effect' like you will with a 2-by-2-inch placement when planting corn," he says.

Roberts recommends strip-tillers band phosphate and potash if they cash rent with a year-to-year lease and soil-test levels for phosphate and potash are low; or if runoff is a concern where phosphorus can enter bodies of water.

Support For Banding

To Laura Gentry, an assistant professor at the University of Illinois, applying phosphate and potash in strips makes the most sense.

"Why would you want to make extra passes to broadcast phosphate and potash if you're strip-tilling, especially if you're strip-tilling in the fall?" Gentry asks. "One of the major advantages of strip-tilling is banding fertilizer because it consolidates field operations and often makes fertilizer more plant-available.

"In the research literature I've reviewed, I can't find any disadvantage to banding phosphate and potash. That's especially the case if you put these fertilizers in the strips you're making in the fall."

That said, there might be benefits to banding phosphorus in the spring, especially if strip-tillers weren't able to make strips in the fall, Gentry says.

Spring banding in strips was something Gentry and Fred Below, another Illinois professor, tried in 2011. Gentry and Below saw more vigorous and developmentally advanced plants throughout the growing season vs. corn that didn't receive phosphate, sulfur and zinc.

"Improved growth early in the growing season doesn't always translate to greater yields," Gentry says. "But in this case, banding of MAP with sulfur and zinc prior to planting resulted in yield increases in corn of 9% to 10%, or 13 to 15 bushels per acre."

Phosphate, Potash Properties

When looking at banding vs. broadcasting phosphate and potash, it's important to understand the properties of the nutrients and how they behave in soil, Gentry says.

The plant availability of phosphorus

Taking Soil Tests In Strip-Tilled Fields

Like any other tillage and planting system, it's important to submit representative soil samples to obtain meaningful soil test reports, says Laura Gentry, an assistant professor at the University of Illinois.

That's especially the case for phosphorus, she says. Strip-tillers often ask her how they should take good, representative soil samples where fertilizer applications have been banded.

"The best research I'm aware of suggests pulling five to 10 cores along a line perpendicular to the strips, beginning at the edge and including one band and ending at the edge of the next band," Gentry says. "This should be repeated in 15 to 20 different areas.

"It's good to pull samples from 6 inches below the surface."

If strip-tillers are applying nitrogen, phosphate and potash 8 to 10 inches deep, they should pull samples from that depth, Gentry says.

Historically, the samples and broadcast fertilizer recommendations have been based on a 6-inch depth, which is the depth that fertilizer was incorporated with tillage.

While banding phosphate and potash concentrates nutrients, it's not likely to build to levels that create problems, she says. High-yielding corn and soybeans gobble up nutrients, leaving many strip-tillers and no-tillers concerned about not having enough in the soil.

"Interestingly enough, some farmers in the Red River Valley in Minnesota and North Dakota are deliberately trying to build up high levels of phosphorus in the soil," she says. "This is the case in areas where they have high pH soils.

"Some of these farmers, who use conventional tillage, buy strip-till machines to band phosphate. They want a 'build-up zone' and hope that banding phosphate over time will build it up in the soil to feed high-yielding crops."

Brett Roberts, Illinois NRCS state agronomist, urges strip-tillers to pay close attention to where they pull soil cores in fields when phosphate and potash have been banded.

"For every soil core pulled from a strip, take two or three from outside the strip," Roberts says. "If you don't take more samples from outside the strip, you will bias the soil-test results considerably toward the nutrient levels in the strip.

"Test levels of potassium may be higher in the strip than between the rows — whether or not phosphate and potash was banded or broadcast — because a majority of the corn stalks are left in the row at harvest and, when the corn stalks get wet with fall and winter precipitation, the potassium readily leaches out from stalk tissue."

fertilizer is primarily controlled by soil pH. Phosphate becomes unavailable for immediate plant uptake when it is "fixed" into a soil mineral, she says.

When soils are either very acidic or very basic — pH of less than 5.0 or pH of more than 7.4 — phosphates are likely to be "fixed" in a mineral form (for example, aluminum phosphate or calcium phosphate) that plants cannot access.

Potassium fertilizer, or potash, is less affected by soil pH, but it can still become unavailable for plant use in the presence of certain types of clay minerals, Gentry says.

Soils with sufficient amounts of "K-fixing" clays that create potassium-deficiency problems tend to be localized, so strip-tillers should discuss specific phosphate needs and rates with a local agronomist.

Gentry cautions that fertilizer banded too close to the seed can burn it. This can happen with urea, ammonium thiosulfate, liquid ammonium phosphate (10-34-0), potash and other fertilizers with a high-salt index.

These fertilizers shouldn't be placed in direct contact with seeds, especially when soil is dry, she says. The salt content of some fertilizers is high enough to cause burn, which will reduce seed germination and seedling emergence.

"Phosphorus moves fractions of an inch in the soil from where you place it with your tillage and planting system," Gentry says.

Potassium is also considered an immobile nutrient. If phosphorus and potassium are broadcast on no-tilled fields year after year, these nutrients become stratified near the soil surface.

"One advantage of strip-tilling and applying phosphate and potash in strips is that corn roots grow down and will intercept the banded nutrients," Gentry says. "An advantage of banding nutrients, compared to broadcasting and incorporation, is that banding reduces contact between the fertilizer and soil.

"This also reduces the fixation of phosphate and potash fertilizer into soil minerals and clay layers."

Broadcast Works Best?

The debate on whether to broadcast or band involves the issues of soil tie-up, root access and soil moisture, Jasa contends.

"When phosphorus and potassium levels are low, more of the applied nutrients are tied up when contacting soil, which favors banding," Jasa says. "If soil-test levels are higher, less nutrients are tied up and broadcasting works fine."

Jasa says banding has long been promoted to lessen nutrient contact with the soil, making it more available for the plants. Research in tilled soils typically shows that a half-rate of banded nutrients performs the same as a full rate that's broadcast. However, the full-rate of broadcasted fertilizer built soil-test levels better than the half rate, he says.

When it comes to soil contact, consider surface-broadcasting phosphate and potash in no-till as a "horizontal band" because the nutrients aren't contacting a lot of soil, Jasa says. In both no-till and strip-till with residue on the surface, there are many roots growing near the surface in moist soil under residue to take in nutrients.

"Several years ago, the International Plant Nutrition Institute said banding and broadcast rates should be the same in no-till in humid environments," Jasa says. "This doesn't happen when the broadcast nutrients are incorporated with tillage, because this increases the soil contact. Also, the tillage dries the soil some and reduces the moisture-conserving mulch, lessening the amount of roots growing near the soil surface."

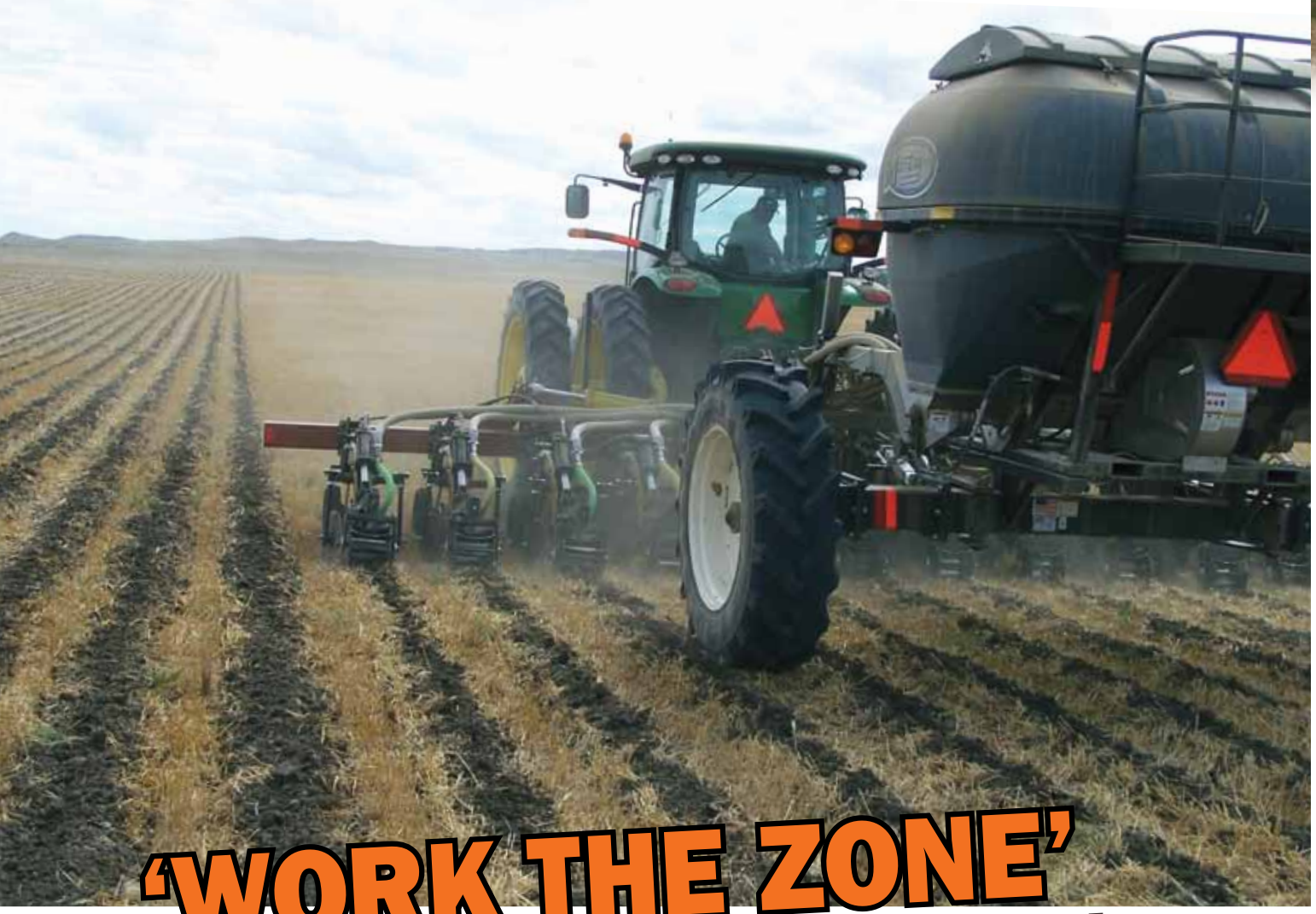
Many strip-tillers and no-tillers are concerned about the stratification of nutrients, but if nutrients are in moist soil and roots are growing in that soil, it's more of a matter of distribution of these nutrients, he says.

"Anyone who says stratification is a problem in no-till and recommends tillage probably hasn't measured nutrient distribution in tilled conditions," Jasa says. "I've seen better nutrient distribution in no-till than in chisel or disc-based tillage systems because the tillage ties up some of the nutrients on the soil.

"With good no-till soil structure, some of the applied phosphate and potash moves deeper than previously thought."

While banding places nutrients close to the seed row, Jasa prefers broadcasting and placing pop-up fertilizer close to the row at planting time.

"Nutrient uptake late in the season comes from the entire soil profile. That's where roots are growing and accessing water," he says. "Why build concentrated bands in the soil when roots are growing everywhere? I'd rather build the entire soil profile."



'WORK THE ZONE' To Boost Strip-Till Fertility

CRITICAL PLACEMENT. Placing fertilizer both shallow and deep in strips should keep corn growing steadily after it emerges, says Montana strip-tiller David Hardy. He decided to place some of the nitrogen, phosphate and potash shallower in the fall of 2011 after seeing corn growth lag in the spring of 2011.

Placing fertilizer both shallow and deep and planting in the middle of the berm can maximize your strip-till corn yields.

By Dan Zinkand

For successful results in strip-till, fertilizer needs to be placed in a zone where the roots and seedlings of corn can readily access plant-food nutrients.

But soil types, weather conditions and soil-sample results that affect the application timing and fertilizer placement and choice can all be major factors in that success.

For example, shallow placement of anhydrous ammonia in spring strip-tilled fields can burn the roots and kill germinating corn.

And if strip-tillers apply anhydrous ammonia in the fall when the soil temperature is too warm — or if they strip-till into sandy soils — nitrogen can drop out of the seed zone.

Fertilizer programs and placement need to be just right, leaving an array of important choices for strip-tillers to make.

Making Adjustments

David Hardy of Fairview, Mont., strip-tills corn and sugar beets under center pivots, which irrigate about 60% of his acres. He also grows malting barley, wheat and alfalfa for a cow-calf operation.

Hardy uses a 270-horsepower John Deere 8270R tractor to pull his 12-row Strip Cat strip-till rig — set to 26-inch spacings — and a 6-ton Montag fertilizer cart.

Before strip-tilling in the fall, Hardy soil tests each field and applies about 85% of the recommended amount of nitrogen.

Since phosphorus and potassium don't move in the soil, Hardy applies 50% of the recommended rates, based on soil-test results.

"We have high-pH soils — 8 to 8.8 pH is typical," Hardy says. "Applying 100% of the phosphate and potash in the fall is inefficient, because it will tie up in the soil."

In the fall of 2011, Hardy decided to place some of the nitrogen, phosphorus and potash at shallower depths than the previous fall, rather than placing it all at one depth.

After seeing his corn grow quite rapidly

after emergence in the spring of 2011, and suddenly lag before growing again, Hardy thought he placed the fertilizer too deep the previous fall.

Typically, the mole knives on the Strip Cat place nitrogen at the bottom of the seed trench, 6 to 7 inches deep.

"Gravity always wins," says Hardy, who estimates 60% to 70% of the fertilizer still finds its way to the bottom of the trench.

But in the fall of 2011, Hardy decided to raise the fertilizer-placement tubes behind the mole knives. After doing this, about 30% of the fertilizer was mixed into the soil, about 3 inches below the surface.

Hardy hopes that placing about 30% of the fertilizer in the top 3 inches of the soil, and the rest about 6 to 7 inches deep in the strip, will help his corn avoid the 2-week lag in growth that he saw last spring.

He'll watch the growth of corn this spring to see if the dual placement keeps corn growing steadily.

Fertilize The Root Zone

Four industry experts agree that a major key to making fertility work in strip-till systems it to place fertilizer in the strip at a depth where corn can easily take in the nutrients.

Most of these experts favor "dual placement," with some of the nitrogen, phosphate and potash applied in the top 4 inches of the soil, and more placed 8 to 9 inches down.

Jerry Wilhm, senior research manager at Agro-Culture Liquid Fertilizers in St. Johns, Mich., says there's still a missing link for optimal placement of crop nutrition, despite the number of advancements in strip-till equipment in recent years.

"Application of dry and liquid fertilizers is usually limited to rather deep placement at the bottom of the shank," Wilhm says. "This is good for nitrogen and possibly potassium, but the best placement for early access of phosphorus, some starter nitrogen, micronutrients and potassium is in the seed zone."

Research at Agro-Culture's 420-acre North Central Research Station in Michigan has shown advantages of dual placement in strip-till using a system the company calls Nutri-Till. It places liquid fertilizer both in the seed zone and at the bottom of the shank, 8 inches below the soil surface.

A custom-built Nutri-Till applicator strip-till rig consists of Yetter coulters and hillers, and an anhydrous shank.

"It's primarily used for UAN liquid, but we have sent anhydrous through it," Wilhm says.

A tube at the base of each shank places fertilizer deep in the strip. Shallow seed-zone placement of fertilizer occurs via a solid jet stream from a nozzle that sits between the two side coulters, at the rear of each row unit.

> "Plant roots don't seek nutrition. They live in the presence of nutrition..."
> — Mike Petersen

The nozzles run about 1 inch below the surface, so when strips are planted, the seed is in contact with the fertilizer. Because two products are being placed, this fertilizer program requires two separate tanks on the strip-till rig.

"In field testing in 2011, we found that with fertilizer applications made in the fall of 2010, the shallow placement of liquid phosphate, potash and micronutrients yielded 9 bushels more corn per acre than with deeper placement," Wilhm says. "Deep placement yielded an average of 8 bushels more corn vs. no phosphate, potash and micronutrients.

"The corn is reaching and using the deep-placed nutrition, but the shallow placement is better."

Complement Corn Roots

Gene Carstens, co-owner of Minden, Neb.-based Twin Diamond Industries, says he agrees with the advice that Orthman Mfg.'s agronomist Mike Petersen gives strip-tillers about fertilizer placement.

Both Carstens and Petersen say strip-tillers need to apply fertilizer in the 0-to-4-inch range and additional fertilizer in a deeper zone, about 8 to 9 inches below the soil surface.

"Plant roots don't seek nutrition," Petersen says. "They live in the presence of nutrition. Roots are pulled down by gravity and follow the warming of soil.

"If nutrition is in the same areas as the growing roots, they will be fed. But if the roots have to hunt for nutrition, the plant suffers and yields suffer."

In the first 45 days of corn growth, the roots tend to grow in two triangles, one on top of the other, Petersen says. The corn roots in the top triangle represent the first shallow growth in that triangle, which is 6 inches tall and 13 inches across at the base.

The second stage of root growth is in a triangle that is 8 inches tall and 18 inches wide at the base, Petersen says. The top point of the second triangle starts 3½ inches below the surface of the soil, which is the top of the first triangle of root growth.

Roots in the top triangle represent the first 20 days of corn growth, while those in the bottom triangle are the next 25 days of growth.

"We must provide fertilizer for the plant so it's healthy up to 45 days after emergence, which is when the corn plant determines yield," he says. "At 45 days after emergence, the plant sets the number of rows around the cob.

"In the next 20 to 40 days — right up to pollination and shortly afterward — the corn plant sets the number of kernels running the length of the ear."

Carstens recommends strip-tillers take two soil samples — 0 to 4 inches and 4 to 12 inches deep — to see what the potassium levels are in the soil.

"In soil with a cation-exchange capacity of 15, I typically recommend strip-tillers place 66% of the phosphate and potash 8 to 9 inches deep," he says. "For nitrogen, I recommend split applications for spring strip-tillers, and then have them sidedress and/or apply nitrogen through the center pivot."

What's In The Soil?

But it's not enough to just think about the depth of fertilizer placement, says Keith Diedrick, Pioneer Hi-Bred's agronomist for west-central Indiana. Strip-tillers must also factor in the levels of phospho-

rus and potassium in the soil.

"Corn and other plants struggle for phosphorus and potassium when soil-test levels are very low, and that holds true if these nutrients are banded in a strip or broadcast," he says. "There's probably some benefit to shallower placement of nitrogen and phosphorus — 2 to 4 inches deep — where the band of fertilizer would act similarly to a starter band in a 2-by-2-inch placement."

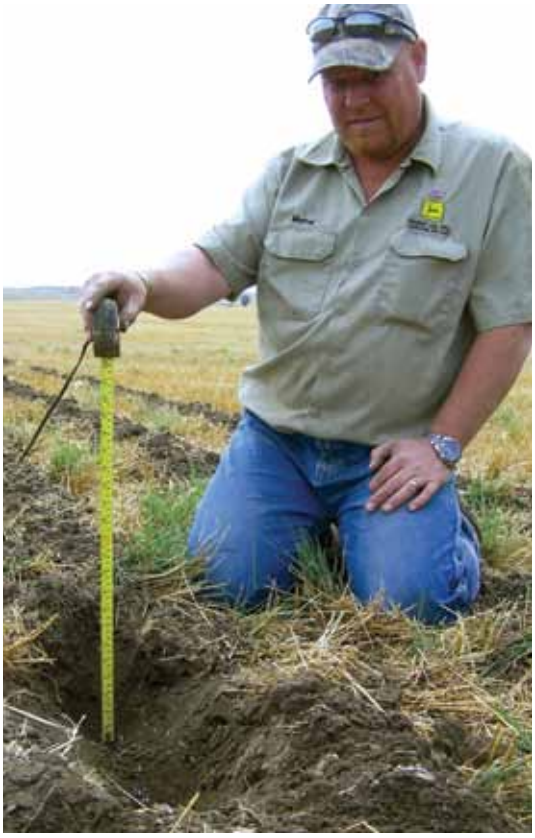
Diedrick says he's leery of applying high quantities of nitrogen or potash in-furrow. That creates the risk of stand loss by "salting out," where seeds can't take in water effectively.

"Most sources say we generally ought to limit the total pounds of urea-containing nitrogen, plus 0-0-60 potash, in a 2-by-2-inch band to no more than 70 to 100 pounds per acre in corn," Diedrick says. "But in-furrow with the seed, the limit for nitrogen and potash is a total of 5 to 10 pounds per acre.

"It's always safer with a 2-by-2-inch band, rather than in-furrow with seed, which is why calibration and settings are so important."

Research on starter-fertilizer benefits in conventional tillage doesn't always show a yield advantage, Diedrick says. But when it does, the starter benefit is usually in cooler, wetter springs.

"As a whole, the majority of a strip-tilled field may be slightly cooler than its conventional counterpart and, as a result, the response to a starter band of fertilizer may be greater," he says.



MAKE ADJUSTMENTS. The mole knives that David Hardy of Fairview, Mont., uses on his strip-till-rig placed nitrogen at the bottom of the trench, 6 to 7 inches deep. But before strip-tilling in the fall of 2011, Hardy raised the fertilizer placement tubes, located behind the mole knives on the strip-till rig, hoping that some shallower-placed fertilizer will keep corn growing steadily in the spring.

Hit The Bullseye

While strip-tillers focus on placing fertilizer at the proper depth, they also need to plant on target, too.

That means planting into the middle of the berm in the midst of the fertilizer, and not far off to the side of the nutrients.

Numerous research studies show reductions in corn yields when kernels are planted away from the fertilizer under the berm, says Petersen.

This includes results from a study the University of Minnesota Extension did in the fall of 2010 and 2011 growing season.

Using RTK at a research site at Morris, Minn., University of Minnesota strip-till specialist Jodi DeJong-Hughes planted corn in the middle of a strip-tilled berm, then 4 inches over from the middle on the berm's inside edge.

"Three of the four replications showed an average difference of 11 bushels per acre — or a 5.5% increase in yield — with the seed planted in the middle of the berm vs. on the edge," DeJong-Hughes says. "The difference in yield has to do with temperature and direct placement of seed over the fertilizer band."

Caution On Sandy Soils

Brandon Bonk, who farms near Dover, Del., strip-tilled for the first time in the spring of 2011 after researching the system for a year.

Bonk strip-tilled 1,260 acres, including all of his corn and about 50 acres of soybeans. He grows about 1,100 acres of full-season and double-cropped soybeans, 600 acres of no-till wheat and irrigates about 1,000 acres of corn.

Bonk built an eight-row strip-till rig with 30-inch spacings on a Krause toolbar that has a 3-point hitch, along with a Blu-Jet coulter cart that carries two 500-gallon tanks of liquid fertilizer.

He applies fertilizer that's in suspension and uses a CDS John-Blue piston pump with a Rawson hydraulic drive motor.

Bonk applies the suspension fertilizer as he strip-tills, and then comes back to plant corn.

His strip-till rig creates a strip about 7 to 8 inches wide and 7 to 11 inches deep. Bonk variable-rate-applied fertilizer 5 to 8 inches deep.

"At that depth, corn can reach the fertilizer within several weeks after planting," he says. "You don't want it too deep, where the fertilizer could dissipate down into the soil. If the fertilizer is placed deeper, at 10 or 11 inches, the corn won't find it when it's needed — as it's growing."

The suspension fertilizer Bonk applies contains 30% clear nitrogen, potash and sulfur.

"Normally, the suspension fertilizer has 50 pounds of nitrogen, 110 pounds of potash and some sulfur," Bonk says. "That's 100% of the sulfur that the corn needs, and about 25% of the nitrogen."

Location Is Everything

Strip-tillers choosing suspension fertilizer like it because they can include a lot of potash, says Dave Wharry, precision agriculture specialist at Hoober Inc., based in Middleton, Del.

Suspension fertilizer is a good fit for soil that needs more potash than can be provided in other liquid fertilizer formulations.

"With suspension fertilizer placed 5 to 6 inches down in the strip, it's readily available to roots where the starter fertilizer leaves off," Wharry says. "Because the suspension fertilizer is where the roots are, the total nutrient levels can be decreased. If we can decrease the amount of nutrients applied while maintaining crop yields, then we can satisfy the environmental demands placed on the agricultural industry."

When Bonk plants corn in 30-inch rows with his 16-row Kinze 3650 planter, he applies 40 pounds of nitrogen and 15 to 20 pounds an acre of phosphorus, along with some micronutrients, in a 2-by-2-inch placement.

"The majority of a strip-tilled field may be slightly cooler than its conventional counterpart, and the response to a starter band of fertilizer may be greater..."
— Keith Diedrick

"By placing starter fertilizer 2 inches down and 2 inches away from the corn, we're putting it where the corn can get up and growing more quickly than if we had broadcast the fertilizer," Bonk says. "The plant comes up faster and it's healthier.

"There are fewer problems with disease pressure if the weather turns cool and damp."

At the four- or five-leaf-stage of corn, Bonk sidedresses nitrogen 2 inches deep with a 16-row Blu-Jet coulter-knife cart on 30-inch spacings.

He applies liquid nitrogen as needed during the growing season with the center pivots.

The results of Bonk's strip-till debut are a little unclear. From spring to fall, he tended to the nutrition needs of the corn, but Hurricane Irene slammed through Delaware in September.

"Before Irene, the corn looked like it would yield 220 to 230 bushels per acre," Bonk says. "We lost a lot of corn in the field because of the hurricane."

ADJUSTING PLACEMENT. By raising the fertilizer placement tubes behind the mole knives on his strip-till rig, David Hardy hopes to mix some of the fertilizer in the top 3 inches of the tilled soil in the strip.

A 50-Bushel Increase

For Plainview, Texas, corn and cotton grower Steve Olson, strip-till not only conserves fertilizer, but also saves money since he started the practice around 3 years ago.

Olson uses a 12-row Orthman 1tRIPr set to 30-inch spacings, pulled by a Deere 8310R with duals.

"We've got RTK guidance on the 1tRIPr and on the tractor," he says. "The name of the game is to get as precise as we can."

Olson applies nitrogen, phosphate and Black Label, a liquid fertilizer from Crop Production Services (CPS), about 8 inches down into the strip.

Black Label contains humic acid, organic acid and phosphate, as well as zinc and other micronutrients.

"These help foster the growth of soil bacteria that is beneficial to the soil," Olson says. "The bacteria eat the fertilizer and convert it to a form that the plant can use for nutrition."

For strip-tillers, there's a direct connection between the depth that fertilizer is placed in the strip and the fertilizer that's subsequently applied, whether it's sidedressed, foliar applied or applied through an irrigation system, Petersen says.

Proper placement of fertilizer in the strip complements the two growth stages of the corn roots in the first 45 days.

"By having enough fertilizer placed both shallow and deep in the strip, the corn seedling and its roots develop well, setting up the plant for steady growth and excellent yields," Petersen says. "By coming back with fertilizer after the corn emerges, strip-tillers can build on the 'fertilizer foundation' they made in the strip before planting.

"In other words, the depth of placement of the fertilizer in the strip is an essential part of the total fertilizer program for strip-tillers who want to maximize plant health and yields."

Olson applies 50 to 60 units of nitrogen and 80 to 90 units of phosphate, along with some zinc and sulfur.

The fertilizer is carried in two 500-gallon tanks that ride on the Orthman combo caddy over the 1tRIPr.

During the growing season, Olson works with CPS, which has a NutriScription program. A CPS agronomist takes leaf and petiole samples around V9 or V10, and then when the corn is at the milk stage.

"We analyze these tissue samples and create a graph to see where the fertility levels are at," Olson says. "You can save so much money because you're only giving the corn the nutrition that it needs."

If the crop needs nitrogen, Olson puts it on through the center-pivot irrigation system.

If the crop needs micronutrients, Olson feeds the corn with a foliar application, using a John Deere 4830 self-propelled sprayer with a 90-foot-wide boom.

If the corn and the cotton are small enough, he can use a coulter rig to precisely place the nitrogen.

"We usually put on foliar fertilizer before the corn tassels, when the corn is around V8 to V10. If we need any micronutrients after that, we normally call in an airplane," he says. "We usually apply some zinc; for cotton, we apply potassium. Our soil has a lot of potassium, but it's not so available."

In the future, Olson says he'd like to place some fertilizer shallow and some of it deep when he strip-tills, because he feels crops would respond better to smaller amounts of fertilizer at different depths.

"Dual placement also lessens the chance of salting out the root zone and killing seedlings," he says. "The next 1tRIPr I buy will have dual placement."

Finding The Right Fit With Fertility

To be more efficient with fertilizer, strip-tillers must be use caution in cutting rates and put nutrients where they do more good than harm.

By Dan Zinkand

One reason why growers are turning to strip-till is so they can place nutrients in the soil where plants need them.

For example, by strip-tilling and banding fertilizer, corn growers can place phosphorus and potassium down where the roots will reach them at V6 to V8.

"Ideally, you want the plant roots to chase the nutrients down in the soil," says Dan Froehlich, agronomy manager for Plymouth, Minn.-based fertilizer manufacturer The Mosaic Co. "When fertilizer is broadcast, the roots tend to stay on top. That's fine, if there's plenty of moisture there.

"But if you put the nutrients down far enough, the roots will proliferate there. If you can drive the roots down, you will help the plant survive and thrive if it turns hot in the summer."

But experts say growers shouldn't make assumptions.

The old rule of thumb about banding fertilizer, instead of broadcasting, was that rates could be reduced by 30% to 50%, Froehlich notes.

"With today's corn yields, that's just not the case," he says. "Farmers are fertilizing at the same rates now as they did when corn yields were 30 bushels less per acre."

Tips For Banding Nutrients

Banding nutrients may enable strip-tillers to gain application efficiencies, says Tony Vyn, a Purdue University agronomist. But growers must not make decisions in a vacuum.

"Don't assume that you will have an overall reduction in long-term phosphorus and potash requirements in strip-till," Vyn says. "You will probably be able to apply less phosphorus and potash with strip-till than by broadcasting it. But you still have to meet the nutrient requirements for crops, and phosphorus and potassium removed by the grain needs to be replaced."

Banding nitrogen and phosphorus does provide flexibility, as strip-tillers are less dependent on applying starter with the corn planter, Vyn adds.

"For maximum starter benefit with strip-till, phosphorus banding should not exceed 3 to 5 inches deep in the fall," he says. "For nitrogen, it depends on the form, rate and timing. Strip-tillers should only apply anhydrous ammonia in the fall, when the depth really doesn't matter."

Spring Strip-Till Cautions

Strip-tillers using anhydrous ammonia in the spring should place it at least 7 inches deep, Vyn says.

There are two exceptions to this rule: The first is the anhydrous is placed at least 3 inches away, in an offset manner, before the radical roots reach the anhydrous zone. The second is that there are at least 2

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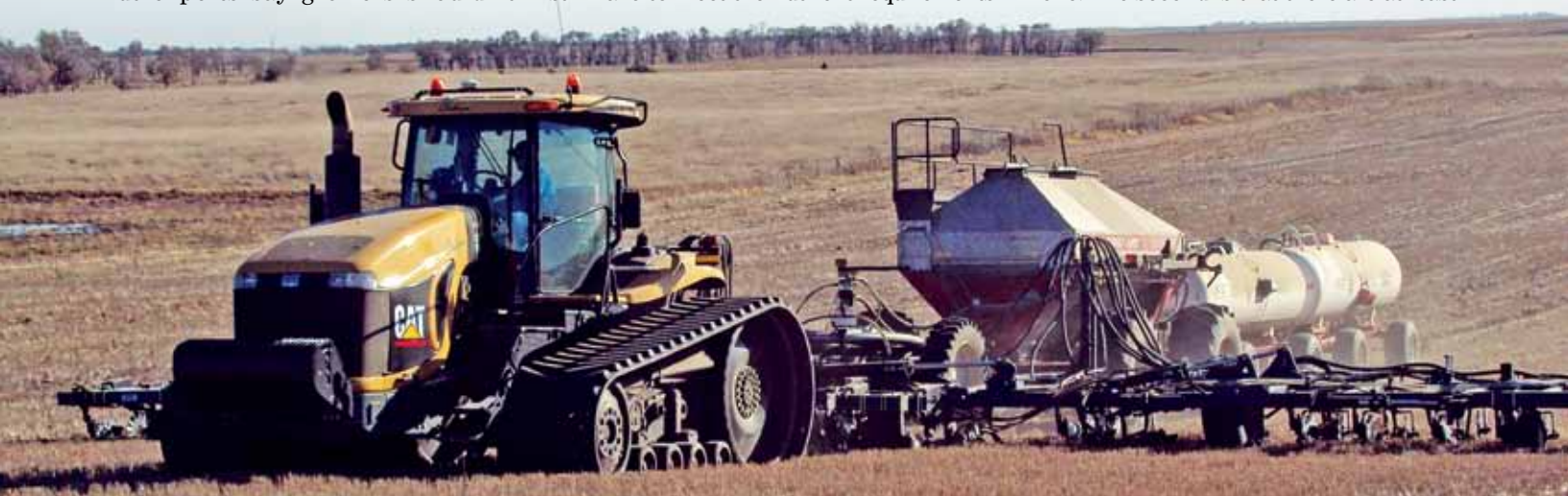
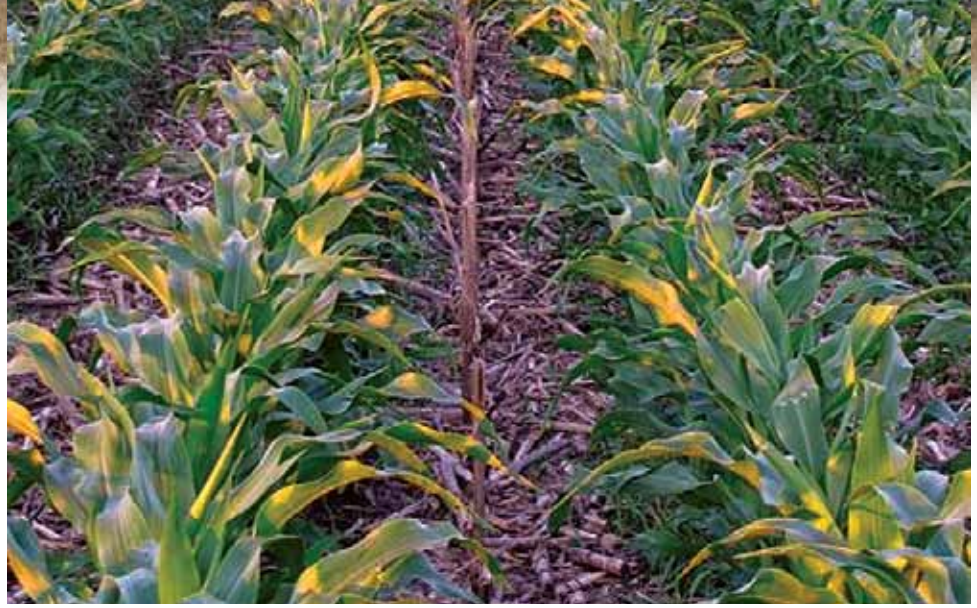


NUTRIENT EFFICIENCIES. Strip-tilling allows corn growers to gain nutrient efficiencies, says Doug Wittmeier, sales agronomist for Northern Plains CHS in Faulkton, S.D. Wittmeier's strip-till farmers are using 0.9 pounds of nitrogen per bushel of corn in strip-till vs. 1.2 pounds of nitrogen per bushel for spreading fertilizer on the soil surface.



RIGHT PLACE, RIGHT TIME. Carson Klosterman, a strip-tiller from Wyndemere, N.D., places fertilizer off and to the side of the strip — usually a 2-by-3-inch placement when he's planting corn. "I like putting the fertilizer that the plant needs close by, and we're seeing some efficiencies from that," he says.

weeks or 1 to 2 inches of rain between the application of anhydrous and planting corn.

Vyn stresses that these recommendations depend on which form of nitrogen — anhydrous, UAN or UREA — strip-tillers select, as well as the depth of placement.

"In the spring, all of these forms of nitrogen could be pre-plant applied in the intended corn-row areas — even as shallow as 5 inches deep — if less than 75 pounds of actual nitrogen is applied per acre," he says. "However, at 100 pounds of actual nitrogen per acre, applied in the spring, pre-plant and in the row zone, the deeper the fertilizer is placed, the better."

Strip-tilling corn in the spring involves trade-offs.

"In a much wetter environment, you may be losing some opportunity for enhanced root growth in corn due to smearing and clodding," Vyn says. "I am very nervous about spring strip-till for corn, with in-row placement of high rates of nitrogen — especially anhydrous and urea.

"If a strip-tiller is applying 100 to 200 pounds of UAN on 30-inch spacing, it should be placed 5 inches to the side of where the corn will be planted. Placing this rate of UAN 5 inches below where the corn is planted might be OK."

Froehlich shares Vyn's concerns about strip-tilling corn in the spring. He prefers fall strip-till for corn.

"You can't strip-till as deep in the spring as you can in the fall," he says. "We'd love to see farmers strip-till 6 to 8 inches deep in the spring, but in reality, it ends up being more like 4 or 5 inches because of the moisture levels. If corn growers plant more than 1½ inch deep, then there's a risk of seedlings burning with shallow-placed fertilizer."

And what do you do if you planned on strip-tilling and there's a wet spring?

"With spring strip-till, it really shortens up your window," Froehlich adds. "Strip-till in the fall and at least get your phosphate and potash applied."

Move Phosphorus, Potash

For many strip-tillers, the system's attraction includes putting fertilizer where it can be easily accessed by the crop's roots. But applying fertilizer in a band may be too concentrated, Vyn says.

"There are some benefits of mixing fertilizer in the soil," he says. "But in my experience, continued deep-banding phosphorus and potassium using RTK in the same root zone — applying a 2-year crop-removal rate before corn — is not as effective, yield-wise, for a multiyear strip-till corn and no-till soybean sequence as broadcasting the fertilizer is."

Strip-tilling and deep-banding of phosphorus and potash is ideal from an environmental perspective, Vyn says.

One option is to deep-band all of the phosphorus but broadcast at least some of the potash. The other option, especially for potash, is to move the deep-band position regularly to try to achieve a more uniform soil distribution of potassium.

"For example, move phosphorus and potash 10 to 15 inches to the side of where the corn was planted last, if you're only deep-banding," Vyn says. "This is especially true for phosphorus. You need to move the zone, or it will be less efficient."

Insight From The Fields

Defiance, Ohio, strip-tiller John Rethmel, his father, Bob, and his uncle Don Rethmel have strip-tilled for 7 years.

Rethmel studies strip-till research results from Ohio State University and works with crop consultant Joe Nester of Nester Ag in Bryan, Ohio.

"We've been testing reduced rates of phosphorus and potassium by about 33%," Rethmel says. "At this point, we feel it's fine, but I think we need more time to evaluate this.

"We don't apply very much nitrogen with the strip-tiller and haven't really changed our nitrogen management as a direct result of strip-tilling. We're pretty new at this, so we are watching this carefully.

"We have a few fields where we have fertilizer plots — cutting rates vs. not cutting them — because we want to see what we should and should not be doing. In our area, there are a lot of low-productivity soils. The majority of the land we farm is

> "You must meet the nutrient requirements for crops, and phosphorus and potassium removed via the grain needs to be replaced..."
> — Dr. Tony Vyn, Purdue University

> "Most strip-tillers can cut back a little bit on fertilizer, but don't cut back a huge amount until you see how your ground responds…"
> — Brandon Grubbs

extremely heavy clay."

For the last 3 years, the Rethmels have been applying fertilizer while strip-tilling with their 12-row Orthman 1tRIPr. Before buying the Orthman rig, which carries and mixes fertilizer, they used a different rig and were not placing fertilizer in the strip in the fall.

"We put on a blend of DAP, potash and AMS," Rethmel says. "The 1tRIPr mixes the DAP with the soil. If you dig down into the strip, it's hard to find a real concentrated band of fertilizer. We pull the shank 6 to 7 inches deep and the fertilizer goes 3 to 4 inches deep.

"It's all variable-rate applied. We based the rate off yield zones we've developed with Joe. We use RTK when strip-tilling and planting. With RTK, we have the opportunity to move the strip with the band of fertilizer over and plant into it in the spring."

Yields of strip-tilled corn vs. no-tilled corn have been pretty variable.

"It really depends on the spring and how cold and wet it is," Rethmel says. "But we are pleased with strip-tilling our corn."

Cut Rates Carefully

Since Brandon Grubbs began strip-tilling 8 years ago, the Piper City, Ill., corn-and-soybean grower has cut back on phosphorus. But he cautions growers about cutting nitrogen and potash.

"We're still looking carefully at cutting potash," he says. "While you can cut back some on your fertilizer program, I wouldn't chop everything 50% or more and then go 6 years between soil tests."

He strip-tills about 80% of his corn using a 12-row Twin Diamond Industries Strip-Cat. He does custom fertilizer and crop-protection application and custom strip-tilling.

When planting corn, Grubbs applies 90 pounds of UAN per acre, then sidedresses 28% liquid nitrogen for the balance of his nitrogen program.

In 2010, Grubbs harvested 230-bushel-per-acre, strip-tilled corn. He doesn't skimp on applying nitrogen for corn.

"We're probably using higher nitrogen rates than most farmers because of our yield goals," he says. "For strip-tilling corn-on-corn, we increase nitrogen by 15 pounds per acre over what we normally use for corn that has been worked with tillage equipment. We increase the nitrogen on those acres by 30 pounds per acre. But we don't increase nitrogen rates 30 pounds per acre for corn after soybeans.

"Most strip-tillers can cut back a little bit on fertilizer, but don't cut back a huge amount until you see how your ground responds."

After harvesting corn, Grubbs sprays corn stalks with 20 to 30 gallons per acre of 6-0-0-8. Twenty-five gallons of liquid AMS equals 100 pounds of dry AMS. He sprays the AMS 2 to 4 weeks before strip-tilling in the fall.

"Because it's liquid, we can cover all of the residue," Grubbs says. "It's really evident in the spring where you applied liquid AMS to the cornstalks. You end up with a lot less residue."

When strip-tilling, Grubbs applies DAP, phosphorus and AMS using variable-rate technology. The range is 100 to 125 pounds per acre of DAP; 25 to 100 pounds per acre of potash; and about 25 pounds per acre of AMS in a band.

"The balance is made up using a spinner-spreader with variable-rate technology to fill in the low spots," he says. "The variable-rate recommendations are made taking previously applied material into account."

Grubbs uses a base blend of all three products, depending on whether it's corn following soybeans or corn on corn. He doesn't want to apply a large amount of potash in a band in the fall because the sandier soils won't hold it well.

"You've got to be broadcasting some of the potash," Grubbs says. "Maintaining potash levels is tough. We aim for 350 parts-per-million (ppm) potassium and 60 ppm on phosphorus.

"Since we started banding our fertilizer with strip-till in 2006, our phosphorus levels have skyrocketed, even though we're putting on less than maintenance rates in our strip-tilled corn-on-corn."

Potassium levels aren't as good as Grubbs would like in his corn-soybean rotation. As a result, he may have to broadcast more phosphorus in soybeans to increase the phosphorus levels.

"In the last 4 years in the continuous corn that we've strip-tilled and banded fertilizer, it's been amazing how fast the phosphorus levels have increased, Grubbs says. "For corn following soybeans and corn on corn, we place the fertilizer 6 to 7 inches deep."

Grubbs uses a knife for fall strip-till, and coulters in the spring.

"Everything we do with our fertility program is based on 15-inch skips," he says. "Each year, we move the fertilizer band over 15 inches from the prior placement."

Grubbs relies on skip placement for two reasons. "First, we want to spread the band of fertilizer so it's not in the same place every year," he says. "Second, especially in continuous corn, you're fighting residue from the old corn rows. You can plant into a lot of residue in the spring, but it's difficult to strip into heavy residue in the fall."

Spring Strip-Till Works

Carson Klosterman of Wyndemere, N.D. started strip-tilling in fall 2007 to lower inputs, reduce tillage trips and control his fertilizer application.

"I wanted to control my own fertility program instead of having it spread," Klosterman says, "I also wanted to improve the organic matter on our sandy ground."

Because of wet fall weather in the past few years, Klosterman has been strip-tilling in the spring. He uses a Dawn Pluribus strip-till rig.

His farm has strip-tilled corn, soybeans and sugarbeets, and most of his acres are corn and soybeans.

"Fertilizer is placed off and to the side of the strip, usually a 2-by-3-inch placement when I'm planting corn 2 inches deep," Klosterman says. "I like putting the fertilizer that the plant needs close by, and we're seeing some efficiencies from that."

Klosterman also moves the strip with fertilizer back and forth 15 inches every year.

"We're using less nitrogen, phosphate and potash with strip-till," he says. "I'd say we're saving 30% or more on phosphate and potash, while still keeping the soil levels up.

"I've also seen that precision-placed nitrogen is allowing us to grow more bushels of corn with less nitrogen. In some instances, 0.6 pounds of nitrogen per bushel."

Klosterman adds that he's done a liquid program the last couple of years — 30 to 40 gallons of 28% nitrogen per acre; 10 gallons of 10-34-0; and 3 gallons of Conklin SideKick, along with Guardian nitrogen stabilizer.

Then he puts down a starter with the planter consisting of 4 to 6 gallons per acre of 3-18-18, a SideKick mix, along with zinc, manganese and sugar in-furrow. Klosterman sidedresses a mixture of 28%, SideKick (for late-season potassium and sulfur) and micronutrients as needed.

Klosterman bands crop-removal rates to feed the crop.

"We're not applying less than what's needed, so the fertility level of the fields is still the same to higher," Klosterman says. "That's due to higher organic matter — the ultimate goal."

> "We have a few fields where we have fertilizer plots — cutting rates vs. not cutting them — because we want to see what we should and should not be doing..." — John Rethmel

Strip-Tilling 22-Inch Corn

While Klosterman strip-tills in the spring, Langford, S.D., strip-tiller Joel Erickson prefers the fall.

Erickson, who began strip-tilling about 15 years ago, uses a 16-row DMI applicator toolbar with 22-inch row spacing. He grows corn, soybeans and spring wheat and typically strip-tills corn after soybeans or wheat.

Erickson's strip-till rig has cutting coulters in front of spring-loaded knives, followed by sealing discs. He puts on anhydrous ammonia and pulls an air cart to apply a blend of phosphorus, potash and zinc sulfate.

"I put fertilizer as deep as I can," he says. "If I can get the fertilizer down to 6 or 7 inches, traveling up to 5 mph with my 330-horsepower tractor, that's great.

"The local co-op strip-tills with a 500- to 600-horsepower tractor, traveling 7 to 8 mph, and gets the fertilizer down 8 to 9 inches."

> "Precision-placed nitrogen is allowing us to grow more bushels of corn with less nitrogen..."

Erickson believes he uses about the same amount of fertilizer for corn since he began strip-tilling because he does variable-rate application based on management zones.

"I'm probably using less phosphate because of strip-till and variable-rate application," he says. "I apply more fertilizer on the really good ground. On the alkali or low-producing areas, we're putting lower rates of phosphate or sometimes no phosphate at all."

Using 22-inch rows limits the fertilizer attachments that Erickson can use on his corn planter.

"I put on liquid 10-34-0 and zinc as popup with the seed, trying to get the corn up a bit quicker," he says.

Advice From Agronomists

Mark Biedenfeld, agronomy sales manager for Northern Plains' CHS Service Center, based in Gettysburg, S.D., says adoption of strip-till is increasing in the company's seven-location trade area, including south-central North Dakota and north-central and western South Dakota.

"All of the strip-till is being done in the fall for corn planted the following spring," Biedenfeld says. "The co-op does custom strip-tilling in the fall, using a knife or shank to place nutrients. In many cases, coulters and trash whippers are used on the toolbar, ahead of the knife or shank."

Strip-tillers are placing nitrogen, phosphate, potash, sulfur and zinc in their fertility programs, he says. The majority of the nitrogen is anhydrous ammonia and is placed 6 to 8 inches deep. The other nutrients are placed about 4 inches deep.

There are nutrient efficiencies to be gained with strip-till, adds Doug Wittmeier, sales agronomist at the Northern Plains' service center in Faulkton, S.D. His strip-till corn farmers are using 0.9 pounds of nitrogen per bushel of corn in strip-till vs. 1.2 pounds of nitrogen per bushel for spreading fertilizer on top of the soil.

Wittmeier says strip-tilling corn has increased yields 10 bushels or more per acre, which more than offsets the increased application costs, amounting to 2 to 3 bushels per acre based upon current production estimates.

"For growers in north central South Dakota who have been strictly no-till," he says, "one of the indirect benefits they can reap from deep-banding fertilizer is the fracturing of the hardpan that isn't being removed by other natural processes."

"Strip-Twinning" Toward 300-Bushel Corn

Twin-row, strip-tilled continuous corn is helping Illinois farmer John Obery pursue his goal of growing the highest yields possible, but the system demands a great deal of ingenuity and patience.

By Dan Zinkand

Conventional wisdom at the coffee shop says John Obery's twin-row, strip-tilled continuous corn won't work and conventional tillage is the way to farm. But the Metamora, Ill., strip-tiller, who began farming in 1973, sets his own course.

"Everybody's got to make a judgment call about how they want to farm," Obery says. "What we want to do is build the soil and raise bigger crop yields and not worry about a big thunderstorm washing the farm away.

"We've got a little bit of rolling ground. Most of it is prime dirt."

Obery farms with his brother, Mark, and his cousin, Joel, in Obery Farms Partnership, which grows 2,920 acres of continuous corn.

For the conventional-tillage diehards at the coffee shop, twin-row strip-tilled corn falls beyond their comfort zone, he says.

"It's all about capturing as much sunlight and nutrients as you can and giving each corn plant enough room to grow," Obery says. "Twin rows help me achieve that better than 20-inch rows, where every inch narrower takes more management."

Obery is used to leaving his comfort zone to increase yields, protect the soil from erosion and build organic matter. He worked through several tillage systems from 1973 to 2004, when he first tried strip-tilled corn on corn.

Obery believes this demanding system will one day reward him with corn crops averaging 300 bushels per acre. To be sure, Obery Farms has grown high-yielding corn crops.

"Our highest yield in the National Corn Growers Association's yield contest was 269 bushels per acre," Obery says. "We've seen 300 bushels per acre on our yield monitor about every year.

"We just can't get a long enough row," he adds with a laugh.

With twin-rowed, strip-tilled continuous corn, Obery is on his fourth tillage system since 1973. In the 70s and 80s, he used conventional tillage.

Then drought hit from 1983 through 1989. In the 1988 drought, which affected much of the nation, Obery's corn yielded 76 bushels per acre.

In the 1990s, Obery started no-tilling soybeans into standing corn stalks. They field cultivated bean stubble once before planting corn. About 10 years ago, Obery began growing more continuous corn. He first experimented with strip-tilled corn — primarily into soybean stubble — in 2004.

"The strip-tilled corn on corn made 246 bushels per acre, which was our best yield that year," Obery says. "Our next best yield was 240 bushels per acre in conventional tillage.

"We were about 10% conventional tillage that year, and those 240 bushels per acre were grown on probably our best farm.

"In the fall of 2004, we bought a Blu-Jet ripper and built our strips with it on 500 to 600 acres of corn on corn. By 2006, we were 80% to 90% strip-till and by 2007, we were all corn on corn."

After harvesting corn, Obery runs a Great Plains Turbo Till with the rows. The Turbo Till goes down into the soil about 8 to 10 inches.

"It's all about capturing as much sunlight and nutrients as you can and giving each corn plant enough room to grow..."

"The wider strip and taller berms dry out faster and warm up the soil more quickly in the spring. I never have an inverted strip…"

— John Obery

Obery says he wants to level and size the residue, but not cut off corn stalks and bring up root balls.

To keep the corn stalks standing and the roots in the ground, the Oberys removed eight Turbo Till blades from the front gang so the Turbo Till is on 30-inch centers.

"In doing so, we leave eight rows of corn stalks standing and only till between the standing stalks," he says.

They prefer to build all of their strips in the fall using hillers Obery built several years ago.

"They build the biggest, tallest berms in the industry, about 6 to 8 inches tall and 10 to 12 inches wide at the base," Obery says. "The wider strip and taller berms dry faster and warm up the soil more quickly in the spring. I never have an inverted strip.

"With many strip-till bars, by the time spring comes around, you've got an inverted strip and you've got erosion."

Obery says his hillers are the complete opposite of any on the market.

"Mine have different angles that no one else uses," he says. "They use gravity to self clean. They don't plug up and they don't build up with mud."

Built Wide For Twins

Nobody makes a strip-till bar for 8-inch twin-row corn, says Obery, so he made one from scratch and attached his custom-made hillers. Obery built his hillers with Case IH disc blades and bearing hangers and shafts from a John Deere deep ripper.

He bolted the hillers onto 2-by-2-inch steel box tube. He made brackets from reinforced steel to bolt the hillers on the Blu-Jet toolbar, behind each of the seven shanks.

"With our tall, wide strips, I thought we could go to twin-row strip-till because our strips were wide enough to support those 8-inch twin rows," Obery says.

The Oberys tried twin-row strip-till using a Great Plains planter in 2007 after 2 years of problems getting their single-row, 30-inch spacing corn planter to stay in the middle of the strips.

"Our fields are relatively flat. The corn planter would roll off the strips on flat ground if you drove more than 4 mph," Obery says. "But it would really slide off a slope of 1% or 2%, depending on the soil type.

"If the field was sticky gumbo, the planter might not slip as much. But on hard ground, the planter didn't want to track true. When we got our twin-row planter, it just wanted to hug our strips. That's why we wanted to go to all twin-row, strip-tilled corn."

By 2009, the Oberys had two twin-row planters and one single-row planter on 30-inch spacings. By this spring, the Oberys had dropped the single-row planter.

"When we strip-till in the fall with our Bu-Jet strip-till bar, we don't put any fertilizer on," Obery says. "It was time consuming to put on nitrogen, phosphate and potash in the fall, and I didn't think my corn got any use from fall-applied nitrogen."

In March or April, Obery applies 125 pounds of nitrogen per acre in the form of ADM ammonium sulfate. This spring, he followed up with a Great Plains Nutri-Pro fertilizer bar — which has 16 rows on 30-inch spacings — to apply 32% nitrogen and micronutrients.

"This fertilizer toolbar is kind of a tillage tickler with residue managers on it and turbo coulters that fluff up an existing strip or make a new strip," Obery explains. "The back two coulters are set about 8 inches apart with a third one in the center.

"The spacing is wide enough for the residue to flow through. It really makes a nice-looking strip in the spring."

Twin Benefits

Obery plants the twin-row corn 1 inch from each edge of the 10-inch-wide strips, leaving 22 inches between the corn stalks on the outer edges of the strips. The spacing within the rows depends on seed populations. The best spacing is 8 inches between each corn plant to form a diamond, Obery says.

"To get the true diamond shape, 40,000 plants per acre works best," he says.

Twin rows provide more space between corn plants than 20 or 30-inch spacings, Obery says. Planting 38,000 seeds per acre on 30-inch centers leaves less than 5½ inches in the row between each plant.

"At a plant population of 38,000 seeds per acre with twin rows, the spacing is closer to 11 inches within the row for each plant," Obery says. "I'm sold on twin rows because you get girthier corn stalks. It just looks like a healthier plant when you give corn enough room to grow."

Tramline Guidance

Obery has been using RTK guidance for about 8 years and calls it a necessity in twin rows.

But even with RTK, driving a self-propelled sprayer through twin-rowed corn to dribble on nitrogen and spray herbicides, fungicides and insecticides pinched corn roots. That reduced yields.

This spring, Obery started using tramlines, which he says were relatively easy to make. Their Great Plains twin-row planters are 40 feet wide and have 16 twin rows, each with 8-inch-wide spacing.

To make the tramlines, they don't use four of the 16 twin rows on the planters.

Keys To Twin-Row, Strip-Till Success

Twin-row strip-tilled continuous corn is not for the faint of heart, John Obery says. It requires a change in equipment and management.

Here's some of the Metamora, Ill., strip-tiller's advice for making this rewarding and demanding system work.

- Commit to it.
- There's less room for error.
- Make large, wide strips in the fall.
- Watch wheel traffic.
- RTK is a necessity.
- Excellent drainage helps.
- Be patient.

TRIPLE THREAT. Residue flows easily through the three Turbo-Till coulters on the Great Plains Nutri-Pro fertilizer bar, Obery says. The back two coulters are set about 8 inches apart, while the third one is in the center.

That leaves 12 twin rows and four single rows.

"That creates two tramlines that are 38 inches wide," he says. "This gives me enough room to come back and spray post-emergence herbicides, dribble on nitrogen in corn that is 3 to 6 feet tall and apply fungicides and insecticides after the corn has tasseled without damaging the corn.

"With the tramlines, we are not pinching roots now. When I sprayed corn on 22-inch centers without the tramlines, I was pinching roots with the tires."

Corn canopies more quickly in twin rows than on 30-inch, single-seeded rows, says Obery. The farm has grown Roundup Ready corn for many years.

"Our weed pressure has been greatly reduced, but our weed species have changed," Obery says. "Our problem weeds used to be foxtail, velvetleaf, giant ragweed and smartweed. Now waterhemp, poison hemlock and morningglory are the weeds we are having huge problems with, but Roundup is killing them."

Obery modified a John Deere 4730 self-propelled sprayer, which came from the factory with a 90-foot-wide boom.

"We took off the outer wing and added Boyd aluminum boom extensions, which makes the boom 120 feet wide," Obery says. "With tramlines, spraying is a breeze. You know exactly where to drive.

"I'm not on pins and needles, trying to stay in between the rows."

With the wheel shields on the 4730 sprayer, there are 26 inches from the outside of the planetary gears to the outside of the wheel motor, Obery explains.

"You have 1 inch of clearance on each side, if the stalks take up 1 inch," he says. "We use tramlines so we don't damage the crop."

Protecting Plant Health

The Oberys apply fungicide and insecticide after the corn tassels. Fungicides play a crucial role in managing one of the problems created by planting as many as 40,000 seeds per acre in twin rows.

"A lot of times, we have mushrooms and fungi growing in the fields in August and September, because it's literally dark in there with 38,000 to 40,000 plants per acre," Obery says. "Every leaf disease imaginable is going to attack that corn.

"Normally, we spray all of the corn to enhance yields, plus it's a harvest tool. The fungicide keeps the corn healthy and sturdy late in the season. It really helped last fall. Our fungicide didn't give us any extra yield last year, but it helped with the standability.

"In 2005, we had no extra yield by using fungicide, but the corn stood well. We took out 240-bushel corn at 16% moisture from a genetic that's very weak on gray leaf spot disease. The seed company told me not to plant this hybrid in corn on corn, but I did."

More residue in strip-tilled continuous corn creates more disease problems, Obery says.

Spraying fungicide on the hybrid that was susceptible to gray leaf spot put it on a level playing field with the other hybrids.

While twin-row, strip-tilled corn requires many changes in equipment, farmers can still use corn heads on 30-inch centers, Obery says.

But the sturdy stalks made stronger by fungicides are as rough as sandpaper, he says. Wear guards on the plastic snouts easily solve that problem.

Fungicide applications helped their corn stand well last fall, but the bottom line was as ugly as the weather.

"We had more than 200 bushels per acre as an overall average, but it was pretty disappointing," Obery says. "Our corn was dark-grass green when we got the killing frost around Oct. 10. It wasn't even dented. It could have been our best crop ever."

The 2009 crop received lots of extra treatment, including a late application of nitrogen, along with fungicide and insecticide treatments. But Obery says it didn't pay off.

"It was our most expensive crop ever," Obery says. "It probably ranked in the top seven of our best yields and we'll probably lose money on it — worse than the 1988 drought.

"We averaged 76 bushels per acre then, but our input costs were nothing compared to today. Last year, we had a cost of production of $4.12 per bushel. We didn't get $4.12 per bushel when we sold it."

Long-Term Focus On Soil

Obery focuses on another bottom line, which he believes provides the foundation for long-term profitability.

"One of the big things for me is trying to save as much soil as possible and to build the soil," he says. "Conventional tillers say, 'You've got to work the ground. Make her black.' There's just no way to be a conservationist and work the ground, in my opinion."

Conventional-tillage diehards in the area have fields with about 2.5%, organic matter, which is about what it was in the 1970s, Obery says.

"I know a farmer who's very noted in the industry and some of his soil tests several years ago showed an organic matter level of 2.5%," he says. "He's got black ground that he works and works and works.

"With twin-row strip-till and continuous corn, we have 6% organic matter on some of our farm ground and 6.5% in places."

Rains of 2 to 3 inches that fell in just a few hours were common during June, causing severe erosion on some farms in the area. But the residue from growing continuous corn and using strip-till limited erosion on their fields, Obey says.

"We have quite a few dry dams and terraces," he says. "But we haven't cleaned soil out any of those dry dams for I don't know how long. In the 1990s, I was cleaning them out every year."

Bio Strip-Till: Best Of Both Worlds

Using cover crops with strip-tillage helps growers improve the crop-row environment, build soil organic matter and protect fields from erosion.

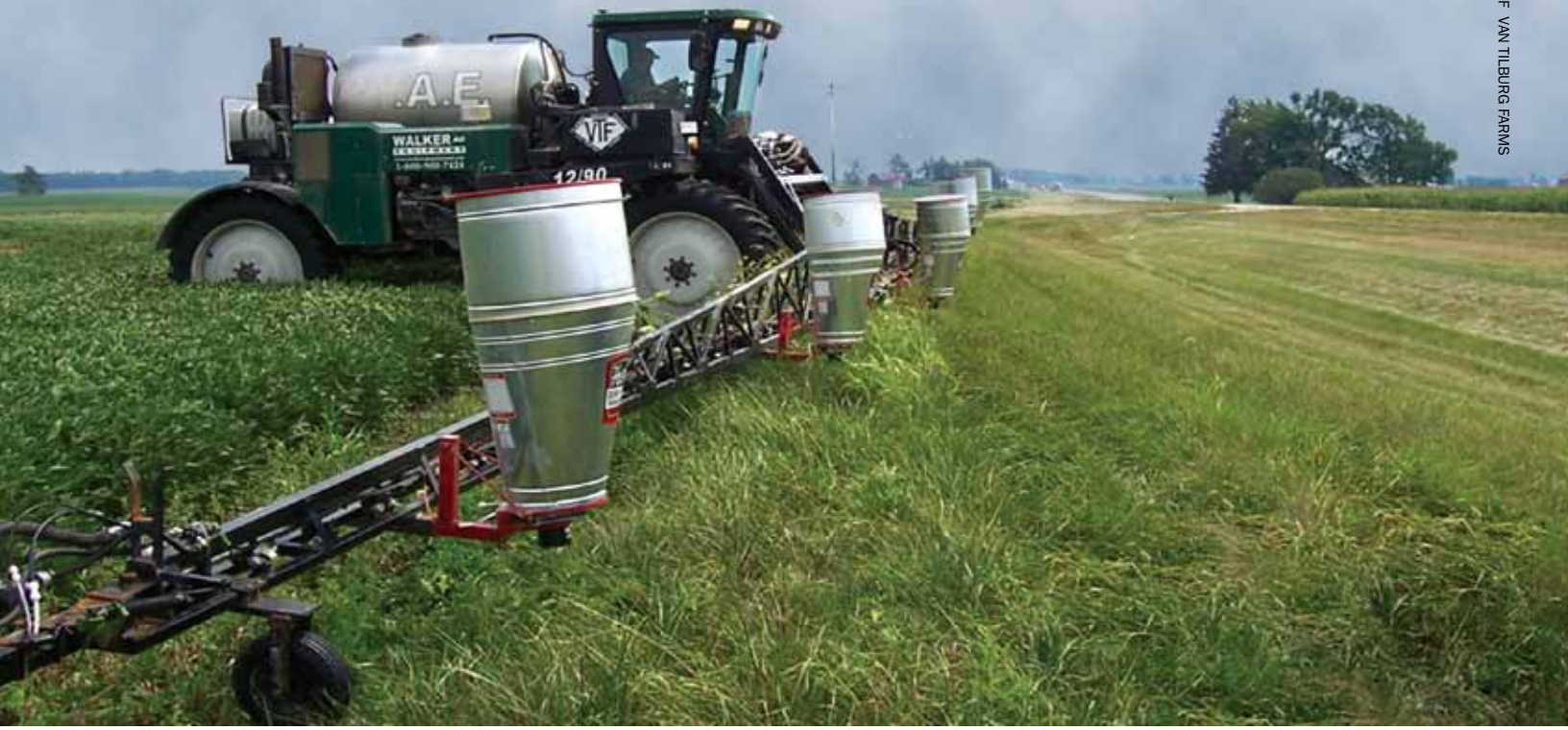


PHOTO COURTESY OF VAN TILBURG FARMS

By Dan Zinkand

There's a new hybrid practice growers are taking advantage of that marries the benefits of cover crops with those of strip-till. The practice of "bio strip-till" represents an advanced way of using cover crops to improve the crop-row environment, says Joel Gruver, a cover crop and soils agronomist at Western Illinois University in Macomb, Ill.

The concept is very new and is being defined mostly by cover-crop innovators. While more must be learned about yield impacts, advocates say bio strip-till improves soil health, reduces erosion, scavenges nutrients for the next crop and speeds up residue decomposition.

Bio Strip-Till's Roots

Using radishes and other crops for bio strip-till started with cover-crop pioneer Steve Groff, the Holtwood, Pa., no-tiller who founded Cover Crop Solutions.

"I first started using this concept with Tillage Radish as a way to allow other cover crops to compete and establish," Groff says. "I planted every other row with Tillage Radish, using a grain drill."

Ironically, it was Lisa Stocking —a University of Maryland graduate student who later married Gruver — who gave him the idea.

Groff and Stocking blocked off holes in a no-till drill with 7½-inch spacings to place Tillage Radish on 30-inch rows. Then they planted into the strips of winterkilled radishes the following spring.

"I'm not sure who coined the phrase 'bio strip-till,' but it certainly fits the concept," Groff says. "Later, when we started using precision planters — Ohio no-tiller David Brandt was the first farmer I know who did this — it was easy to fit bio strip-tilling with the planters used to no-till soybeans on 15-inch row soybeans.

SEEDING INTO COVERS. Van Tilburg Farms in Celina, Ohio, has used this seeder and an air drill to seed cover crops. Then brothers Matt, Luke and Kyle Van Tilburg build strips into the cover crop later in the fall.

"Tillage Radish was planted in every other row. Austrian winter peas were the most popular cover crop in the alternating rows, in between the rows of Tillage Radish."

Other farmers who use planters with 30-inch row spacing fill half of the planter's boxes with Tillage Radish, and the other half with Austrian winter peas or another cover crop, he says.

These farmers plant and then return, splitting the 30-inch row to create a 15-inch row spacing. This works well with RTK guidance.

"Precision planting lets you cut cover-crop seeding rates in half, due to precise spacing of the seed vs. drills," Groff says. "Going over a field twice with a planter with 30-inch spacing can be economical.

"Seed spacing with planters is generally 3 to 4 inches apart with most of the cover crops we've tried. We have the disc or plate-part numbers for most planters, so we can help farmers choose the right plate and settings for the different cover crops."

Gruver says bio strip-tilling with radishes creates three distinct benefits:

✔ Planting radishes on the same rows that will be planted to a subsequent crop may move some old crop residue away from the row, which can help no-tilling the following spring.

✔ Radish growth may accelerate decomposition of other crop residue.

✔ Since little radish residue remains aboveground, a burndown is easy if the tops don't winterkill.

"Seeding radish as a cover crop tends to improve drainage and helps the soil warm up faster," Gruver says. "Radishes winterkill and decompose quickly. They leave a zone of nearly bare soil, but it's soil with better aggregation and structural stability. It's not likely to crust in the spring."

Two Bio Strip-Till Systems

Decatur, Ind., strip-tiller Gene Witte uses oilseed radish, annual ryegrass and clover seed to complement strip-tilling, crop rotations and manure application.

This year was his fourth planting corn into strips.

Witte first tried bio strip-tilling in mid-August 2009 after harvesting winter wheat and spreading liquid hog manure on the fields. He says strip-tilling fields spread with manure helps create a better seedbed and reduce soil compaction from liquid-manure tankers and dry-manure spreaders.

"The 2009 growing season was wet, and between the moisture and the hog manure, the radishes grew huge," Witte says. "In the summer of 2010, the ground was bone dry when I seeded the radish and annual ryegrass, but everything sprouted and grew.

"I had a good stand of radishes and annual ryegrass, even though the radishes weren't as big around as my finger."

The radishes winterkilled in mid-December. Last spring, the annual ryegrass took off, aided by the hog manure. But the stand got out of hand because of wet weather plaguing the eastern Corn Belt. So Witte mowed and baled the annual ryegrass and sold the hay to a local cattle farmer.

"Having the cover crop get away from you in wet weather is one of the risks you take," Witte says. "We got the annual ryegrass baling done on June 14 and planted the Roundup Ready corn June 16. The new growth of the annual ryegrass had just started as the corn emerged."

Witte planned on waiting for more re-growth on the annual ryegrass before spraying it with glyphosate.

"This is what I like about the concept of strip-till and cover crops," he says. "It gives you a little more window to control the cover crop without hurting the corn yields, because of the bare strip that strip-till creates."

RTK Planting Works Well

Witte plants a mixture of annual ryegrass and oilseed radish on 15-inch rows using a Kinze 12-24 Interplant with splitter units.

It's the same planter he uses for corn, soybeans and winter wheat.

Witte seeds a mixture of 15 pounds annual ryegrass and 2 pounds radish per acre. The seed comes pre-mixed in bags. He has a six-row Remlinger strip-till rig with 30-inch spacing, along with John Deere's Green Star 2600 with an ITC receiver and RTK guidance.

Witte has talked to no-tillers who plant radish seed with a milo plate, but he thinks a soybean plate works better for the radish-annual ryegrass mix, which he describes as "a little more fluffy" than the hard radish seed.

Seeding Clover Covers

After harvesting winter wheat, Witte frost-seeds a mix of medium red clover and alsike clover. Then he strip-tills the field.

"I don't kill clover until spring, when I apply a herbicide before planting corn," Witte says. "With RTK, I can find the fall strips as I'm planting corn. By seeding the clover, I'm increasing the nitrogen in the soil, which the wheat crop had depleted.

PHOTO COURTESY OF STEVE GROFF, COVER CROP SOLUTIONS

RADISH-WHEAT COMBO. Seeding radishes with wheat is a popular bio strip-till practice, says cover-crop pioneer Steve Groff. Some farmers seed radishes with winter wheat, while others seed radishes and Austrian winter peas after harvesting wheat in the summer.

"Years ago, when we had crop rotations longer than corn and soybeans, seeding clover was common."

Witte devotes about 15% of his acres to alfalfa, evenly splitting the balance between corn, soybeans and winter wheat. He contract-finishes about 1,500 hogs a year and gets half of the manure from the 2,500 hogs that a neighbor finishes. Witte also finishes about 150 Holstein dairy steers.

"The fertilizer from the hogs and the cows add up to savings on the fertilizer for my corn," Witte says. "I agreed to inject manure on my neighbor's land in exchange for getting half of his hog manure for free."

While some researchers and farmers have experimented with slurry-seeding cover crops in liquid manure, Witte says that won't work with his row spacing and manure tanker.

Tips For Bio Strip-Tilling Radishes And Peas

- Use soybean seed discs or plates for peas.
- Use small sugarbeet seed discs or plates for Tillage Radish.
- Set planters to 4-inch, in-row spacing for both cover crops.
- Plant peas 1 inch deep in moist soil or 2 inches deep in dry soil.
- Plant Tillage Radish ½-inch deep in moist soil or 1 inch deep in dry soil.
- Planting date for both species is up to a month before the average first-killing frost.
- Tillage Radish will winterkill when temperatures drop to the mid-teens for several nights.
- Peas may or may not winterkill — it depends on snow cover.
- Peas surviving the winter add more nitrogen in the spring. They must be terminated with a burndown herbicide like glyphosate and/or 2,4-D.

Source: *Steve Groff, Cover Crop Solutions*

PHOTO COURTESY OF VAN TILBURG FARMS

BETTER SEEDBED. Strip-tilling in the fall into an annual ryegrass creates a better seedbed for corn in the spring, says Celina, Ohio, bio strip-tiller Matt Van Tilburg.

"I prefer to plant the radish and the annual ryegrass on 15-inch row spacing, so slurry seeding with the 30-inch spacing of the knives on the manure tanker wouldn't work for me," he says.

Strip-Tilling Annual Ryegrass

At their farm in Celina, Ohio, brothers Matt, Luke and Kyle Van Tilburg are solid-seeding annual ryegrass in the fall and strip-tilling into the grass using a strip-till rig and Trimble RTK guidance.

In the fall of 2009 and 2010, the Van Tilburgs seeded annual ryegrass into soybeans using a high-boy seeder with drop tubes. They returned with a 60-foot-wide Wil-Rich toolbar with 24 Soil Warrior units mounted on 30-inch spacings.

The Soil Warrior coulters kill the annual ryegrass growing in the strips. For corn following soybeans, the Van Tilburgs don't apply phosphate or potash because these nutrients are in the poultry manure applied to the fields.

For corn-on-corn, they apply ammonium sulfate. In the spring, the brothers make another shallow pass with the strip-till rig, then they plant corn.

Before the Van Tilburgs began strip-tilling after seeding ryegrass, the roots created problems for planting corn, even after the cover was sprayed with herbicide.

"The roots were so thick and tough that we couldn't get the furrow 'V' to close," Van Tilburg says. "By strip-tilling, we get the benefits of ryegrass. We plant into that tilled strip in the spring and control traffic.

"For us, this is the best of both worlds: cover crops and no-till. You have to have something growing on your soil year-round to help it."

Over the years, the brothers have flown on annual ryegrass with an airplane and seeded it with an air drill, followed by shallow vertical tillage to incorporate the seed. To make seeding easier, they are building a custom cover-crop seeder with a 90-foot-wide boom and drop tubes.

"It's in our shop, but this high-boy seeder will be ready this fall," Van Tilburg says. "It will be a dedicated cover-crop seeder that will be able to seed into standing soybeans, standing corn or any crop."

Van Tilburg says it's hard to quantify how much cover crops improve yields in bio strip-till, though their best corn yield from the dry 2010 growing season occurred in fields seeded with annual ryegrass that were strip-tilled.

"For years, farmers have tested their soil, looking at phosphorus and potassium, to build the soil chemically," Van Tilburg says. "But we haven't done a good job of building the soil's organic matter and tilth. There's definitely a benefit to that.

"When I drive by a fenceline that has never been tilled, the soil is 6 to 8 inches taller than the rest of the field. That tells me what we have to do to build our soils."

Strip-Tilling With Clover

While radishes and annual ryegrass get lots of attention in bio strip-till, Blake Vince of Merlin, Ontario, relies exclusively on red clover. He grows corn, soybeans and wheat in the province's southwest region.

Vince's bio strip-till system starts with frost-seeding red clover onto dormant winter wheat in March or April once snow disappears and the fields are fit. He applies 8 to 10 pounds of clover seed per acre with a spinner spreader mounted on an ATV.

The freeze-thaw cycles in the spring help work the small clover seed into the soil.

The clover grows up in the field after the wheat is harvested in July. Then, in mid-August, Vince chops the clover with a Bush Hog rotary cutter to reduce weed competition and stimulate root growth.

"I don't touch the field until October, when I apply dicamba and glyphosate to kill clover," Vince says. "If clover overwinters, it can be a challenge to kill in spring."

Ten days after applying herbicide, Vince makes fall zones with an eight-row Soil Warrior on 30-inch-spacings that's equipped with Trimble RTK guidance.

With the dual-compartment tank on the Soil Warrior, Vince applies a blend of 120 pounds MAP and 120 pound potash per acre. He plants corn with a 16-row, 30-inch John Deere 7000 planter without coulters.

He recently added a new attachment called a "row basket" in front of each row unit to firm the soil and move residue.

Vince says crop yields are improving. In 2010, corn yields were 178 to 200 bushels per acre. Wheat yields were 93 to 115 bushels per acre, while soybeans hovered around 50 bushels per acre.

"The limiting factor to high yields is our soil type," he says. "The topsoil in our geography has 3 to 5 inches of Brookston clay with heavy clay subsoil, which is classified as imperfectly drained. Tile drainage is paramount to achieving top yield."

The clover in Vince's bio strip-till contributes 50 to 100 pounds of nitrogen per acre, according to research from the Ontario Ministry of Agriculture. But the clover does more than add nitrogen.

"The tap root of the clover reaches deep into the soil profile to help recycle nutrients to the top," Vince says. "The tap root helps open up the heavy clay subsoil to allow channels for improved soil aeration and water filtration.

"I have seen clover roots — identified by nodules — growing in tile drains 36 inches below the surface of the ground."

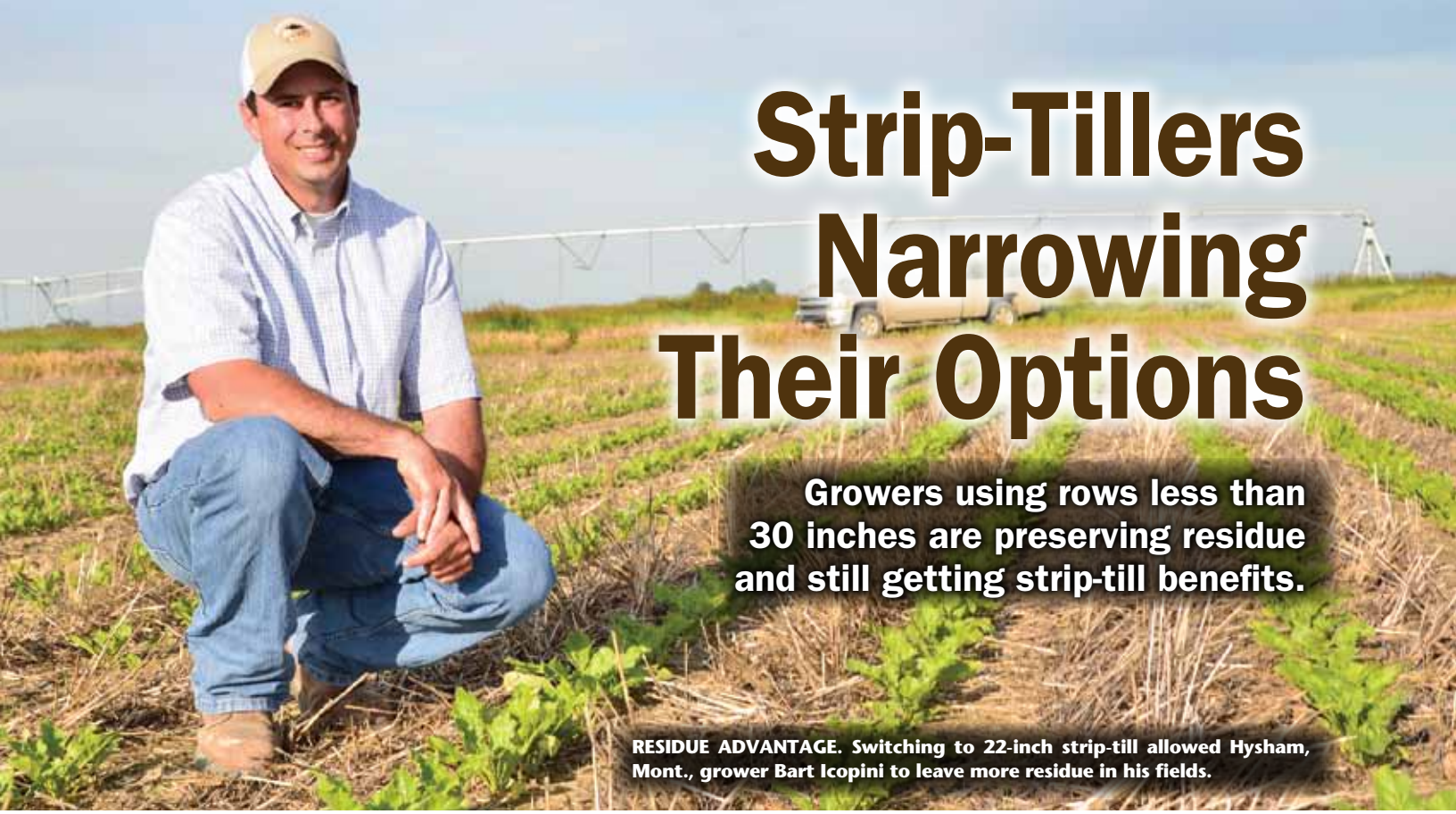
As more strip-tillers use cover crops, RTK guidance systems allow them to experiment with new uses, Gruver says.

"You can plant right over the row where the cover crops were planted the prior year," he says. "Everyone I'm aware of who bio strip-tills uses radish, although I think they could use other crops, too.

"The rapid fall growth and winterkill of radishes are optimal for bio strip-tillers."

Relying on RTK, Witte plants corn between 15-inch-wide rows of radish and ryegrass planted the previous summer.

"When I fall strip-till, I go between the 15-inch rows of the beans. I plant corn between the rows where radishes and ryegrass grew," he says. "Corn roots grow where the radishes and ryegrass had been. By planting between the rows of cover crops, the corn establishes better."



Strip-Tillers Narrowing Their Options

Growers using rows less than 30 inches are preserving residue and still getting strip-till benefits.

RESIDUE ADVANTAGE. Switching to 22-inch strip-till allowed Hysham, Mont., grower Bart Icopini to leave more residue in his fields.

By Dan Zinkand

Whether it's strip-tilling on 20- or 22-inch rows, a small, but dedicated number of strip-tillers are making narrow rows work for them.

For farmers who've used 22-inch rows and conventional tillage for dry edible beans and sugarbeets, going to a 22-inch strip-till system seems like a natural transition.

Increasingly, these farmers are growing corn on narrow-row spacing. Whether raising sugarbeets, dry edible beans or corn, they all agree that residue management is challenging but doable.

Why Narrow Rows?

After growing sugarbeets on 22-inch rows for years, growers in North Dakota, Minnesota and Idaho have been moving to narrow-row strip-till for beets and have also been growing more corn that way, says Mike Petersen, Orthman Mfg.'s precision-tillage agronomist.

"Monsanto, Pioneer and Syngenta now have 88-to-90-day, relative-maturity hybrids adapted for that northern region that can average 220 bushels per acre," Petersen says. "It's a no-brainer. Up north, growers have much more sunlight per day — 14 to 15 hours — since the Earth is tipped toward the south during the summer.

"But they also take the chance of frost in early September and on the 1st of June."

Some growers in eastern Indiana, Michigan, Ohio, Pennsylvania and Ontario are also turning to narrow-row strip-till.

"They want to harvest more sunlight with the narrower row spacing and getting ground canopy as soon as possible to suppress weeds, reduce evaporation and hold moisture within that canopy," he says.

But the challenge for many strip-tillers is how to handle the residue in narrow-row continuous corn — primarily, how to get it to flow through strip-till rigs without plugging, Petersen adds.

Manage The Residue

In some respects, 22-inch-row strip-till seems like a natural fit for sugarbeet growers who traditionally have used 22-inch-wide rows in conventional farming, says Jodi DeJong-Hughes, University of Minnesota Extension strip-till expert.

But weather and residue cause problems, she points out. The wet weather in northwest Minnesota and eastern North Dakota prevented many farmers from planting their crops.

In southwest Minnesota, the fall of 2010 was favorable — but in fall of 2009, corn didn't mature and growers were harvesting until Christmas.

"Growing corn on corn on 22-inch rows in heavy soils is the most difficult challenge there is for strip-till," DeJong-Hughes says. "In one of our field trials — with 22-inch-wide rows for fall strip-till in corn on corn — we stopped every 30 or 40 feet to pull out 'muskrat huts' of cornstalks that built up under the strip-till rig."

The field trial compared fall strip-tilled continuous corn versus fall strip-tilled continuous corn with a spring pass with a Salford RTS. There was 74% residue remaining in the strip-tilled plots versus 54% with plots that received the Salford pass.

"With 74% residue, there was just no place to put the cornstalks in the 22-inch strip-till trial," she says.

Farmers who want to strip-till continuous corn on 22-inch row spacing with fall fertilizer placement need to do two things, according to DeJong-Hughes.

"The row units need to be on a staggered bar to allow the residue to flow through," she says. "Narrow-row strip-tillers also need a Plan B if the fields are really wet in the spring, if residue blew and stacked up during the winter or if the soil is really chunky.

"If any of these things happen, strip-tillers should make a secondary pass in the spring to freshen up the strips using dual or triple coulters instead of shanks."

The growth of narrow-row strip-till acres, and potential for future growth, may depend on geographical factors.

Nationally, there has been no gain in corn acres with row widths of less than 30 inches, says Steve Butzen, agronomy information manager for Pioneer Hi-Bred International.

Narrow-row corn production is well below 5%, perhaps as low as 2% nationally, he says, adding that years of research data has failed to show a consistent yield increase with that method.

Pioneer conducted replicated plot research on narrow-row spacing in corn from 1991 through 1999 and 2003 through 2006, and found an average yield increase of 2% in Iowa and Illinois. For yields that average 200 bushels per acre, that's 4 bushels per acre more.

"Yield data has not motivated many farmers to move to narrow rows in the central Corn Belt," Butzen says. "However, Pioneer data shows the northern latitudes — such as Minnesota and the Dakotas — do produce a more consistent yield response to narrow-row corn of about 4%."

Narrow-row strip-till offers a better fit for crops that have less residue, like vegetables and dry edible beans, than for corn, says Andy Thompson, Yetter Mfg. Co. regional sales manager.

"Because of the trend to continuous corn, it's becoming more difficult to strip-till on row spacings of less than 30 inches," Thompson says. "We're making strip-till work better for growers on 30-inch row spacing, but strip-tilling on narrower rows may be more of a challenge because our new row units are wider."

While Twin Diamond works with narrow-row strip-tillers, co-owner Dean Carstens says he doesn't understand why they use the practice for corn and beans.

"I find no reason to strip-till on narrow rows other than the sales increases for seed and fertilizer suppliers," he says. "Those advocates say narrow rows increase light exposure, which allows for higher plant populations and increased corn yields."

Carstens says he believes more plants in higher populations on narrow rows diminishes the effects of added sunlight from the increased spacing. Higher corn populations also require more fertilizer and water, which is already in short supply in the West and the Great Plains.

"In my opinion, a 5-bushel pop from narrow rows doesn't warrant the investment required," Carstens says. "I am not a proponent of narrow-row strip-till."

Straight Coulters Work

In spite of skeptics of narrow-row strip-till, some growers report success.

Eden, Idaho, farmer Doug Carlquist switched to narrow-row strip-till 3 years ago for growing sugarbeets, dry edible beans, field corn and silage corn. He uses a 12-row Strip Cat with 22-inch row spacing.

"We went to a Twin Diamond field demonstration in Idaho and liked what we saw," Carlquist says. "I liked the potential of saving time, money and inputs."

There are more problems with 22-inch strip-till in corn, he says, because there isn't as much of a place to put the trash.

"We're still learning how to strip-till well. When we strip-tilled into cornstalks, we needed help with some modifications to the Strip Cat," Carlquist says. "To make cornstalks flow through the rig better, we replaced the curved hillers with straight coulters. For other crops, though, the curved hillers work well."

Carlquist bales small-grain straw and kills volunteer grain growing up from rows of chaff left from combining.

"If we don't control the volunteer grain, it can be hard for the strip-tiller to go through the field in the fall. And then we might have problems with seed-to-soil contact when we plant corn," he says.

Carlquist has strip-tilled dry edible beans into fields where triticale had been grown. He chops triticale for local dairies and irrigates to get volunteer triticale growing. Next, he kills the triticale with herbicide and strip-tills and plants dry edible beans as a double crop.

"With conventional tillage, we would plow, harrow once or twice and then plant," Carlquist says. "With strip-till, we can often make one pass with the strip-till rig and then plant.

"We're using less fuel and have reduced tractor use by at least 33% with strip-till."

Being able to plant Roundup Ready beets helps make strip-tilling an attractive practice, and with dry edible beans, strip-tillers can clean up weeds with a post-emergence herbicide application.

But old attitudes die hard.

"With strip-till, your fields have a trashy look for a while and you take some ribbing from neighbors," Carlquist says. "But when you harvest, your yields are right there, so the ribbing is worth it."

Working With Residue

Bart Icopini of Hysham, Mont., has been using 22-inch rows to strip-till beets, corn and pinto beans since the fall of 2008.

He uses a 16-row Orthman 1tRIPr strip-till rig with 22-inch spacing, along with a 6-ton Atlas dry fertilizer cart and tanks holding 1,000 gallons of liquid fertilizer.

The liquid-fertilizer point on each 1tRIPr shank runs 8 to 9 inches deep. There are two tubes that run directly behind the shank and fertilizer point.

The tube for dry fertilizer is set 4 to 5 inches deep and releases product 2½ to 3 inches below where the seed is placed. The tube for liquid fertilizer runs directly behind the shaft and places the fertilizer at the bottom of the 8- to 9-inch-deep strip.

Icopini farms about 950 acres with center pivots and linear irrigation and about 300 acres with flood irrigation. He also farms 900 dryland acres.

Icopini switched to strip-till from conventional tillage when he stopped flood irrigating and started using center pivot and linear irrigation.

Icopini prefers to fall strip-till, but will strip-till corn on light ground in the spring. He typically strip-tills corn into wheat or beet fields since they leave little stubble.

"We wanted to leave more residue on the fields and strip-tilling allowed us to do that," he says. "Roundup Ready sugarbeets also make strip-tilling work well. On our heavy, sticky soils, it would be difficult to cultivate to control weeds."

Icopini says he hasn't seen a huge increase in corn yields with 22-inch spacing, but it depends on the year.

Since Icopini began strip-tilling, he's learned several lessons.

"In the fall of 2010, there was quite a bit of tough wheat stubble left, so I shredded it before strip-tilling last fall," he says. "Our heavy soils tend be cloddy, so after strip-tilling I use a 45-foot-wide Mandako roller on all the fields. This firms the soil, which mellows over the winter.

"We've found that rolling the fields and the loose soil in the strips keep the wheels of my sprayer from drifting into them," he says.

Twin-Row Strips Attract Farmers

Strip-twinning helps farmers increase in-row spacing between corn plants, exposes corn to more sunlight and can increase yields.

By Dan Zinkand

Argyle, Iowa, grower Brian Klemme began twin-row strip-tilling corn in the spring of 2009 because he wanted to increase plant populations and spacing within rows and, hopefully, increase yields. Klemme farms with his stepfather and an uncle, growing 1,100 acres of corn and 700 acres of soybeans. On 200 to 300 acres, Klemme has used 7½-inch row spacing on 30-inch centers, for corn on corn and corn after soybeans.

On irrigated, sandy ground he pushes the corn population to 35,000 per acre. On dryland acres he plants 25,000 seeds per acre.

"We want to place fertilizer in a zone in the spring because of the loss of fall-applied nitrogen due to large amounts of rain," he says. "We don't apply anhydrous ammonia anymore in the fall."

Klemme's strip-till rig consists of an Elk Creek caddy for a 6-ton Montag dry fertilizer skid, Yetter Maverick row units on a Moore-Built toolbar and Raven Precision equipment that controls the anhydrous ammonia. He uses RTK for the 12-row toolbar and for the 16-row, twin-row planter with 7½-inch row spacing.

A GOOD SIGN. Increasing the plant spacing produces more twin ears on the sweet corn that Scott Setniker of Independence, Ore., grows for processing. "The processors have said the ear size in the sweet corn that's twin-rowed is really good," he says.

Klemme advises spring strip-tillers wait at least 10 days after applying anhydrous ammonia to plant corn.

"In 2009, we followed too closely with planting and the anhydrous burned off corn roots," he says. "This year, we waited at least 10 days to plant. The twin-row, strip-tilled corn looks really pretty good as of mid-June. On low spots and in our area, the corn is yellow. But on the high ground, the corn is nice and green."

Whatever row spacing strip-tillers use, Klemme recommends RTK guidance and a rig and planter with the same number of rows.

Even with RTK, it's possible to get off center after making many passes in the same field, he says.

"Getting off a little bit from the center of the strip-tilled berm in 30-inch rows would be a whole lot more forgiving," Klemme says. "I was watching one side of the planter and the rows were on the centers, but the other side was off.

"But if I had moved, then the other half of the 16-row planter would have been off. That's a problem that can happen with a 12-row strip-till rig and a 16-row planter."

Making Adjustments

Scott Setniker of Independence, Ore., decided to try twin-row strip-tilled corn in 2010 after reading about it on the Internet. He thought using twin rows would create more space between corn plants, exposing them to more light.

"I get more plants with twin ears of sweet corn by increasing the spacing with twin-row, 7½-inch row spacing," Setniker says. "The processors have said the ear size in the sweet corn that's twin-rowed is really good."

In 2010, Setniker had twin-row, strip-tilled corn that yielded 225 bushels per acre. His best conventionally tilled corn on 30-inch spacing yielded 220 to 230 bushels per acre, and the average was 180 bushels per acre for conventionally tilled corn.

Setniker staggers the planting of sweet corn, green beans and peas for the food processor. After harvesting peas last summer, he planted the last of the sweet corn on July 1.

"It grew slowly because the summer was cold," Setniker says. "It finally warmed up at the end of September.

"Moisture in strip-tilled corn was a bit of an issue last year. It was 28% to 32% for most of the harvest, and the moisture level of the strip-tilled corn was 3% higher across the board versus corn planted at the same time in conventionally tilled fields. I don't know why there was a difference."

When Setniker tried strip-till for the first time in 2010, he planted twin-row corn on 7½-inch centers, as well as corn on 30-inch row spacing. But last spring, Setniker reduced the amount of twin-rowed corn and he strip-tilled more corn on 30-inch rows.

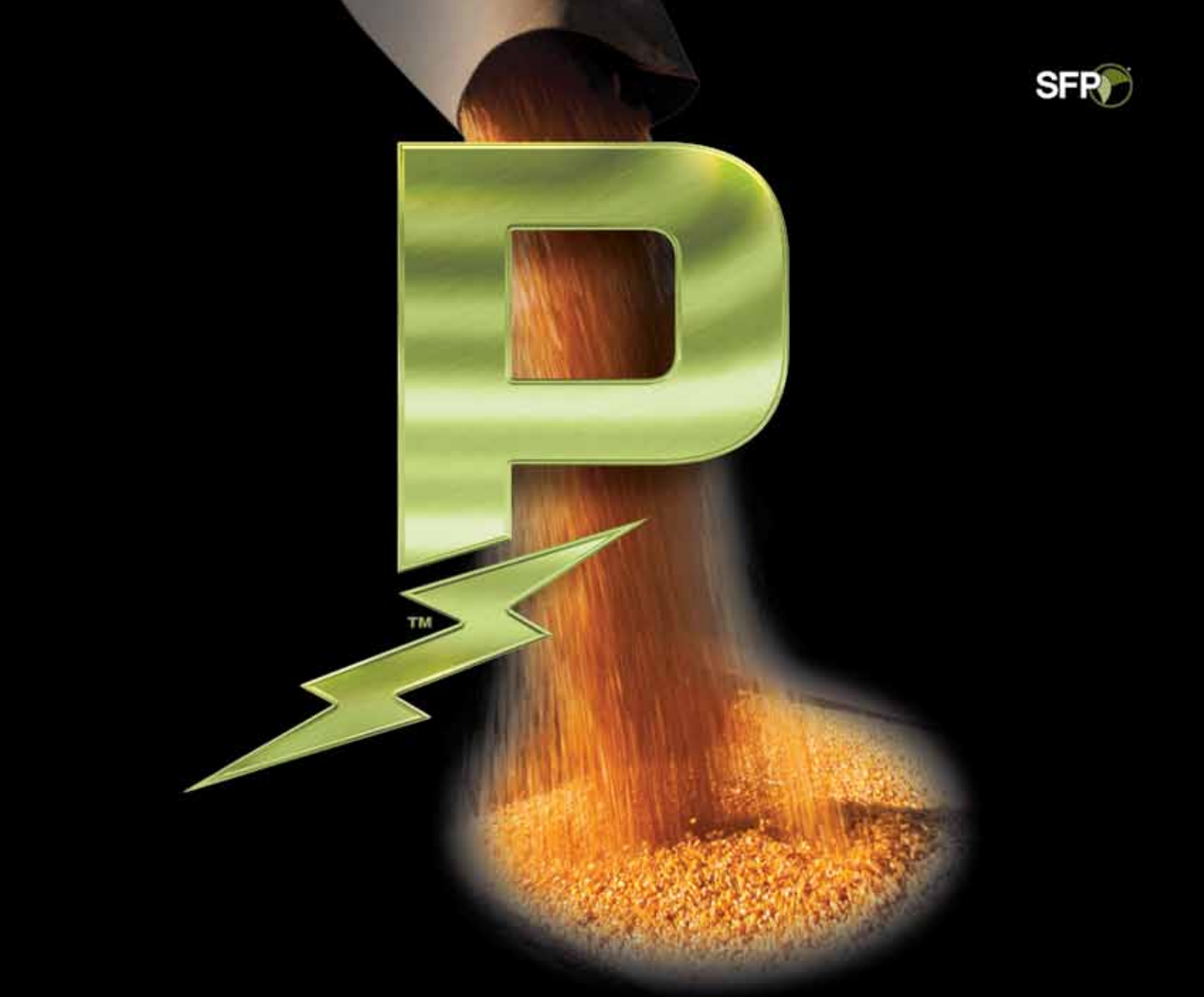
Even with RTK, it's a challenge planting corn right in the 10-inch-wide strip, he says.

"That's why I planted more corn in single rows on 30-inch spacing," Setniker says. "To meet the NRCS definition of strip-till, the strip may not be wider than 10 inches.

"I'm making a strip 8 inches wide and 8 inches deep. That's why it's a challenge to plant twin-row corn with my Monosem planter, where there's just 7½ inches between the rows."

Setniker has Dawn Equipment row units on a toolbar for strip-tilling. To cut fuel costs, Setniker would like to make just one pass with the strip-till rig instead of two. But that wasn't possible last spring because fields were saturated and full of clods.

"Strip-till is a work in progress," he says. "If we can go across the fields in the spring, running the strip-tiller shallow, the fields should be nice before we plant."



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