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Special No-Till Management Report No. 49

By No-Till Farmer Editors

Profitable Practices for Boosting Strip-Till Yields

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Strip-Till Success Rooted in Motivation to Farm Smarter

Farmers are an intelligent group, honing their skills and intuition in the field, then often passing along that experience-based knowledge to the next generation.

But for better or worse, farmers can also be creatures of habit, which in some cases can curb the growth and sustainability of their operations. Everyone is familiar with the old adage, 'Just because that's the way it's always been done, doesn't mean it's the right way.'

Thumbing through the 48 pages of shared strip-till tips, knowledge and advice found within this special report, I'm reminded of how many of these farmers concluded that they wanted to find a better, smarter way to farm.

Was this an easy decision? Probably not. Did it take time, effort and money to make the transition? Almost certainly. In many instances, strip-tillers are trendsetters, breaking the mold of conventional farming practices and injecting their own innovation into equipment setups, fertility programs and precision farming techniques.

Success stories are as varied as the operations themselves.

But there is a common thread: They adopted the practice with purpose. Trial and error, frustration and even failure are part of the process — but as you'll read in this report, the rewards are worth it.

Whether it's saving nearly $80,000 in labor, fuel and machinery costs, gaining 10% in productive hours per day or adding 30 bushels of corn per acre, strip-tillers are calculating their return on investment in the practice.

Intensive number crunching will continue to be an essential practice for many strip-tillers. Others are sure to start paying closer attention to their balance sheets as operating expenses increase and commodity prices fluctuate.

Strip-till can inject a little stability and consistency — words synonymous with the practice — and also be an asset to combat abnormal weather extremes that are becoming more normal.

We hope the articles and information in this special report feed your hunger for more strip-till knowledge and help you become an even more successful and profitable farmer.

Jack Zemlicka, Technology Editor

In This Special Report:

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How to Tweak Planters for Strip-Till Systems

Creating the ideal seedbed in strip-till requires the right precision technology, diligent residue management and consistent depth control.

By Jack Zemlicka, Technology Editor

In any farming practice, the cornerstone of growing a profitable crop is an effective planting strategy.

But strip-till often requires more attention to detail because farmers only have several inches of optimal planting space to work with. Hitting — or missing — that target zone can be the difference between a bumper crop and disappointing yields.

"One thing I love about strip-till is that it provides the most consistent planting condition of all tillage systems," says Andy Thompson, an Illinois strip-tiller and regional sales manager with Yetter Mfg. "But we've witnessed farmers struggle with strip-till when they don't put the proper time and effort into getting their planter ready to take full advantage of those ideal conditions."

Both strip-tillers and equipment manufacturers say certain factors — including down pressure, seed depth control, residue management and seed trench closure — are critical to planting a profitable crop in strip-till.

PLANTING PROFICIENCY. Strip-till can create an ideal seedbed, but an effective planting strategy starts with down-pressure monitoring, seed depth control and residue management.

Clearing the Strip

Strip-till rigs often serve as primary residue managers, but that doesn't mean farmers can take a casual approach with their planter to keep strips clean, Thompson says. Ideally, farmers should have planter lift wheels riding on the residue, and the row units on the clean strip, to ensure the best planting conditions.

"If a farmer makes poor strips and comes out to plant into them with residue mixed in, there's no magic fix with row cleaners or the planter that is going to compensate for that," Thompson says. "This can lead to poor seed-to-soil contact and emergence. Paddle or spiked closing wheels and residue managers are very important on the planter to ensure we get every seed emerged evenly and as quickly as possible, but there's also no way to trump Mother Nature."

Thompson farms with Niota, Ill., strip-tiller Kevin Schmitz, and his son, Brent, and helped set up their Kinze planter for better residue management on 800 acres of strip-tilled corn. The soil on top of their strips in was particularly hard, and the rigid residue managers mounted on no-till coulters that were previously on their planter were making the row unit hop. Erratic seed placement was a concern.

To compensate for the harder soil, they added Yetter's Air Adjust Residue Manager system, which provided more flexibility to adjust down pressure on the row cleaners from the tractor cab.

"We made sure our residue managers were clearing those clods and leveling off those strips," Thompson says. "We didn't create a big divot, but we made a smoother strip for the row unit and closed the seed trench with a paddle wheel."

Thompson says they harvested some of their best corn yields ever in 2014, with some fields pushing 260 bushels per acre.

While several factors contributed to the bumper crop, Thompson says smoothing out the ride of the planter and adding floating residue managers helped with consistent seed placement while the paddle closing wheels gave them consistent seed-to-soil contact.

DEPTH OF KNOWLEDGE. Consistent planting depth in the strip can promote early season emergence. In 2014, Nebraska strip-tillers Ray and Kevin Kucera saw a 2-5 bushel per acre bump in strip-tilled soybeans over no-till planting at 1½-inch depths, instead of 1-2 inches.

Clear it Up

Clearing residue off the strip also sets the stage for good seed-to-soil contact in a strip-till environment, experts say. Proper closure of the seed trench is an objective in any tillage system, but in no-till or strip-till there are additional variables to contend with, which can make this objective more difficult, Thompson says.

"Identifying inadequacies is important on each farm and then being able to address and fix those issues are where many people fall short of reaching these goals 100% of the time," he says.

Fort Dodge, Iowa, strip-tiller Dave Nelson says his primary goal is ensuring a smooth ride for the planter row unit across the strip.

Nelson runs a 32-row John Deere planter with Yetter floating residue managers and Precision Planting's CleanSweep down pressure adjustment system. They are valuable tools for clearing excess residue that can accumulate, but they also smooth out the strips he makes with his 12-row Blu-Jet strip-till unit the prior fall, Nelson says.

"You can smack that clump of soil with your finger — and that's what you need that row unit to do — to give you that smooth strip," he says. "The first time I strip-tilled, I remember in the fall it was a little clumpy and I thought, 'This is my seedbed, I have to do a better job.'

"To protect and manage that ideal seedbed I've created in strip-till, I want to be very specific with the settings on my planter. Being able to adjust those settings from the cab is a big benefit, because I'm less likely to get out of the tractor and make those slight pin adjustments manually."

'Planting on a Pillow'

For Nelson, a key component to improving planter ride and seed-to-soil contact on different field conditions is managing down pressure on row units.

"I know when we go from strip-till to no-till, I have to adjust my depth because the strip is such a mellow seed bed," he says. "It's like planting on a pillow vs. the harder ground I encounter with no-till."

Nelson uses Precision Planting's DeltaForce system, which allows for down pressure control on individual rows through the manufacturer's 20/20 SeedSense monitor. He says the system keeps his planter row units firm against the strip and provides consistent seed depth.

"The even stands, and seeing all the plants coming up at the same, is what we aim for," Nelson says. "That's been the biggest benefit of precisely controlling our down pressure in strip-till."

While most strip-tillers rely on RTK-level guidance to set and transfer A-B lines in the field, that accuracy is only as good as the placement of the seed in the strip.

As Sean Arians, marketing manager with Precision Planting notes, the objective of strip-till is to create the most ideal planting conditions.

"With strip-till, you generally have a very soft pass where your row unit is not going to require as much downforce as you may need with conventional tillage, because you have that 'grandma's garden' soil type you are planting into," he says. "If you get off of the row and you're in hard soil, you're going to lose the depth of that seed. And once you change the seed depth, you start to create emergence problems and that will affect yield."

This is something Bruning, Neb., strip-tiller Jerry Baysinger keeps in mind, especially when enduring an unpredictable freeze-thaw cycle that can rapidly change planting conditions.

Baysinger strip-tills about 3,000 acres of corn and soybeans with a custom, 12-row toolbar and an older version of Yetter's High-Residue Maverick row units.

He prefers to build strips in late fall, or even early winter, and wants at least a 2-week buffer before planting to reduce any potential burn from anhydrous ammonia application.

But the last several springs have produced inconsistent planting conditions and challenged Baysinger to closely regulate down pressure on his 24-row John Deere 1770 planter, equipped with Yetter's Air Adjust floating row cleaners and Precision Planting's AirForce pneumatic down pressure system.

"Controlling the depth of the row cleaners can be tough with a 24-row planter," he says. "I'd have to get out and adjust every row cleaner individually, so for us, it's really important to have an adjustable or floating row cleaner on a strip so we don't throw soil out and create a valley."

After a bitterly cold winter in 2013,and rapid spring thaw, Baysinger says his fall-built strips were exceptionally soft because they didn't receive much moisture ahead of planting to settle the strips.

"We had a very deep freeze, so everything heaved up and we were planting on marshmallows," he says. "Our row units had a tendency to sink down on the strip, so having Air Adjust on the row cleaner allowed us to constantly be moving that down pressure up or down according to the strip conditions."

Baysinger says the mellower planting conditions required less down pressure than usual on the row units and regulating it improved seed-to-soil contact and early-season emergence.

"We have Air Adjust air bags on our planters, so we took our down pressure down to as low as 35 pounds per row on some of our fields," he says. "The more down pressure we had, the further down that row unit sunk in that strip and made a divot. By lowering that down pressure, the soil didn't run down and blow our seed out when we did get a nice rain."

Controlling Consistency

As some manufacturers move toward designing faster planters, experts still

maintain that speed is secondary to planting accuracy.

"It's safe to say the metering capacity is there to manage the populations strip-tillers want at higher speeds," says Phil Jennings, service manager with Kinze Mfg. "The biggest concern is maintaining consistent depth and seed spacing. Strip-till provides that uniform seed bed, so the row units should be traveling smoothly across the field."

One thing Jennings has seen in the field while planting into strips is soil buildup on gauge wheel tires picking up some moist soil from the strip.

"For some fall-built strips, there might be some stale dirt on top of that finely tilled soil below, which holds the moisture," Jennings says. "In certain conditions, operators should watch the row unit gauge wheels and make sure they are not building up with dirt and reducing set planting depth."

Consistency in soil structure is critical when planting into strips, notes Kevin Kimberley, owner of Kimberley Ag Consulting in Maxwell, Iowa.

While doing a planter evaluation in a farmer's field, he noticed a pattern of shallow, misplaced corn seeds and saw the gauge wheels on the planter kicking up dirt from the row. Kimberley went in for a closer look and found that the walls of the row were fractured and raised.

"The gauge wheels were running over all the residue going up and down, causing that sidewall lift, which can have a huge impact on emergence," Kimberley says. "In strip-till, you need more down pressure on those wheels because they aren't riding on soft ground — it's firm — and it's one of the things we see missed the most by farmers."

CLEAN SWEEP. Clearing residue off the strip starts with the strip-till rig, but floating residue managers on the planter are commonly used tools to prepare seedbeds, especially into corn residue.

One of the best practices for strip-tillers to do in the spring is to take a spade and cut a slot to examine the soil profile and check for sidewall lift. Kimberley says that soil profile should be together without any gaps or fractures.

"I've seen a lot of farmers get carried away with their berms, but it should be almost flat in spring, because if it's raised, that means you'll probably blow more dirt out," he says. "But once you know what you're looking for, it can be corrected and avoided in the future."

Cedar Bluffs, Neb., strip-tiller Ray Kucera and his son, Kevin, want to see fall-built strips about 1-inch above their soil in spring. They strip-till about 1,300 acres of corn and 700 acres of soybeans with a 12-row Strip Cat knife rig made by Twin Diamond Industries.

The desire for more consistent yields drove the Kuceras to switch from no-tilled soybeans to strip-tilled in 2013. A challenge they often faced with no-till was getting good seed-to-soil contact through corn residue.

"We'd sometimes end up with soybeans on top of the ground or under a mound of residue, where they wouldn't get much sunlight," Kevin says. "Neighboring seeds might be an inch tall, while others would struggle to emerge through the residue and that would lead to inconsistent stands and yields."

While a fall strip-till pass helps clear the rows, the Kuceras' fields are susceptible to residue blowing back on the strips during winter. They outfitted their 18-row John Deere planter with Yetter spike wheel row cleaners and Copperhead Ag Furrow Cruiser closing wheels, which have improved seed-to-soil contact and allowed the Kuceras to plant soybeans slightly deeper than in the past.

"We're going about 1½ inches deep, compared to about 1-2 inches with no-till," Ray says. "Our goal is that the consistent depth placement is going to give us the most yield consistency because there won't be a layer of residue to break through, but still enough moisture in the strip."

Early returns were positive, with the Kuceras seeing better early emergence of soybean plants and a 2-5 bushel per acre bump at harvest.

"We had more even emergence and plant growth early on, which gave more time for the nodes to get established," Ray says. "That certainly contributed to the yield increase and planting was a lot easier."

Work in Progress

Finding the right setup for the planter in strip-till is often an evolution.

Frankton, Ind., farmer Mike Shuter and his sons Brian and Patrick, have progressively modified the setup on their 24-row John Deere 1770NT planter to better handle strip-tilled corn-on-corn residue.

The Shuters strip-till about 2,500 acres of corn using a 60-foot custom toolbar built by Misenhelder Welding, based in Ithaca, Mich., with 24 Orthman Mfg. row units.

On their planter, they had used Martin fertilizer openers behind the floating row cleaner, but after a few years had problems with plugging.

In 2013, they switched to Yetter single-disc fertilizer openers behind the row units by extending the closing setup back 8 inches, and then used Martin floating row cleaners up front with treader wheels to prevent trenching, followed by Martin spiked closing wheels and a drag chain in back.

"This gave us a better system in varied conditions and cleaned off that stalk residue that may have floated over the strip in winter," Shuter says. "The less residue we have in that seed trench, the better off we are."

The first year with the system, they averaged 198 bushels per acre on their strip-tilled corn-on-corn acres, compared to about 171 bushels per acre on strip-tilled corn acres planted into soybean stubble.

Shuter admits additional factors contributed to the yield differential, but their corn-on-corn acres came out ahead again in 2014. However, overall corn yields were lower, and Shuter plans to further refine his planter setup for strip-till.

"We had some issues with planter depth control, which I think cost us quite a

CUSHION THE BLOW. Nebraska strip-tiller Jerry Baysinger closely regulates down pressure on his 24-row John Deere 1770 planter, equipped with Yetter's Air Adjust floating row cleaners and Precision Planting's AirForce pneumatic down pressure system, to avoid erratic seed placement in mellow soil conditions.

bit of yield," he says. "I think there's some improvements we can make that will give us better emergence in the future."

Shuter was satisfied with the performance of the Martin row cleaners, but plans on replacing the spiked closing wheels with Dawn Equipment's Gaugetine closing wheels with the intent of getting a firmer seed bed. He's also removing the Yetter fertilizer openers and replacing them with a Totally Tubular system to apply fertilizer behind the closing wheels.

"We want to try not having anything application-wise engage the soil, which we thought might have impacted depth control," he says. "The Totally Tubular system just kind of hangs off the back of the row unit and we're looking to pull a 1,500-2,000 gallon tank behind the planter."

Shuter is also switching from Precision Planting's 20/20 AirForce down-pressure system to Ag Leader's Hydraulic Down Force setup to integrate with their Integra monitor in the planter tractor. He says they struggled getting the down-pressure system to function properly.

"It cost us the first day of planting and we ended up having to replace some wiring and a module," Shuter says. "I'm hoping the new system will be a little more reactive."

Planting Flexibility

Another benefit of strip-till is that there is less pressure on the planter to be a primary source of fertilizer application or residue management. This can allow for more flexibility and experimentation with planter row-unit setups and fertilizer placement.

Fox Lake, Wis., farmer Jonathan Gibbs strip-tills about 525 acres of corn in spring, including 100 acres of corn-on-corn ground. For corn planting, he uses an 8-row Hiniker machine with Rawson coulters. The planter was originally built for ridge-till, but he modified the row units when he made the move to strip-till several years ago.

"We're running a triple-coulter setup in the front," Gibbs says. "We were using one of the Rawson coulters for 2-by-2-inch fertilizer placement, but one of the disadvantages was that the cornstalks would get trapped behind the tine, causing the coulter to plug."

He removed the fertilizer tine and switched the row cleaners out for a Sunco Nutri Mate 3 system with the company's row cleaners. He also added Totally Tubular steel tubes to place the fertilizer underneath the seed. The modifications improved fertilizer placement, ensuring the nutrients are placed below the ground, and he uses the row cleaners to skim off any corn residue or rocks left on the strip, providing a clean seed bed.

With the planter, Gibbs applies 4-5 gallons of ammonium phosphate (10-34-0) with zinc and Ascend plant growth regulator. The balance of urea is sidedressed when corn is a foot tall and before canopy, mixed with Agrotain nitrogen stabilizer.

"We have a busy planter," Gibbs says. "But if we end up strip-tilling a couple weeks ahead of planting, we've had our ground seal back up.

"So it's nice to be able to drop those Rawson coulters back in the ground to loosen the strip right in front of our planter unit."

In 2013, Bethany, Ill., strip-tiller Mike Bland outfitted the row units on his 24-row John Deere 1770 planter with a variety of different closing wheels to determine the best fit for planting in his wetter clay soils. He typically builds strips the previous fall with a 12-row Redball machine.

Among the systems he tried were Case IH's press wheels, Copperhead Ag's Furrow Cruisers, Martin Dimple closing wheels and Dawn Equipment's Curvetine closing wheels. Bland says they all performed well in ideal planting conditions, but differently in muddier fields with heavier residue.

"With some of the systems, the mud and residue tended to wrap around the wheels and get packed and plug," he says. "We ended up going with the Martin system because it crumbled the sidewall really well, and in muddier conditions left a nice loose seedbed, which is what we want."

In 2014, Bland harvested 250 bushels per acre of strip-tilled corn in some fields and he attributes the success to a strategic, yet simple approach to planting.

"In strip-till, we know that if we achieve consistent planting depth, we'll get consistent emergence and, at the end of the day, consistent ear size," he says. "That all translates to more consistent yields."

Focus on Precision Farming Reaps Strip-Till Benefits

GPS guidance, variable-rate seeding and other technologies have provided Ohio's Brian Watkins with a 145% return on investment.

PHOTO COURTESY OF BRIAN WATKINS

SPRING STRIPS. Brian Watkins builds strips in spring with a 24-row Wil-Rich bar with Dawn Pluribus row units modified with a rolling basket. He prefers a coulter and rolling basket setup to break up clumps and build a good seedbed.

By Jack Zemlicka, Technology Editor

Not every farmer using precision ag technology takes time to crunch the numbers and get a tangible feel for their return on investment.

But Ohio no-tiller and strip-tiller Brian Watkins tries to account for nearly every dollar spent on precision tools and how they help improve his family's 7,000-acre corn and soybean operation near Kenton, Ohio.

Since he began adopting precision practices in the mid-1990s, Watkins estimates a 145% net return — or $216,611 — on their ongoing investment in tools like auto-steer, RTK guidance and variable-rate systems.

"Before we start thinking that precision ag is a magical money tree and we're just going to go shake it and get this massive return on investment, know that it doesn't quite work that way," Watkins says. "The system doesn't just fall into place.

"It's a learning process and once you have evolved it, then you can make it pay."

Pathway to Profits

Trial and error, patience and persistence have all been part of Watkins' precision journey. For years, a variety of different precision brands for GPS and auto-steer were used to control the farm's multi-colored fleet of equipment.

But like many farmers, they struggled with compatibility. Last winter, they moved to one system for field navigation. They use Ag Leader ParaDyme auto-steer systems in each of their five tractors and subscribe to a cellular RTK data plan to deliver Ohio's free

Continuously Operating Reference Station (CORS) signal for corrections.

"When we're planting or sidedressing, we can interchange the systems in our tractors if we need to because managing multiple brands was just impossible," Watkins says.

Before harvest, Watkins moves two auto-steer systems to their Claas Lexion combines, which also have yield monitors.

They have row clutches on their 24-row John Deere corn planter, a variable-rate system on their 24-row Great Plains soybean planter and variable-rate application capabilities on their Hagie sprayer.

Their total investment in technology to date tops $158,000, with the cornerstone of the operation being guidance technology. With auto-steer and swath control, Watkins has improved efficiency, cut fuel and labor costs and been more accurate with fertilizer and seed placement.

"When you are driving across the field and steering an implement by hand, I made the assumption that 75% of the time you are overlapping and 25% of the time you are skipping," he says. "Part of the benefit of auto-steer and swath control is driving straighter, but it's also about shutting off the boom on the sprayer when you have point rows or odd-shaped fields.

PHOTO COURTESY OF BRIAN WATKINS

FALL PREPARATION. Brian Watkins runs a 24-row Progressive bar with Yetter Magnum fertilizer coulters to apply potassium and phosphorus in the fall using a Montag dry-fertilizer, air-delivery system. The setup allows him to inject fertilizer about 4 inches deep in the ground so the soil can be left alone until spring.

"In northwest Ohio, we have a lot of odd-shaped fields. Our average field size is about 75 acres, but we've got 80 different fields and I would bet there's not more than 20 of them that don't have some sort of waterway."

To get the most out of their irregular fields, Watkins researched the benefits of auto-steer and swath control and accounted for variables, including overlaps and skips. While some of his conclusions were based off estimates, Watkins has seen measurable savings from the guidance equipment of more than $156,000.

He's assumed certain costs — machinery, inputs and labor — but also included some hypothetical goals to assess savings. Watkins set price and yield targets of $12.40 and 58 bushels per acre for soybeans, and $5 and 175 bushels per acre for corn, that translated to about $5,500 in savings through the use of auto-steer and swath control.

He admits the figure pales in comparison to the farm's $2.2 million machinery budget, but the savings add up once fuel, labor and input figures are included. Based on estimates of $3 per gallon for fuel, labor costs of $24 per hour and 9% depreciation on equipment, they've saved $3,000 in fuel and labor with guidance technology.

"One way to look at that is if you get things planted quicker, maybe you get a yield boost out of it. But I'm looking at it a little differently," Watkins says. "You determine what you need for capacity to get the work done, based on your conditions and what you need. We're getting about a 10% increase in hours per day we're able to work because of reduced driver fatigue."

Using university research, that suggests a 12% yield loss in double-planted

STRAIGHT SHOOTER. With a significant number of odd-shaped fields, Brian Watkins relies on auto-steer and swath control to minimize skips and overlaps with his Hagie sprayer. "Part of the benefit is driving straighter, but it's also about shutting off the boom on the sprayer when you have point rows or odd-shaped fields," he says. Of Watkins 80 fields, at least 20 of them have waterways.

corn, a 5% yield loss in double-planted soybeans and a 5% yield loss for over-spraying, Watkins says they've saved nearly 2% of their input budget through auto-steer and swath control.

They typically spray 3,500 acres of corn twice and 3,500 acres of soybeans three times during the year, so being as accurate as possible with those applications is crucial.

"Those percentages, when looking at an input budget of $1.5 million, add up quickly. We're looking at saving phosphorus, potassium, nitrogen, seed corn, seed soybeans and spraying," he says. "With these small improvements, we can save $62,000."

Variable-Rate Return

For planting, Watkins variable-rates their no-tilled soybeans. For years, they planted in 15-inch rows, but recently switched to 8-inch twin rows.

The move has allowed Watkins to experiment with their variable-rate program. This year, their average seeding rate was 158,400 seeds per acre — down from 175,000 seeds per acre. The change led to a seed savings of $19,125 and a 2% yield increase on their best soils.

"I believe that if you want to push yields, you have to push populations — even in soybeans," Watkins says. "But we're not managing soybeans for super-high populations. We're not using growth regulators, so if we overplant in good dirt, we'll get too much foliage. We've gotten a $12,586 boost in yield and a total benefit of $31,000 from variable-rate soybeans."

For corn planting, seed placement is key and Watkins manipulates this manually through the down-pressure monitors on his planter. Although he sees merit in automatic down-force adjustments, Watkins says the manual system is an improvement in their operation.

"We have air bags on the corn planter and springs on the soybean planter, but what we see in our soils is the first time we're planting, it stays fairly mellow and then we get the rain," he says. "We come back in and it's a little damp, so we keep the down pressure low. Then, after that rain and 6 hours of sunshine, it starts to get hard.

"We've had this problem before where we're behind the curve. We're adding down pressure, but we're doing it about 6 hours late. And the fact we have a number staring us in the face on that monitor makes a big difference for us to adjust accordingly."

Hardware is only part of the precision pre- and post-planting puzzle. Watkins invests about $95,000 each year in precision amenities, including data-management consulting and soil testing at $21 per acre. He samples in half-acre grids, and the samples are pulled automatically, analyzed and stored by a consultant. The plan is to do soil samples on 10-year rotations.

"We pay a consultant to warehouse our data and do prescription recommendations," he says. "It's not like we're being spoon-fed this stuff. We work with them to do the number crunching."

Committing to Strip-Till

When Watkins Farm first incorporated precision technology, they were almost entirely no-till for both corn and soybeans. They attempted strip-till for their corn on and off for about 15 years, but always struggled with getting berms built in the fall.

Precision Practice Adopted	Return
Auto-Steer, Swath Control	$156,061
Better Seed Placement	$43,211
Yield Map P and K Removal	$38,391
Variable-Rate Soybeans	$31,711
GPS for Strip-Till	$23,122
Capital Utilization Capacity	$19,998
Total	**$312,494**
Annual Operating Costs (consulting, data mgmt., soil testing)	**$95,883**
Net Return	**$216,611**
Return On Investment	**145%**

Precision Technology	Investment
5 Auto-Steer Systems, 2 Yield Monitors, Precision Modules	$131,595
Planter System/Clutches on Planters	$21,100
Variable-Rate Fertilizer Application	$5,000
Precision Software	$1,200
Total Investment	**$158,895**
Annual Operating Costs (consulting, data mgmt., soil tests)	**$95,883**

"With our typically late, wet falls, we couldn't really do a very good job with tillage, so we kind of gave up the idea of strip-till," he says. "We tried different things in the spring and thought we had a pretty good no-till system, but it just wasn't quite what we wanted."

Watkins came up with a solution. He purchased a 60-foot Progressive toolbar and mounted 24 Yetter 2987 high speed Magnum fertilizer coulters on the bar to apply potassium and phosphorus in the fall using a Montag dry fertilizer air-delivery system.

Watkins says he wanted a flat-fold bar, rather than a vertical bar, to accommodate the dry-fertilizer hoses. The new setup is cleaner and easier to maintain, he says.

The goal with the rig is to inject fertilizer in the fall about 4 inches deep in the ground so the soil can be left alone until spring, when Watkins builds his strips using a Wil-Rich toolbar with 24 Dawn Pluribus row units.

"We're still fine-tuning, but it's worked well. This idea of a single-disc, zero soil-disturbance machine is not really tillage," Watkins says. "It's strip placement, but there's really no tillage. It fits our operation better, because as long as it's not a muddy mess, we can do it. We're not worried about working up the soil. We're just placing fertilizer."

Watkins variable-rates their fall fertilizer application and applies at least the removal rate of phosphorus, as well as 100-300 pounds per acre of either diammonium phosphate or monoammonium phosphate.

Soil disturbance is so minimal with the fall rig, he says, that a few weeks after applying the fertilizer, he can't tell

where he drove in the field.

This is where RTK is essential to the success of their strip-till system. He records the A-B lines in the fall and transfers them to the tractor in the spring to make sure the strips are built over those nutrient zones.

With the spring strip-till unit, they apply about 20 gallons per acre of 28% nitrogen at least 2 inches deep with a coulter just to the side of where the corn seed will go.

"We don't run a knife, just a coulter and a rolling basket, which we added to the row units to break up some clumps and build a better seedbed," Watkins says. "In the spring, we're trying to do something fairly light ahead of the planter. A knife would be more disruptive and we might get into some wetter soil down deeper where we don't want to go."

Watkins doesn't apply any fertilizer with the planter, but sidedresses the balance of nitrogen.

Worthwhile Investment

In breaking down their strip-till expenses, Watkins Farm's move has proven profitable, both with improved yields and reduced input costs. Their strip-till system investment is $268,000, which translates to a direct operating cost of $2.46 per acre.

The biggest savings they see from their strip-till setup is in soluble phosphorus. They've been able to save more than $29,000 in phosphorus costs through more precise application at the right time.

"We're guessing at a 5% savings in soluble phosphorus, which is a big deal in Ohio — especially if you've done no-till for a long time and you have high phosphorus levels in your surface soil," Watkins says. "You don't have enough soil attachment sites for your surface applications and you lose phosphorus."

Although they've had success with no-till corn, the commitment to strip-till 3 years ago has given them a 4% bump in yield, which translates to a $122,000 profit. Overall, the farm has seen a $92,486 return on their strip-till investment, $23,122 of which is attributable to the use of precision guidance.

Watkins admits that when they moved to their current strip-till system, he wasn't sure how successful it would be. But he's seen noticeable differences in plant health and says the numbers speak for themselves.

A key benefit has been placement of nutrients below the surface in fall to help protect the phosphorus from flooding rains and make it more available to plants in spring.

"I felt like we would get better, more even distribution of fertilizer and that was worth something," Watkins says. "With the placement, as far as being able to plant into it, I didn't know if it would work out or not. This year, there was a visual difference, depending on how close we planted to that strip of fertilizer. Plants looked healthier where that seed came into contact with that band sooner and they took off a little faster."

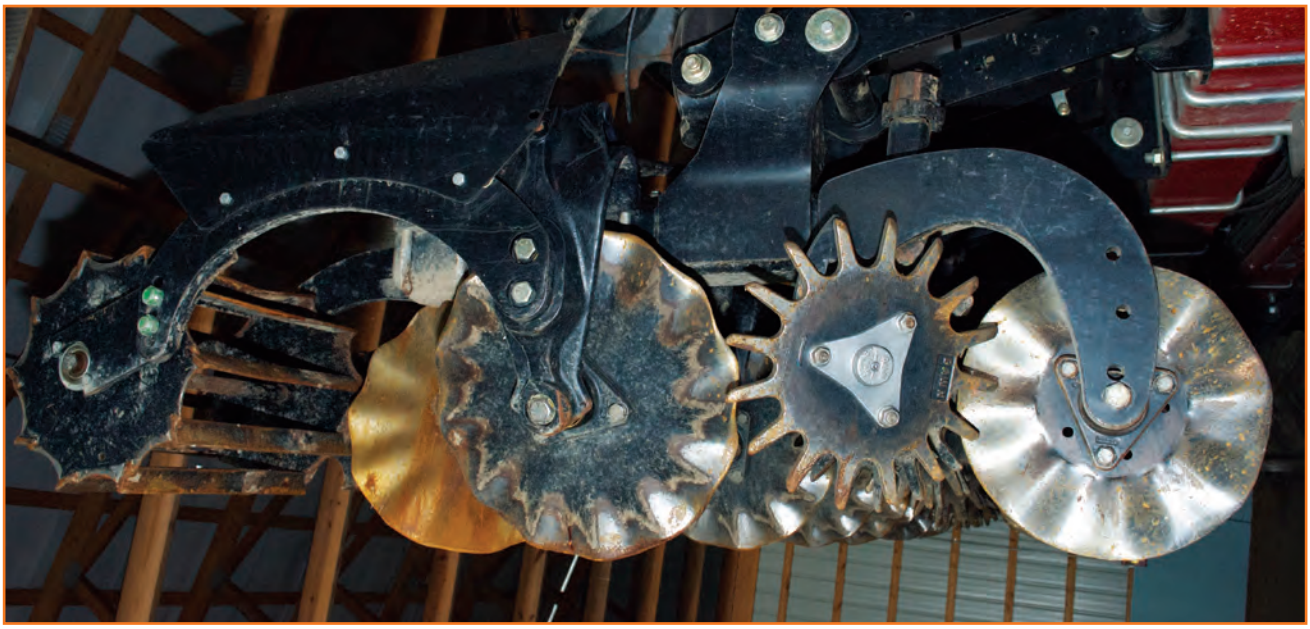
Looking Ahead

Although they've developed a profitable system, Watkins says there is always room for improvement. As an early adopter of precision technology, he's learned over the years that it takes time, effort and patience to be able to reap the long-term rewards.

"We started with RTK in 2004 and I can promise you that system cost me a heck of a lot more than the one we have now and we didn't get nearly the benefits we do today," he says. "I don't have a single piece of GPS equipment that I purchased in 2004. It's all gone."

With technology rapidly evolving, there are always new opportunities to pursue. At least some of those are on Watkins' radar to potentially increase profitability.

"Wireless communication is a technology that a lot of people are investing in, where you can manage equipment fleets from a central hub," he says. "To be able to view and send things from one machine to another, and not have to deal with flash drives or other devices, is nice. We're not there yet, but certainly, we will be at some point."



PRECISE PLACEMENT. With the spring strip-till unit, Brian Watkins applies about 20 gallons per acre of 28% nitrogen at least 2 inches deep with a coulter just to the side of where the corn seed will go.

Crop Diversity Requires Tailored Strip-Till Techniques

Strip-tilling a variety of crops, including cabbage, Joe Brightly is evolving fertilization practices and equipment on his New York operation

PHOTO COURTESY OF JOE BRIGHTLY

UNIQUE STRIP. Hamlin, N.Y., farmer Joe Brightly is among the few farmers who strip-till cabbage, which he began doing in 2012. He's been able to refine his early experiments and is finding success with a cross-tillage technique in which he vertical tills an inch down in addition to strip-tilling to fight weed issues.

By Ian Gronau, Associate Editor

When the Brightly family began strip-tilling in 2010 near Hamlin, N.Y., they were among the early adopters of the practice in their area. But they've noticed that many farmers who may have raised an eyebrow initially have also jumped on board.

"It's a highly adapted way of farming for our area," says Joe Brightly, who farms with his father, Dean and brother, Paul. "About 5 years ago, there were some farmers in the southern and western parts of New York strip-tilling, but not so many in our part of the state near Lake Ontario."

Since making the move from conventional tillage to strip-till, Brightly says their farm's soil health and structure have improved, along with yields.

"I can't say it's strictly because of strip-till, but our corn yields have increased by about 35 bushels per acre, compared to 5 years ago," he says. "Soil health and structure are really starting to change as well. It's becoming a bit darker and mellow. Last year I thought I saw a big difference, but this year I've see the most difference out of any year, and that is saying a lot."

Strip-Till Variety

The Brightly farm grows a large variety of crops, including about 850 acres of corn, 500 acres of soybeans, 300-400 acres of wheat, 250-300 acres of cabbage, 200 acres of winter squash and about 400 acres of other mixed vegetables like sweet corn, peas and snap beans.

One of the more unique strip-tilled crops to manage is cabbage, which Brightly first began doing in 2012. He's been able to refine his early experiments and is finding success with a cross-tillage method.

"We had a lot of early issues with weeds, but now we do a hybrid technique that's half vertical tillage, half strip-till," says Brightly.

A few weeks prior to planting, they run a 34-foot Case IH 335 vertical-tillage tool over the field to eliminate troublesome weeds. Then they build strips and apply a pre-emergent herbicide that must be incorporated into the soil, followed by another vertical tillage pass ahead of planting.

"If I'm going down the road, it actually almost looks like a plowed or fully worked field," Brightly says. "But in reality, it's only tilled an inch down across the field except in the strips where it's 16 inches down. We do it that way to preserve soil structure and combat weeds."

Brightly says he found that vertical tillage 1 inch deep is more effective in combating pre-season weed issues, rather than applying more herbicides that weren't working.

One advantage of strip-tilling cabbage is moisture retention. The soil stays firmer on the top and wetter down

PHOTO COURTESY OF JOE BRIGHTLY

WEEDED OUT. A few weeks prior to planting, Joe Brightly runs a vertical-tillage tool over the field to eliminate troublesome weeds before building strips with the Unverferth 120 and applying a pre-emergence herbicide. After that, Brightly runs one more vertical tillage pass ahead of planting to ensure weeds don't become an issue.

below, and cabbage really needs a lot of moisture especially when it's really hot in the summertime, Brightly says.

Equipped for Success

For most of his crops, Brightly builds strips 10 inches deep with the same 12-row Kuhn Krause Gladiator rig, set to 30-inch spacings, that he's used since 2012. But for cabbage he finds that a depth of 16 inches works better and uses a 6-row Unverferth 120 strip-till rig.

"We have it set up to go deeper and have the rows moved so they aren't exactly on 30-inch centers," says Brightly. "Overall, it's 15 feet wide, but we have the row units set a little bit wider between rows 2-3 and 4-5 to make room for the tractor tires."

Building deeper strips for cabbage is necessary to help compensate for more rigorous spraying and harvest needs, which can compact the soil.

"Cabbage is pretty hard on the ground when you harvest it," says Brightly. "We harvest our fresh-market cabbage by hand, loading it into 2-ton boxes on the backs of tractors. Plus, we have to spray it once every 10 days, so there is some significant compaction in the spray rows."

Perfecting this method has taken some trial and error, made even more challenging by the fact that there is little information available to compare his results to.

"I've only come across one other farmer strip-tilling cabbage, and he was still just trying to figure it out too," says Brightly.

Fertilizer Accuracy

Since adopting strip-till, Brightly hasn't modified their farm's fertility program much, except for a slight increase in application rates. But he feels that this can be attributed more to his rising expectations.

"We're just looking to get a bit more yield out of everything and have increased application rates slightly," he says. "When we are putting fertilizer right in the root zone we are as efficient as we can be, and we're getting the 0.8-0.9 ratio of pounds of nitrogen used per acre to bushels per acre."

Brightly builds management zones for soil testing every spring on some fields, but on others, he relies on grid sampling. He consults yield maps and soil maps to make his application decisions, but 3 years into that process he admits that he is still perfecting the art of creating zones.

In the spring, each variety of crop calls for a different mix of fertilizer, but for his cabbage he variable-rate applies about 200 pounds per acre of potash and enough lime to keep his pH levels at about 6.8. He also applies 150 units per acre of nitrogen and 60-80 pounds per acre of phosphorus, banded 8 inches deep with the Unverferth strip-till rig. At planting he adds a bit more phosphorus in the transplant water with a 6-row Checchi & Magli carousel planter on an RJ equipment frame.

It's taken time to perfect his method for strip-tilling cabbage, but Brightly sees vast improvement since his start in 2012. He points out that yield increase has been a bit difficult to pinpoint, but it hasn't lagged. He feels that the most improvement has come in the form of fuel and labor savings and overall soil health.

"There is definitely no yield drag or issues with quality," says Brightly. "We used to moldboard plow about four times, then spray it and work it a final time.

"So we're saving at least three tillage passes, which easily equates to $48-$50 an acre in savings, and you're still getting a good seedbed."

PHOTO COURTESY OF JOE BRIGHTLY

COMPACTION CONTROL. For strip-tilling cabbage, Joe Brightly uses a 6-row Unverferth 120 strip-till rig set up to build strips 16 inches deep. He has found that the depth helps him work through the significant compaction the soil is subject to through frequent spraying and high-traffic harvest.

Getting Every Inch Out of Strip-Tilled Soil

To make the most of their sandy topsoil and diverse cropping system, Wisconsin strip-tillers Eric and Megan Wallendal rely on targeted fertilizer applications and soil preservation.

By Jack Zemlicka, Technology Editor

The phrase "change is constant" is an appropriate one to summarize the ever-evolving strip-till operation at Wallendal Supply in Grand Marsh, Wis.

After nearly a quarter-century of strip-tilling a variety of crops, third generation farmer Eric Wallendal and his wife, Megan, still view their system as a work-in progress.

Farming in primarily sandy topsoil with heavy clay underneath, preserving water and fertilizer has long been a challenge for the Wallendals on their 3,200-acre operation. With largely stagnant organic matter content between 0.7-1% they adopted strip-till and other practices to help preserve soil health and increase crop yields.

"We're always fine tuning, but strip-till has improved our management practices in what can be a challenging environment," Eric says. "Our family came to the realization a long time ago that plowing our fields wiped out the organic matter that we struggle to maintain anyway. Strip-till lets us preserve the integrity of our soil."

MULTIPLE MACHINES. Grand Marsh, Wis., farmer Eric Wallendal strip-tills with two 12-row Orthman 1tRIPr rigs. One is set on 22-inch spacings for forage corn and the other on 30-inch spacings for snap beans and soybeans.

'Guerilla Farmers'

The Wallendals' operation includes a diverse rotation of forage corn, snap beans, soybeans, peas and alfalfa. They also grow forage corn for a sizeable dairy operation and rent out about 800 acres for potatoes.

Megan says they are "guerilla farmers" because they partner with canning companies to grow the crop of choice any given season.

"We grow whatever makes sense for us and our partners, and that requires a great deal of flexibility on our part," she says. "With six or seven crops in the rotation it's a little unconventional, but strip-till allows us to experiment with that diversity."

All of their strip-tilled acres are under center pivot irrigation, and in 2014 they spring strip-tilled 2,000 acres of soybeans, forage corn and snap beans, which accounted for about 80% of their crops.

They use two, 12-row Orthman 1tRIPr units; one on 30-inch spacings for soybeans and snap beans and the other set at 22-inches for forage corn.

They offset the row units 11 inches on the 12-row unit using John Deere's RTK network and GreenStar3 system on their Case IH tractor. Eric admits the 22-inch system is a bit unusual for corn, but he's seen positive results.

"We feel we're able to localize nutrients better with a banded placement of fertilizer in the root zone, while not overcrowding the plants," Eric says. "In 2013, we averaged between 250-270 bushels per acre for forage corn, applying about 260 units of nitrogen per acre."

They don't offset the row units for soybeans or snap beans, but going into corn residue they've had to use a Turbo-Till vertical-tillage tool from Great Plains Mfg. to clear debris off the row ahead of planting with their John Deere 1760 18-row planter.

The Wallendals have strip-tilled snap beans off and on for the last 10

BUFFER ZONE. The Wallendals traditionally banded a starter fertilizer package 4 inches into spring-made strips, but plan to experiment with a second band 8 inches below the soil surface to provide more "wiggle room" for timing of a broadcast fertilizer application when forage corn is at V3 stage.

years, and this past year, strip-tilled 350 acres of the crop.

"Snap beans are a 55-day crop, so with strip-till we're able to help those roots develop a little deeper and more easily access nutrients in a shorter amount of time," Eric says. "We had one of the canning company's representatives in the field this year and he said the stands looked perfect."

Wallendal also sees more consistency with the color and emergence timing of snap beans, compared to conventional tillage practices.

"It can be a risky crop, but strip-till has probably added at least a ½-ton-per-acre yield bump for us," he says.

Strategic Fertilization

The Wallendals admit that seed genetics have contributed to increased crop productivity throughout the years, but with strip-till, they've been able to maximize the potential of various seed varieties with targeted placement of fertilizer.

This is especially vital on their harder soils, which don't allow for fall application of nitrogen (N).

"We'd love to be building strips after harvest and applying our N," Eric says. "But we can't because our soils won't hold the nutrients."

The Wallendals prefer to build strips as early as possible in spring, and plant the following day, but Megan says that's not always possible.

"If we build strips and get a big rain 2 days later, we can't put those bands down because they will wash out with our sandy soils," she says. "When we strip-till, it's not just thinking about where that frost layer is, or if we've applied manure on the field."

They've applied manure on 80% of their fields going to forage corn and have to wait until it dries before they can build strips. Overall, the Wallendals apply manure on about 40% of their acres through a dragline, semi or chisel plow on the back of a truck.

"We want to incorporate the manure as deep as we can within the ground so we're not losing the value of the application," Eric says. "The manure application gives us about 100 units of N and is increasing the nutrient-retaining capabilities of our topsoil."

For forage corn, they typically band a starter fertilizer blend of potassium, phosphorus, boron and sulfur 4-inches deep with the strip-till rig. At V3 they broadcast apply 100 pounds per acre of ammonium sulfate (AMS) and fertigate another 60 pounds per acre of N at V8 or V10.

Eric says in the future, he may experiment with splitting the final application of N between V10 and R3, a couple of weeks before harvest. Another change the Wallendals plans to make is moving to a dual application of fertilizer with the strip-till rig.

"I'm looking to band a starter package both 4 inches deep and again at 8 inches, with the thought that the second layer of nutrients will supplement our V3 application," Eric says. "This would give us a little more wiggle room with timing of that broadcast application and give our roots and extra boost of nutrients at that 8-inch depth."

Improving Soil Structure

While the Wallendals struggle with improving soil health, they take an analytical approach to make the most of their farmland. They use Veris carts and soil moisture probes to record organic matter, pH levels and water-holding capacity in their soils.

"What we've found is that historically, our topsoil depth has been about 1 foot, but through strip-till we've been able to increase that depth to nearly 2 feet," Eric says.

Adds Megan, "Even if we see an increase of 0.1% or 0.2% of organic matter, having that extra foot of topsoil allows us to catch and retain more nutrients, so that's huge for us."

Though they've just started utilizing the soil sensing technology, Eric says they've seen some early returns.

"It's important for us to understand our soil makeup to understand how to irrigate," he says. "We can see the rooting depth throughout the season, see how full the soil profile is, whether it's 50% or it's at wilt, how close it is to wilt and how much water we need to apply to saturate that profile."

Working with a local irrigation dealer, the Wallendals have begun to write their own variable-rate irrigation prescriptions to better assess water needs in specific strip-tilled fields, rather than arbitrarily apply water.

"Strip-till allows us to pay attention this type of detail," Eric says. "We hope we can translate the data we're collecting into more efficient use of water to produce higher yields."

Fix-it List for Strip-Till Rigs Goes Beyond the Iron

Technology updates and assessing field conditions are becoming increasingly critical for successful strip-tilling in the spring or fall.

By Jack Zemlicka, Technology Editor

Illinois strip-tiller Mike Bland admits that he's a stickler when it comes to equipment maintenance.

The last thing he wants when heading into the fields to build fall strips is wasting time diagnosing and fixing a problem that could have easily been prevented with a little foresight.

Since he began strip-tilling 6 years ago, Bland prides himself on making sure his two strip-till rigs — a 12-row Blu-Jet and a 12-row Redball — are ready to hit the field after harvest.

"I'm a big advocate of making sure mechanical systems are working properly before I start building my strips and applying fertilizer," he says. "Summer is always a good time to check the equipment and make sure it runs."

This includes changing out worn anhydrous knives and taking preventive measures like spraying down rigs in the off-season with diesel to ward off rust caused by corrosive dry fertilizer.

Bland strip-tills about 1,200 acres of corn near Bethany, Ill., and primarily no-tills 800 acres of soybeans, although he has tried strip-tilling them in the past.

Keeping his rigs functioning is a priority. In his first year strip-tilling, Bland learned a valuable lesson about maintaining his coulter blades.

"The first year, we used a 16-row toolbar that we worked pretty hard, so we got the torch out and did some bending of the blades," he says. "The next year, we got some big humps in the berms. And when they're 8 inches high, they don't settle down.

When he came back to plant in the spring, Bland struggled with keeping the planter on top of the strip.

"We had a real dry spring and the planter would get on top of the strip, then slide off to one side because it was too tall and hard," he says.

Bland narrowed the coulters so they wouldn't build as big of a berm, which has proven easier to plant into every year since. Today, checking the coulter width is a routine part of the maintenance of his strip-till units.

But Bland and other industry experts note that inspection and upkeep of strip-till machinery is only part of the equation.

"There are really three pieces that strip-tillers need to look at each year," says Curt Davis, marketing manager with Kuhn Krause. "Equipment is one aspect, along with the technology or outside data components, and then the last is environmental factors."

TRIPLE THREAT. There are three pieces that strip-tillers should evaluate each year prior to heading into the field — equipment maintenance, technology upgrades or outside data components and environmental factors.

Machinery Checklist

Before heading into the fields each season, strip-tillers should make sure their rigs are in working order — inspecting everything from the fertilizer hoses to the individual row units — because worn parts can lead to in-field breakdowns.

"You get acres done as long as the machine moves," Davis says. "It's the mechanical wearing parts like the knife points, hosing and rate-control systems that really need to be looked at and evaluated."

If the strip-till unit is set up for anhydrous application, make sure to test the system for leaks because it's a lot easier to fix a problem in the shop than risk a dangerous leak in the field, says Kevin Kuehn, product specialist with Environmental Tillage Systems.

Checking and replacing thin or damaged lines that deliver liquid fertilizer through the strip-till rig is critical.

Running water through the system to test for leaks is safer and cheaper as a way to pinpoint problems than waiting to see if fertilizer drains into the field, Kuehn says.

"Calibrate liquid-flow rates to make sure flow-meter pulses per gallon are set correctly and the section valves turn on and off," he says. "Doing this prior to loading your fertilizer into the system is a good idea because a lot of monitors require pulse width modulation (PWM) flow calibration and getting the RPM over 100.

"It's extremely difficult to do that with fertilizer in the system."

While replacement time differs for each strip-tiller, preventive measures can be taken to extend the life of parts. Bland will spray his older Redball unit with diesel fuel or a diesel fuel/hydraulic-fluid mix to prevent rust.

He removed the closing blades on the row units and sandblasted them to remove rust. He also cleaned the scrapers on the inside of the blades to remove mud and help prevent future buildup.

"We were ending up with a gap, and that didn't leave us a nice strip — and in some cases, it was even concave," Bland says. "So we'd come back and scrape the blades off by hand. It works for a few acres, but then you have to clean them again.

"We initially had scrapers on, but they were pretty rusty. So we went back to square one with sandblasting them, then put on some good paint. Hopefully, it will stay slick."

Updating Technology

An increasingly vital part of a strip-tiller's off-season preparation is making sure their precision-farming technology is current and functional.

This includes everything from updating guidance software in the tractor to managing and analyzing yield data and soil-sample results.

"Be sure to consult with your GPS or IT technician for whatever system you have to make sure your monitor, strip-till module nodes and software is all up to date," says Kuehn. "Make sure to transfer the right A-B lines to the strip-till unit and monitor so you've got them intact. I've arrived at farms to set up the field and everyone is running around with flash drives to get the A-B lines in the tractor."

Precision farming companies are routinely updating software and strip-tillers don't always keep current with the latest upgrades, Kuehn says. But outdated or improper software can lead to confusion in the field and, eventually, hurt a farmer's profits.

Kuehn and others have worked with strip-tillers who struggled with technology compatibility because they didn't update their guidance software and the A-B lines didn't properly transfer to the tractor.

"If you are off half an inch, you'll watch it on the yield monitor next season and just see those bushels per acre drop off," says David Fickel, territory manager for Thurston Mfg./Blu-Jet. "It's pretty critical to make sure all that stuff is in tune with each other."

CLEAN SLATE. To prevent rust on his 12-row Redball rig, Illinois strip-tiller Mike Bland sprays the unit with diesel fuel. Last winter, he removed the closing blades on the row units and sandblasted them to remove rust and cleaned the scrapers on the inside blades to prevent mud buildup.

A Strip-Tiller's Maintenance Checklist

Prior to getting into the fields in fall, manufacturers say strip-tillers need to consider three areas; equipment, technology and environment. Here are their top tips to prepare for successful strip-tilling:

- Change out worn anhydrous knives, check fertilizer hoses for leaks and calibrate systems to avoid losing fertilizer in the field.
- Spray rigs with a diesel mix and clean coulters in the off-season to prevent rust and mud buildup.
- Test-drive strip-till rigs across 10-12 acres to make sure the machine functions properly.
- Check soil nutrients after harvest to manage fall application rates accordingly.
- Update and calibrate GPS systems so they accurately transfer A-B lines to the tractor.

It's also important to have a game plan for collecting and using precision data, since information is an increasingly valuable commodity to improve crop production and make better management decisions.

Fickel and others encourage customers to set up strip-till test plots and utilize soil sampling as ways to help paint a picture of organic matter and soil health.

"Review those soil tests, take soil samples and just develop a program," Kuehn says. "Get those prescription applications programmed into the software and use that harvest data to make better management decisions in your strip-till operation."

Environmental Prep

If the last few years have taught strip-tillers anything, it's that Mother Nature is anything but predictable.

A wetter-than-average spring can quench the thirst of many drought-parched fields, but many areas of the country have endured prolonged dry spells in recent years.

It's important that strip-tillers make sure their rigs are equipped with the right tools to match their soils. Although some areas of the country are wetter, that isn't the case everywhere and building strips into dry soils can quickly wear down coulters. Davis says it's important to know what's beneath the soil before building strips, especially in excessively wet or dry conditions.

"Some springs we've had very wet weather and I'll bet there isn't much nitrogen left in the soil," he says. "We know a lot of nitrogen probably didn't make it to the plant because of the water carrying it off. Thinking about the environmental side, we need to be a little heavier in management of nitrogen application."

Fickel has advised strip-tillers to monitor application rates with their strip-till units. When facing a later harvest, strip-tillers will want to be conscious of how much fertilizer they are applying, so as not to lose valuable nutrients come spring.

"Some years can be a lot wetter than others, and we don't want that wash-off," Fickel says. "We want to make sure that nothing turns into nitrates because farmers spend too much time and money on a machine and on the practice of strip-till to just watch their nutrients evaporate."

Experts also recommend farmers do test runs with their strip-till rigs so they can tinker with mechanical issues before hitting the field. Running a strip-till rig across 10-12 acres in a wheat field can test hydraulics, hoses and row units.

How High-Yield Strip-Tillers Manage Nitrogen Applications

Farmers recovering from punishing rainy seasons may wonder how their nitrogen programs fared. Three strip-tillers share their experience-based best practices for preserving and profiting from in-crop N management.

By Ian Gronau, Associate Editor

In some respects, strip-tillers who band fertilizer in their strips enjoy a distinct advantage in terms of nitrogen (N) management over other tillage practices. After an exceptionally rainy spring, many farmers throughout the country can start to worry about N that may have washed away.

Parts of the Midwest were drenched by heavy rains in 2015, but soil conditions vary just as much as climate does throughout the Corn Belt, so *Strip-Till Farmer* spoke with high-yielding strip-tillers in Indiana, Nebraska and Illinois, to find out how they manage N applications to compensate for unpredictable weather patterns, maximize nutrient uptake and improve yields.

FLEXIBLE FERTILITY. Some farmers may face nitrogen loss from heavy rains. But strip-tillers are at an inherent advantage when it comes to placing their nitrogen. Designing a flexible program that includes various applications can help protect against seasonal volatility.

Tailoring Applications

Frankfort, Ind., farmer Jerry Neidlinger and his son Jeremy have been strip-tilling 500 acres of corn on their 1,100-acre operation since 2007. Even though Jerry suspects that heavy spring rains may negatively impact his 2015 corn yield totals, he has confidence in the N program he's developed. By using a few simple strategies fitted to his soil type and climate, he's able to keep his farm average up around 234 bushels-per-acre.

Neidlinger staggers both his N application and strip-tilling practices. In the fall, he strip-tills about half of his acreage, banding anhydrous ammonia 8 inches deep through his 12-row Case IH/DMI strip-till bar on 30-inch spacings. For corn-on-corn, he shoots for a rate of 200 pounds of N and 165 pounds per acre for corn following soybeans.

In early spring, he comes back to finish the remainder of his acreage. Neidlinger says that concerns about N leaching can be sidestepped by taking a few precautions.

"To make sure the nitrogen stays put in the fall, I don't start strip-tilling until the temperature hits 50 degrees and stays at or below that," he says. "Also, in the fall I make sure to use N-Serve stabilizer to prevent movement. I'll use it in the spring too if I'm able to get out early enough, but only up until April 1."

He admits this strategy may not work as well for a farmer with a different soil type, but much of his highest yielding corn is pulled from the acreage he prepares in the fall.

"A lot of people will tell you that sidedressing will give you better yields, but for us and our soil types, this is the best way," says Neidlinger. "We have heavy black soil throughout, and it has a tendency to hold onto the anhydrous a little better on it's own."

With additional N applied at planting and sidedressing, as needed, Neidlinger builds some flexibility into his program to accommodate for extremely wet years. When planting with his Case IH 1250, he applies about 8 gallons per acre of Nature's Release starter fertilizer in 2-by-2 inch placement. As for sidedressing, he often bases rates off his 4-year cycle of soil tests.

"With corn-on-corn, we'll usually put 100-150 pounds of MAP (monoammonium phosphate) down, depending on what my soil tests show," says Neidlinger. "This year has been different. If we have an early wet spring, we'll come back and sidedress some 28% if we feel like we've had a significant loss. We haven't had to do a lot of that, but we try to do a few early tissue tests in wet springs to find out what we need."

Follow with Fertigation

Matthew Beckman of Elgin, Neb., has been strip-tilling 1,200 acres of corn on his 4,000-acre family farm with his dad, brothers and uncle for about 6 years. Even though Nebraskan farmers usu-

ally have to contend with drier springs on average, they weren't spared from heavier rains in 2015. However, Beckman believes maintaining flexibility above a baseline strategy is the best route to consistently high yields.

"If it looks like we might need a shot of N earlier in the spring, we're not afraid to go spread some extra urea," says Beckman. "We have a baseline program, but if weather dictates that we need to deviate from that in the spring, we can. We have options through our local co-op — they have a good selection of fertilizer and equipment that we can get at in a minute's notice."

In the spring, Beckman builds strips 8 inches deep and 7 inches wide with a 12-row Twin Diamond Strip Cat, and applies 130 pounds per acre of N in the form of anhydrous ammonia. He also applies 175 pounds of a liquid blend.

"The liquid blend that goes on with the strip-till applicator is a custom blend made for us by our local co-op," says Beckman. It's a combination of 10-34-0 (liquid ammonium phosphate), 12-0-0-26 (thiosulfate), 0-0-25-17 (potassium thiosulfate) and zinc."

When he's planting with his 24-row John Deere 1775NT, he follows up with another 4 gallons per acre of 10-34-0 with zinc, in-furrow and about 15 gallons per acre of surface-banded 28-0-0-5 (a blend of 32% UAN and thiosulfate).

Beckman uses fertigation for a final follow-up application, which proves to be a perfect time to make up for N suspected to have been lost. After wet springs, he looks for early yellowing or wilting to gauge the need for adding N.

"Fertigation is part of our plan regardless if it's wet or not, but it's a good time to add N if tissue testing has shown a loss," says Beckmen. "It's usually just a shot —anywhere from 40-60 more pounds of the 28-0-0-5 blend."

Although other factors, like genetics, are at play, the strip-till has helped him boost yields to around a consistent 240 bushels-per-acre.

"We have some poor areas in our field, like all of our calcareous yellow clay hills, but banding the fertilizer seems like it gives them a boost," says Beckman. "Our bottom end of yield has come up a long way and our top end has maintained and even increased in some spots. We're getting maybe 10-30 bushels better in most spots since adopting strip-till."

Stable Products, Program

On his farm in Beardstown, Ill., David Wankel has been strip-tilling 2,200 acres of corn and 200 acres of soybeans for the last 3 years. Originally, he started the practice in the '90s, but temporarily abandoned it because of issues with fertilizer placement.

"In light to moderate drought situations, our heavy river bottom soils were suffering," says Wankel. "The roots weren't able to get out of the strip to pick up the potassium.

"I stopped because I didn't think it was going to work, but when it became possible to place dry fertilizer in the strip where I knew the crop could get to it no matter what the conditions were, I picked it back up."

Wankel builds his strips in the fall, applying a blanket rate of 130 pounds per acre of diammonium phosphate (DAP) with his 12-row Kuhn Krause Gladiator on 30-inch spacings. He places the DAP at a depth of 4 inches, but he builds the strip about 12 inches deep and 8 inches wide — a experiment he started in 2015.

"We went from 8 inches down to 12," says Wankel. "We did it because some of the strips in our heavy traffic areas were ending up as depressions. The knife would just slip through without much disturbance.

"It might throw a chunk of soil here or there, but it would be out past where the closing disc could get a hold of it so it would leave a low spot. At 12 inches deep, we are tending to lift the profile better, and build a better strip."

While the majority of Wankel's N is applied at sidedress, he puts a significant amount down at planting as well. He applies 40 pounds per acre of 10-34-0 in-furrow with Keeton seed firmers and dribbles another 30 pounds per acre of N in the form of 28% and some triazole — a fungicide — behind the closing wheels.

To finish out his program, he sidedresses 200 pounds per acre of N in the form of anhydrous ammonia. Wankel evaluates tissue tests with his crop consultant throughout the year for guidance on N deficiency.

"Our application of ammonia at sidedress is very stable," says Wankel. "The bacteria hasn't had a chance to break it down into nitrates yet, which is leachable. If I put down a ton of liquid 28%, I would be more concerned because a lot of it would have already been in the form of nitrates."

Keeping around a 238 bushel-per-acre yield, as he does, isn't easy in extremely wet years, but Wankel says staying vigilant on signs of N deficiency will help strip-tillers respond quickly.

"With N loss, we see wilting and yellowing," says Wankel. "The crops will start dropping their leaves from the bottom up, and if I see them doing that with more than two regular leaves, I know it's time to do something about it."

PLANNING AROUND SOIL. Some soil types are more suited to holding nitrogen (N) better than others. For instance, heavy black soil may be more likely to stand up to continuous rain better than light sandy soils in terms of N retention. This is an important consideration when designing a fertility program.

Fertilizing Experiments Yield Strip-Till Savings and Profit

Michigan strip-tiller Ryan Groholske's move to spring strip-till has helped cut potassium application rates and improved soybean yields.

SMOOTH STRIPS. Ryan Groholske farms 1,800 acres in south central Michigan and is accustomed to navigating rocky, but fertile, ground. Six years ago, he moved to strip-till to improve fertilizer placement and broaden his planting window.

By Jack Zemlicka, Technology Editor

Farming 1,800 acres in south central Michigan, Ryan Groholske is accustomed to navigating rocky — though fertile — ground.

Through long-term no-till practices, he's been able to elevate organic matter content on some sandier soils to as much as 5%, while also creating a thriving habitat for earthworms.

But Groholske wanted a more efficient way to apply fertilizer, and also increase planting flexibility for both corn and soybeans. In 2010, the Tekonsha, Mich., farmer purchased a 16-row SoilWarrior strip-till unit made by Environmental Tillage Systems.

He says the machine has helped him gradually cut application rates of potash through more targeted placement beneath the soil surface, create a broader planting window and increase strip-tilled corn and soybean yields.

"I can get out and open up the soil a little earlier and plant a little sooner, and my seeds come out of the ground a little faster," Groholske says. "There's a definite advantage to having loose dirt that the plant can quickly emerge from and get away from all the troubles that it has before it's out of the ground."

Banding Benefits

Groholske primarily strip-tills in the spring, and for that reason he's careful with the types of fertilizer he bands in the berm.

With the strip-till rig he applies 270 pounds per acre of a potash, mono-ammonium phosphate (MAP) and urea blend for corn. Also included is about a ½-pound per acre of Wolf Trax Innovative Nutrients, which includes zinc, boron, copper and magnesium.

WORMS WELCOME. Long-term no-till practices helped boost organic matter and earthworm populations on Ryan Groholske's farm, but he sees strip-till as a way to be more efficient with nutrient application to improve corn and soybean yields.

The banded fertilizer is mixed into the berm, about 3-5 inches beneath the surface. Groholske says he likes incorporating the nutrients into the soil to avoid potential seed burn caused by a concentrated area of banded fertilizer.

"Instead of putting a small, hot band in one spot, the fertilizer is shot down behind the closing discs as the soil is coming up," he says. "So some of it hits the soil and moves with it and some will end up 5 inches deep. The way my row units are set, maybe 3% ends up on the surface and the majority of fertilizer is in the top 3 inches."

This gives the strips a "potting soil" texture that is easy to plant into, Groholske says, and gives him confidence that fertilizer is evenly distributed within the 10-12-inch-wide strips.

Through soil samples taken even 2 years, Groholske has identified areas on his field that have ample potassium levels, and he's dramatically reduced applied amounts with banding in strip-till vs. broadcasting with no-till.

"I've probably cut my applied potash by about 100 pounds per acre," he says. "I'm not seeing any depletion based on soil tests, and I attribute that to the potash being where the plant needs it and uses it."

Groholske will occasionally supplement his primary nutrient application with the strip-till rig by spreading chicken litter in either fall or spring, depending on the cost. He applies 1 ton per acre to provide about 80 pounds nitrogen (N), 60 pounds of phosphorus (P) and 40 pounds of potassium (K).

At planting, he applies about 5 gallons per acre each of liquid ammonium phosphate (10-34-0) and 28% N, along with a smaller amount of Thio-Sul, liquid ammonium sulfate in 2-by-2-inch placement with his 16-row John Deere planter. Groholske then sidedresses 40-60 gallons per acre of 28%, depending on his yield goals.

In 2014, he conducted a comparative experiment in one of his corn fields, strip-tilling part and no-tilling the rest. Groholske applied about 200 pounds per acre of N to both parts of the field, but the strip-tilled field had an additional 100 pounds per acre of potash and 50 pounds of Micro-Essentials SZ (MESZ), starter fertilizer banded with the strip-till rig.

Groholske expected the banded application to result in a yield boost, but he was surprised with just how much of an advantage he saw.

"It ended up being about 50 bushels per acre," he says. "The entire field had chicken litter spread and an equal amount of nitrogen, but having that early package of nutrients placed in the strip probably made the different between 175 bushels and 225."

Soybean Success

Groholske strip-tilled seed corn before transitioning to field corn about 2 years ago. In 2014, he strip-tilled about 800 acres of corn and, for the first time, strip-tilled about 450 acres of 30-inch soybeans into corn residue.

He experimented with several different fertilizers and amounts to see which would produce the best results, and to help guide future application decisions. Using the Deere rate controller on his strip-till rig, Groholske varied rates of potash and MESZ in the strip.

From the front tank, he applied 0-125 pounds per acre of MESZ and then from the secondary tank, 0-125 pounds per acre of potash in different parts of the field.

"It definitely wasn't a scientific trial, but where I saw the biggest yield gain was when I applied 100 pounds of potash and no MESZ in the strip ahead of planting soybeans," Groholske says. "I saw a 5-6 bushel-per-acre advantage in that area compared to the other trials.

"It was a good learning experience and put to rest some of my fears about applying too much fertilizer in my lighter soils and getting the strip too hot."

Overall, Groholske says he saw a 2-3-bushel-per-acre yield increase strip-tilling soybeans vs. no-tilling. He attributes part of this boost to more precise fertilizer placement, but also credits strip-till with being able to harvest more soybeans per plant.

"With strip-till, I have a raised berm, so the plants are a little higher than the rest of the ground, especially on top of that corn stubble, so we're able to cut the plants a little bit lower," he says. "In the past, if we had a low node, they might end up on the ground, or we'd cut them open with the

PROPERLY EQUIPPED. Ryan Groholske runs a 16-row SoilWarrior for spring strip-till on a corn-and-soybean crop rotation. He's seen more consistent corn yields and a bump of 2-3 bushels per acre in soybean yields.

combine. We've got better 'harvestability' with strip-till.

Mapping Improvement

While Groholske soil samples every 2 years, he is still trying to figure out the best time to pull samples to get the most useful results.

Sampling in the fall provides a good "report card" as to remaining nutrients in the field, but he's found that taking a second sample in the same part of a field a short time later can produce a different result.

"It's peace of mind, but when if you are in school, you like to know if you are failing before the end of the year," he says. "I want a progress report of my fields throughout the year and I've found that tissue sampling is the way to go."

Groholske has used the Climate Corp.'s Climate Pro application to assist in scouting crops, tracking nutrient levels and monitoring weather. In 2014, he enrolled 500 acres in the program.

While he didn't receive in-crop data until late in the growing season, Groholske says it did reveal an area in one cornfield where operators had under-applied 28% N.

"We had some wiring issues on one of our sidedress applicators, but when I initially looked at the as-applied maps, everything looked pretty good, so I wasn't sure if it was just one row or throughout the entire field," he says. "When we got the Climate Pro maps back, we saw that halfway across the field in either direction is where the malfunction occurred."

Groholske estimates that the N deficiency cost him as much as 60-bushels per acre in some parts of the field. He plans to use the Climate Pro platform again and hopes to be able to leverage the data to make in-crop decisions.

"With low-dollar corn, I can't afford to mess up," he says. "If I can gain 5-10 bushels from a small application of a micronutrient or identify an area where there's a deficiency, that's where getting those timely tissues tests done are important. The whole idea of grading myself at the end of the year is yield."

On The Web

Seeding Cover Crops in Strip-Till

Scan the QR code or visit *strip-tillfarmer.com* to learn more about farmer Ryan Groholske's operation, shot on location by editors at his Tekonska, Mich., farm. In this video, he discusses some early challenges he encountered incorporating cover crops into strip-till, and his experimentation with seeding cover crops with his strip-till rig in fall and planting into the strip in spring.

Looking Beneath the Soil Uncovers Strip-Till Benefits

Soil-moisture sensing and analysis allow Colorado strip-tiller Chad Godsey to make smarter irrigation decisions and increase yields.

By Jack Zemlicka, Technology Editor

Growing up on his family's farm outside of Wray, Colo., Chad Godsey gained an early understanding of how important water is to growing a good crop.

This knowledge shaped his professional career as cropping systems specialist with Oklahoma State University and the founder of Godsey Precision Ag, which provides conservation-minded water management, grid sampling and seeding advice.

For the last decade-plus, Godsey, his dad and brother have worked to implement no-till and minimum-tillage practices on the family farm, which is about 3,000 acres of primarily irrigated corn, and a few acres of dry beans, in northeastern Colorado.

But when, they converted their corn operation to strip-till to maintain and improve soil structure, they also incorporated soil moisture sensing technology to apply water more precisely from center pivots.

STRIP-TILL SUCCESS. Chad Godsey worked with his family to convert their irrigated corn acres in Wray, Colo., to strip-till to solve wind erosion problems and improve soil structure. Although they haven't seen much growth in organic matter yet, covering the soil surface with crop residue is protecting the ground.

Saving Soil

The biggest perennial challenge the Godseys faced on their farm was losing soil to wind erosion.

"We've always had problems with wind erosion and that's the main reason we wanted to move to strip-till," he says. "Probably the biggest benefit we've seen is that we get very little to no erosion now.

"For the first time that I can remember, I've been finding earthworms the last couple of years. Especially in our sandy soils, that's really saying something. There's not as much soil blowing around in spring."

Although they haven't yet seen much growth in organic matter, covering the soil surface with crop residue is protecting the ground, and Godsey is an advocate of staying off the fields as much as possible.

"After fall harvest, the ground is cattle grazed, and we don't touch it until March," he says. "We want to build our strips within 2 weeks of planting, and sometimes we'll strip-till 2 days before planting."

In the past, he's done some vertical tillage with a Landoll machine to break down residue prior to planting. This sizes the residue and lets the residue settle and speeds up planting.

"We'll do straight strip-till if we don't have heavy residue," Godsey says. "But sometimes we need to resize some of that residue before we build our strips because we don't want loose residue blowing over the row when we plant."

They build their strips 6-8 inches wide and 6-8 inches deep using a 12-row Orthman rig. They previously used an Orthman 1rRIPr to also apply fertilizer in the strip, but now apply the majority of fertilizer at planting and sidedress.

"I know a lot of strip-tillers put the majority of their nitrogen (N) on with their rig, but our sandy soils dictate that we can't do that," Godsey says. "If we put that nitrogen on up front, we may lose it.

"We got rid of the fertilizer caddy and I prefer putting that fertilizer in the ground, as close as we can to when the plant will need it. We also don't apply anything in fall because there's too high a risk of leaching."

FERTILITY FOCUS. With primarily sandy soils, the Godseys moved away from applying fertilizer with their strip-till rig, to applying their phosphorus and nitrogen (N) needs with two 12-row John Deere MaxEmerge planters. They will then variable-rate between 30-100 pounds per acre of 28% or 32% N at V4 to V6 stage.

With their two 12-row John Deere MaxEmerge planters, they apply about 30-45 pounds per acre of phosphate (P205),and 10-15 pounds per acre of a liquid urea-ammonium nitrate (UAN), along with 32% N mix in 2-by-2-inch placement, at a rate determined by soil tests.

He then variable-rate sidedresses 30-100 pounds of either 28% or 32% N at V4 to V6 stage, and the balance is spoon fed through the center pivots during irrigation.

Probing for Savings

With the majority of their corn under irrigation, Godsey leverages the natural benefits of water infiltration in strip-till to make every drop count. With primarily sandy soils, they don't have nearly the water-holding capacity that farmers in the Midwest, or even parts of Kansas and Nebraska have.

"We've got fuller moisture-content profiles, which reduces early-season irrigation requirements and maintains soil moisture near the surface," he says. "We're seeing reduced evaporation losses early in the season, and there's no doubt there's some moisture savings — especially prior to canopy closure."

While Godsey says it's hard to quantify specific water savings through strip-till alone, using soil-moisture sensors during the last several years has provided more tangible benefits. He says that soil moisture monitoring is the best ammunition farmers have against over-irrigating crops.

"Keeping track of soil moisture content data, we've done a better job early in the season, late in the season and after a heavy rain of knowing when to turn the sprinklers on," he says. "In the past, we'd just apply the rule of thumb that after 1 inch of rain, leave the pivots off for 3 days and then start them up again."

On a 120-acre irrigated cornfield, Godsey installed a handful of data recorders and four Decagon water-content sensors at depths ranging from zero to 40 inches.

"I like to put two sets of sensors in each field in drier areas, and one in wetter areas with better soils," he says. "A lot of places will try and get by with one set because it can be very expensive.

"But when we're talking about 130 acres and taking one snapshot in a single area, it's not good enough to get an accurate reading. And if we can save even a half-inch of water per acre, it's worth it."

MOISTURE SENSING. The Godseys incorporated soil-moisture sensing technology on their farm, which has allowed them to better manage seed populations and water application to increase yields, especially on hilltops. They have reduced seed populations on hilltops by about 20% and have seen yields increase by 10%.

Boosting Yield

One thing Godsey learned from soil-moisture sensing is how to better manage seed populations and water application to increase productivity, especially on hilltops.

"We know traditionally, those areas aren't going be very high yielding, so we're identifying areas where we can reduce plant population and speed up the sprinkler to get back around quicker," he says. "We've learned that on our hilltops, it's not a quantity issue, so much as it is a timing issue."

Based on moisture sensor data, Godsey has reduced seed populations on hilltops by about 20% — from 33,000 seeds per acre to about 24,000 seeds per acre — and seen yields increase by 10%.

"That's probably a conservative estimate," he says. "But we've seen yields improve from 170 to 180 bushels per acre to almost 200 bushels per acre."

6 Tips for Successful Spring Strip-Till

From proper fertilizer placement and depth to the right row unit setup, manufacturers offer valuable considerations for strip-tillers.

By Ian Gronau, Associate Editor

For some strip-tillers, conditions may prevent them from building strips soon after harvest.

While spring strip-till is commonplace for some growers, those who build strips exclusively in the fall, or have a two-pass system, may have to adjust their plans when this happens.

Strip-Till Farmer editors caught up with several strip-till manufacturers to solicit advice for novice and veteran spring strip-tillers. Here is what they had to share.

1. Plan Your Fertility Program Accordingly

Fertility plans may change from season to season, but in light of a wet fall, farmers may want to revisit their strategy.

"For full spring application you should watch your fertilizer rates," says Nick Jensen, co-owner and chief marketing officer of Thurston Mfg.

"It may be better to make a partial nitrogen application, then come back with the planter and sidedress the second half to spoon feed the crop and avoid getting it too hot right under the seed zone."

Looking at samples can help farmers gauge their specific needs.

"You should preplan your fertility program based on soil samples or mapping programs to ensure desired rates and formulas for optimal yield potential," says Justin Troudt, sales manager of Orthman Mfg.

2. Be Wary of Fertilizer Placement

Going into the spring with a good fertility plan is a start, but in order to apply fertilizer effectively, placement is also important.

"Don't get your nitrogen levels too high and don't get your salty fertilizer levels too high in the zone," warns Kevin Kuehn, product support manager of Environmental Tillage Systems. "If you do have to apply those saltier fertilizers, make sure you put it down at least 5 inches, and get it out of the seed zone."

Placement may be especially challenging with fertilizers that are tricky to handle, such as urea.

"The only major case of anyone burning their crop with fertilizer in the spring that we've had is with urea. Be cautious with it," says Bassett. "It's a lighter product that can be harder to get mixed and place properly."

3. Calibrate Application Systems

Without properly calibrated equipment, planning a precise fertilization program may be all for naught.

"I suggest calibrating your drive fertilizer system and calibrating your liquid systems before spring," says Kuehn. "You have to make sure what you anticipated putting on is what you're actually putting on."

4. Use Shanks Carefully

In the spring, farmers should keep a close eye on the effect their shanks are having on the soil. "When you're using a shank in the spring, just make sure to use a less aggressive knife or point than you would in the fall," says Jensen.

"You still want some of that explosion, but not so much that the basket can't come up afterward to take some of the air pockets out."

Some situations might call for a shank run at a good depth, but it's up to the farmer to know their soil types. In some locations or times of season, it might be best to remove the shank entirely in favor of running just coulters.

The way to be sure, though, is by pulling out a shovel and finding out first hand.

"You have to adjust to conditions," says George Mayo, sales manager of Bigham Bros. "If it's getting too late and we are just ripping the slot, we'll just run our unit without a ripper shank.

"I'd build a strip at full speed with the shank, take a trenching shovel and dig it out to see what kind of work you're doing before deciding."

5. Use a Basket Attachment

Some farmers who build strips in the fall do so without a basket, but if they're forced to strip-till in the spring instead, they may have to change their approach.

"You'll want to have a rolling basket in the spring," says Jensen. "A lot of guys will run without one in the fall and say that the freeze/thaw cycle will take care of the strip and mellow it out. You'll need a basket in the spring to push the berm down, take the air pockets out and crumble the soil."

6. Look Closely at Depth

Paying close attention to depth is another consideration dependent on a farmer's location.

"I'd say to run shallower than you would normally," says Joe Bassett, president of Dawn Equipment. "We usually strip-till in the spring anyway, and it's just a fact of life for us in Illinois. Whether you are 2-3 inches in the ground, but you don't even necessarily have to get that deep."

For parts of the country where fall strip-till is the norm, stripping deeper in the spring is equally ill advised.

"In Minnesota, we don't have a lot of spring tillage because of what happens to the soil," says Wayne Buck, sales manager of Hiniker.

"If you leave a void from a strip-till shank that's 7 inches deep and drop a seed in the bottom of that, it takes a long time to come up — it's not pretty. One of the major advantages with strip-till from my perspective is emergence. I wouldn't want to jeopardize that by going too deep in spring."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Applying Farm Data to Improve Strip-Till Decision Making

Turning raw precision numbers into actionable information helps Dan and Trent Sanderson save money on inputs,increase efficiency.

Jack Zemlicka, Technology Editor
& Clair Urbain, Contributing Writer

While many farmers collect field data, one of the ongoing challenges is knowing what to do with it. This is something Dan Sanderson, his son, Trent and their family have made a priority to improve management of their 2,000-acre corn, soybean and wheat operation near Clare, Ill.

Trent has taken the lead on crunching and analyzing the numbers to assess return on investment and shape annual input expenditures. Before they even get into the field, he calibrates all of their equipment, including the yield monitor, to ensure accurate and useful collection of data.

"We choose to calibrate our equipment a few times each season, or at least check it's accuracy," he says. "It's probably overkill from a lot of people's standpoint, but if we've got the equipment to do it, I'd prefer to take the time to do it and have confidence in decisions we make based on that data."

The Sandersons work with E4 Crop Intelligence, a precision ag consulting firm based in Woodbine, Iowa, on creating a summary report of input use on each field and how it correlates to yield.

"We look at what products worked and didn't work, whether it's chemicals, fertilizer or seed," Trent says. "I can do a yield analysis based on certain applications.

"For example, if we did a droplet application of nitrogen (N) and we got the perfect rain, we can drill down to evaluate the cost per acre and the profit."

Using Ag Leader's SMS farm management tool, Trent helps analyze the previous year's field information to develop a game plan for the following year and identify operating costs for their corn, soybean and wheat acres.

"If we're doing a sidedress application of N, we can see where we sidedressed, on which date and determine whether it boosted yield," he says. "Did it pay for that application or not, and should we change the timing to make it more worthwhile?"

At the end of the season, Trent compiles all of the invoices and expenses and presents the family with a summary report, which includes a breakdown of input costs and average yields for each field.

As a group, they are then able to quickly identify whether a field was profitable or not.

The Sandersons also record each field's scale tickets, crop moisture content and grain weight, which they incorporate into the annual reports. "It's down to the bushel," Trent says.

PHOTO COURTESY OF TRENT SANDERSON

NUMBER'S GAME. Clare, Ill., farmer Dan Sanderson and his son, Trent, collect, crunch and analyze precision farming information to improve management of input costs on their 2,000-acre corn, soybean and wheat operation.

PHOTO COURTESY OF TRENT SANDERSON

SEASONAL STRADDLE. The Sandersons run an 8-row Dawn Pluribus strip-till unit and use John Deere's StarFire RTK and AutoTrac systems for strip-tilling, planting and spraying. They move 15 inches off the row every year.

PHOTO COURTESY OF TRENT SANDERSON

FAST ROI. The Sandersons fastest ROI on precision equipment came with section control on their 16-row Case IH 1200 planter. They saved $5,500 in seeds costs in one 50-acre field using Ag Leader's electric clutches on each row unit. They monitor seeding with a Deere GreenStar2 rate controller.

"We can use that information to better manage our operation from a dollar and cents standpoint."

Dealing with 'Dirty Data'

Trent has developed a side business out of cleaning up field data for more accurate interpretation. "I've started with our operation and now offer the service to other farmers," he says. "When we get the data clean enough, we'll be able to do prescription fertilizer and seeding rates."

But one of the challenges is making sure the data is useable. He cites four main sources of "dirty data."

- **Poorly calibrated equipment.** "This applies mainly to yield monitors. No one wants to calibrate them more than once a year, but we see too much variability," Trent says. "The only way you can be sure it's correct is to double check it with weigh wagons. Only then do you know what's actually going into the bin and at what moisture."
- **Equipment malfunctions.** "When farmers forego tracking data because of an equipment malfunction in the interest of getting the crop in or out, it makes it impossible to take the next step of data analysis," Trent says.
- **Incompatible data.** "When you upgrade from one system to another, data may not flow from one system to another. It can usually work with the new system if you know what you're doing," he says.
- **Running more than one machine per field.** "We had four different combines run across a section. Even though they were calibrated to the manufacturer's specification, they weren't consistent," Trent says. "Their colored maps matched up, but yield data didn't. I think it's best to use one machine, calibrate it, then use that data for greater consistency," he says.

Calculated Investments

The Sandersons are savvy enough to manage the data produced on their farm and also analyze the return on investment of equipment and technology purchases for the operation.

In 2007, they traded in their chisel plow for an 8-row Orthman 1tRIPr strip-till rig and started strip-tilling all of their corn, which required an investment in RTK-level GPS accuracy. The Sandersons also no-till soybeans and wheat.

They work closely with their local John Deere dealer, DeKalb Implement, and precision specialist Lindon Gord, when updating equipment and technology. They use John Deere's StarFire RTK and AutoTrac systems for strip-tilling, planting and spraying, and to move 15 inches off the row every year.

"That was important to us, to be as far away from the corn-on-corn roots as possible and not to disturb that nutrient zone every year," Trent says. "We need that repeatability in all of our farm field operations.

"RTK provided the opportunity for us not to be limited on equipment size. We could run a 12-row strip-till unit with our 16-row planter and eliminate an error with our guess row."

The Sandersons are satisfied with the reliability of the RTK signal subscription they purchase from their farm equipment dealer. The 450 mHz that the signal offers suits their terrain well, which is scattered with tree lines and sloping acres.

"The signal seems to blow through trees and hills and we don't lose it," Trent says. "Plus, our controller won't shut off auto-steering if the signal drops. It simply picks up the next best signal until the RTK signal reappears. We like that."

This contributes to the confidence the Sandersons have to be able to strip-till in fall or spring, depending on field conditions, without having to sacrifice accuracy.

After running the Orthman strip-till rig for several seasons, they moved to a 12-row John Deere 2510S shank-style unit 4 years ago. But in 2015, they purchased an 8-row Dawn Pluribus coulter machine.

Trent says they got to a point where it became hard to justify the annual operational costs of using their 530-horsepower John Deere 9630 tractor for strip-till. With the 12-row unit, they Sandersons typically could only strip-till about 6 mph, in part because they were using a mole knife to fracture soil 5-7 inches deep.

Trent hopes to increase that speed to closer to 10 mph pulling the 8-row unit with their 200-horsepower Deere

8300 tractor, and also experiment with precise fertilizer placement on either side of the berm.

"The per-horsepower cost for newer tractors these days is upward of $1,000," he says. "We're all about return on investment and that's tougher to come by because horsepower is an issue with any shank-type strip-till setup we've used.

"For our operation, there's no justification for spending $250,000 on a tractor. We're more interested in paying for assets that are going to go up in value."

Rate of Return

Perennial payback with technology is important for the Sandersons and they've been able to achieve that with recent investments in application rate controllers and row clutches.

The fastest return on a precision investment came with section control on their 16-row Case IH 1200 planter. They use Ag Leader electric clutches on each row unit and monitor seeding with a Deere GreenStar2 rate controller.

"We farm a lot of point rows, so we find a lot of value with section control on all our applications," Trent says. "The first year, I penciled out the return on a 50 acre, triangle-shaped field with one waterway and the worst angles you can imagine. Our seed costs were about $126 per acre for corn in that one, 50 acre field.

"We saved $5,500 in seeds costs alone that year. We paid for the cost of the row clutches in one field."

Fertilizer application control has also paid off for the Sandersons. Section control on their sprayer allows them to more precisely monitor overlap or field boundaries to reduce application drift.

"It is nice to be able to run borders to make sure we don't overspray in an area," Trent says. "Sometimes we get in an area where the boom reaches over where it shouldn't, so it's nice to be able to shut off those sections."

But controlling rates is also critical to reducing the bottom line impact of the Sanderson's complex fertility program. They are experimenting with the timing of nitrogen applications to improve efficiency and productivity.

On a strip-tilled corn-on-corn field that produced 243 bushels per acre in 2013, they made five different N applications, which proved to be an expensive, but worthwhile investment.

They started with a 40-unit per-acre application of aqua ammonia in the fall strip, then 3 units of N with starter package on the planter. This was followed by 40 units per acre broadcast with a herbicide application with their Top Air sprayer when corn was between V5 and V8 stage. They then sidedressed another 80 units and finished with a droplet application of another 60 units of N per acre before tassel.

"We spent a lot of money on N, about $165 per acre on that 120-acre field, but after costs, we ended up making $250 per acre," Trent says. "We're all liquid with our fertilizer, and section control is probably saving about $5 per acre because we have our 12-row fertilizer applicator split into 4 sections.

"That's probably a little extreme, but we were anticipating maybe having all 16-row equipment in the future, so we set it up for the next common denominator of 4 and that would simplify the plumbing for us in the future."

> "We're all about return on investment and interested in paying for assets that are going to go up in value…"

Staying Updated

While the Sandersons are satisfied with precision service and support they receive from their dealer, Trent says there is always room for improvement. Specifically, when it comes to software updates.

He recently had a bad experience with their section control system making changes on its own — something which could have been avoided had the Sandersons been made aware of a software update sooner.

"A software upgrade created problems, and it wasn't until we started asking questions that we found it was a known issue," Trent says. "Dealers and companies can do a much better job of telling us about these problems and how to fix them. As producers, we'd like to know about technology updates as quickly as possible through an email or text."

PHOTO COURTESY OF TRENT SANDERSON

DATA MATTERS. The Sandersons record and evaluate collected data to assess ROI and shape annual input expenditures. Before they get into the field, they calibrate all of their equipment, including the yield and planter monitors, to ensure accurate and useful collection of data.

Something else Trent says could benefit both dealers and farmers is having precision technology engineers and software programmers spend some time in the field. These experiences could be good learning opportunities for both developers and end users.

"I suspect there is a disconnect between the engineers programming technology for agriculture and how it's being used in different areas, because not every field is square and flat," Trent says. "It would be nice to see programmers spend a week with producers while we're operating this equipment.

"Then we could show them what we like, what we don't like and also give them ideas on how to improve products in the future."

Hybrid Tillage System Brings Balance to Soil Health, Production

A combination of strip-till and no-till practices in hilly terrain, along with an advanced fertility program, are helping Iowa farmer Bill Darrington create a productive, sustainable growing environment for corn.

By Jack Zemlicka, Technology Editor

One of Bill Darrington's guiding principles for managing his farm is to treat it like a human being.

The longtime no-tiller and strip-tiller builds his fertilization strategies around the philosophy that like humans, crops need to eat on a regular basis to grow and remain healthy.

"It takes multiple feedings for us to maintain complete nutrition and stay energized," Darrington says. "It's the same concept with plants. We know that corn plants determine how many rows will be around an ear at V3 stage, and how long that ear will be at V8.

"It's all about basic pre-natal care to promote a healthy and happy growing environment to maximize yield potential."

But he adds that continuously feeding crops fertilizers with potentially harmful elements, or the equivalent of human "junk food," can stunt plant growth and sterilize soils. The long-term practices of banding fertilizer beneath the soil surface, the use of organic-based nutrients, and multiple, timed applications throughout the growing season have contributed to strip-tilled corn yields over 290 bushels per acre on some of Darrington's highly variable soils and sidehills.

"We're very comfortable with our system, even though I know it's not perfect," he says. "We do the best with what we have, and I've not seen a yield limit on the top side because of our farming practices and goals."

LONG-TERM GROWTH. Persia, Iowa, strip-tiller Bill Darrington takes pride in building a balanced and environmentally conscious system to include multiple, timed fertilizer applications, which contribute to higher corn-on-corn yields.

'Hybrid' System

A second-generation farmer, Darrington has been active in the operation for nearly 30 years and has always used some form of conservation tillage on several thousand acres near Persia, Iowa.

Farming in the western part of the state, only 30 miles from the Nebraska border, Darrington deals with unpredictable Nebraska weather patterns and rolling ground. This is partially offset by fertile Loess Hills soils, but his fields still require an intricate management system.

"We have slopes that can exceed 20% in some areas, and on our terrain

PHOTO COURTESY OF BILL DARRINGTON

DIGGING DEEP. Bill Darrington keeps an eye on soil structure beneath the surface with root digs and prefers using organic-based fertilizers when banding applications in strip-till to preserve and improve soil health.

we have trouble being completely loyal to one tillage system," he says. "It's not unusual to get a 2-4 inch rain that comes hard and fast, and even on our long-term no-till fields we still end up with a lot of residue moving because the hills can't hold the moisture."

To compensate for the rolling ground, Darrington devised a "hybrid" tillage system to manage residue, prepare seedbeds and place fertilizer. This often begins with a fall discing pass into cornstalks using a Landoll implement.

Darrington acknowledges this isn't a "by-the-book" strategy, but a necessary strategy that serves several benefits. The pass helps create a smoother planting ride, better seed-to-soil contact and dislodge root balls the can be more easily moved with trash wheels on the planter.

"It's a little easier to find good dirt to get the seeds established, rather than having that seed get stuck in an old stalk," Darrington says. "It's also the difference of being able to plant soybeans at 120,000 seeds per acre vs. 160,000. I know that tillage pass is costing me time and fuel, but we've seen as much as a 5-10 bushel per acre advantage fairly consistently, and I think a lot of that is attributed to better seed placement on our hills."

The fall pass is the only tillage Darrington does ahead of planting soybeans with a 15-row Kinze planter. But for corn, he adds a spring strip-till pass, primarily for fertilizer application. They use an 18-row Blu-Jet dual-placement strip-till toolbar, which has two pumps and separate delivery systems.

"We run a fairly aggressive coulter on the row units and an anhydrous ammonia knife with closing discs in back," Darrington says. "We don't apply anhydrous, but the knife and closing discs help limit the amount of soil explosion and keeps from having any open cavities ahead of planting, which is very important."

Darrington builds berms 10-12 inches wide in 30-inch rows for corn and likes the seedbed preparation he gets with the strip-till rig. However, he is limited with the amount of residue that can be moved with the row units on sidehills because of planter drift.

"I'm not able to run the trash wheel-type strip-till bar. When I start moving residue and make a nice strip, that's fine, as long as I'm planting into it," he says. "But if it's on the hillsides, where the planter lists downhill a foot, then all of the sudden I'm trying to plant through a windrow of residue I pulled together with my strip-till bar."

Planting Pressures

To maintain a clean seedbed on sloping ground, Darrington has his two 16-row Kinze 3660 corn planters setup for a no-till environment. With corn-on-corn accounting for about 70% of their acres, residue management is critical.

They use Yetter's spike-tooth row

A Precise Approach to Cutting Input Costs on Sidehills and Slopes

Persia, Iowa, strip-tiller and no-tiller Bill Darrington doesn't consider himself an expert when it comes to precision farming. But he's invested in technology for nearly a decade, primarily to improve the accuracy of planting and fertilizer application on his sidehills.

While he still struggles with implement drift on his sloping ground, autosteer has helped mitigate the challenge. Darrington uses an Ag Leader system, Integra monitor and section controls for his strip-till bar, planters and sprayer.

The biggest precision payoff is the ability to save fertilizer and seed costs by reducing overlap on his irregularly shaped fields and hillsides.

"On our hillsides, we have point rows where we can come into a spot from three different directions to contour it the right way," Darrington says. "We might be planting 95,000 population of corn and applying 130 gallons of 28% nitrogen and three times the rate of pre-emerge and post-emerge herbicide, and we didn't realize how much it was hurting us until we eliminated it."

Darrington says there's an immediate visual effect in the field when corn is overpopulated, but there is also the later effect of applying too much fertilizer on smaller corn. Adding section control and row shutoffs have helped eliminate end-row overlap and reduced the occurrence of downed corn in fields where they overplanted and over-fertilized.

"Overall, we've saved 10-15% in input costs, largely through the reduction in overlap on our terrain," Darrington says. "If we were square quarters, we might only be saving a couple percent, but we've gotten a nice return on our operation."

The next step in precision farming for Darrington is to add variable-rate seeding and fertilizing. However, he is somewhat reluctant to cut corn populations and nutrition too severely on his sidehills because given the right growing conditions, they can produce high yields.

"I'm a little apprehensive to cut much on my sidehills, because there are years I've had tremendous yields on my hills if I get the moisture," he says. "They are fertile windblown soils. Just because they aren't flat, doesn't mean it's not good soil. My grandfather told me 'The good lord just stacked it a little higher there.'"

"The secret to my success is placing a little fertilizer at a time and allowing the roots to run into more nutrition as they grow…"
— Bill Darrington

cleaners with Precision Planting's CleanSweep adjustable down pressure system. The ability to automatically change down pressure from the tractor cab allows Darrington to make on-the-go adjustments of as much as 40 pounds when moving from lighter sidehill soils to heavier riverbottom soil conditions.

"We'll go from sticky gumbo to pure sand in 15-20 feet on the river bottoms, so we're constantly putting pressure on trash wheels and taking it off," he says. "The system is almost a must for farmers in my situation because I'm not constantly planting and looking back, thinking I should have changed those trash wheels, but then on the other side of the field, they are working just perfectly."

Darrington typically runs about 20 pounds of down pressure, but he's gone as high as 60 pounds in strip-tilled corn-on-corn fields that have residue from yields of up to 250 bushels an acre. Though initially nervous about applying that much down pressure and possibly moving too much soil, Darrington says a closer look alleviated any concerns.

"I was making a windrow of residue between my rows, so I got out and took a handful of residue to see how much actual soil was mixed in," he says. "It was almost all residue and once I knew how it was supposed to look, it's nice to look out the back of the planter and see these nice, black strips. That's medicine for a lot of issues that can occur."

Darrington credits his planter mentor and friend Kevin Kimberley of Maxwell, Iowa, with helping setup his planters and planting system to always perform to its maximum potential and efficiency.

On the back of the planter, Darrington runs Copperhead Ag's spiked press wheels to help maintain a consistent planting depth of 2-2½ inches for corn. He likes the indented wheels with points to close the seed trench, rather than a smooth wheel.

SPRING STRIP-TILL. Bill Darrington runs an 18-row Blu-Jet dual-placement strip-till bar featuring a coulter and anhydrous ammonia knife with closing discs in the back of the row unit. He likes the seedbed preparation with the unit, but is limited to how much residue he can move on sidehills due to planter drift.

"It's the difference between trying to slide that furrow shut with the side of my hand or push it shut with my fingers," he says. "At our depth, we need the tip of our fingers to poke down there.

"The other thing we like is the variation in the way the wheel goes through the soil. We end up with indentations that can make fracture joints when the corn plants begin to emerge, instead of 2 solid wheels that are just rolling a strip. With the knobbed indentations, the ground is a little more forgiving when our corn begins to emerge."

Banding with Care

Darrington typically doesn't apply any fertilizer at planting. However, he's developed a comprehensive fertility program to suit his operation, with an eye on environmental stewardship, organic efficiency and balanced soil health.

This starts with a broadcast application of 150-200 pounds per acre of ammonium sulfate (AMS) in early winter to alter the carbon-nitrogen ratio in the residue and jump-start decomposition.

The cornerstone of his split-application system is the banded placement of nutrients in spring with the strip-till rig. With the front anhydrous knife, Darrington injects 40 gallons per acre of 28% nitrogen (N) and 5 gallons of ammonium thiosulfate, phosphorus (P) and potassium (K) (7-25-5), plus, zinc and sugars in the strip, about 7 inches deep.

Then a second application system of the dual-tube knife applies about 10 gallons per acre of a 2-16-14 blend from Indiana-based CarboTech America, a direct liquid fertilizer supplier.

"We drilled a small hole in the back of the second tube to shoot the product out behind the knife. This is 2 inches shallower than the 28% and keeps the tube from plugging, and gives us a staggered application site in the strip," Darrington says. "We don't want to apply everything all in one spot and walk away. I want that soil profile to be layered with nutrition, eliminating our corn from being pale yellow until it finally runs into the fertilizer hot spot.

"The secret to my success is placing a little at a time and allowing the root system to run into more nutrition as it grows."

Darrington says the dual application is contributing to more consistent emergence and corn plant health throughout the growing season. But just as important as the timing of applications, is the type of fertilizer being banded in the strips.

He recalls a 1999 visit from mentor Ray Rawson, who helped change Darrington's thinking about how non-organic elements in fertilizers can negatively impact soil health.

"Ray came to my farm and in 30 seconds could tell I was still applying anhydrous ammonia because he showed me a hardpan and crack in the soil where the anhydrous knife ran," Darrington says. "That was the last year we ran anhydrous.

Today, I have a much better understanding when banding fertilizer, it is always important to remember the good and the bad ingredients are all being banded in the root zone. This could be salt or chloride or even some heavy metals.

"The million dollar question for me is always, 'What else is in it?' because I'm willing to pay a little more for products that are going to promote and preserve soil biological health."

Organic Influences

Darrington applies the same philosophy to his insecticide and foliar applications. He's worked with Wisconsin-based Midwestern BioAg to develop a soil-friendly program.

For both corn and soybeans, Darrington typically makes two foliar applications, using a complete mix of N, P and K, along with a blend of micronutrients including boron, copper, calcium, iron, magnesium, manganese, molybdenum, zinc and carbohydrates.

The carbohydrates are derived from a product containing sucrose, fructose, dextrose and glucose, all which play a key role in converting N to proteins and biological energizers. These applications are based on key growth stages of the plants to provide either growth or fruiting energy — whichever is needed at that physiological stage.

"That carbohydrate component makes that conversion more efficient and ultimately, that's what nitrogen is for," Darrington says. "It isn't just to make plants green. If all it took to increase yields was more N, P and K, we'd have 500-bushel corn on our end rows, because when we covered that area in years past with a dry spreader, we hardly ever turned it off. But I've never seen a spot where we hit 500 bushels per acre because I quadrupled my N, P and K."

Darrington recently began applying a natural bacteriacide/fungicide product called Procidic, along with an organic, oil-based insecticide called SafeStrike. After a recent threat of Goss's wilt emerged in central Iowa, he shifted from only applying his bacteriacide/fungicide mix at R1 stage to an application at V3-V5 stage for corn with the herbicide, and then another application — either aerially or with his high-clearance Hagie sprayer — at R1.

CLEARING RESIDUE. With corn-on-corn accounting for about 70% of Bill Darrington's acres, residue management is critical. He uses Yetter's spike-tooth row cleaners and Copperhead Ag's spiked press wheels on his Kinze corn planters to help maintain a consistent planting depth of 2-2½ inches.

"The products are systemic, so we have organic activity in the plant's root system which allows me to be proactive with disease and pest control," Darrington says. "I can apply them at virtually any time — in-furrow, with our first post-planting pass, and just prior to corn tasseling or anytime we see a need."

More flexibility to time applications with biological friendly fertilizers, without the risk of damaging the soil, is helping build up the immune system of plants throughout the season, Darrington says. The cost is made up from the savings of the reduction of fertility with the banded system.

Darrington adds there is an additional benefit at harvest. Spoon-feeding nutrients — especially nitrogen — year round, rather than taking a "shotgun" approach is accelerating dry-down of Darrington's corn crops.

"When we go to the elevator, a lot of years we're some of the only trucks delivering 16-18% moisture, full-season corn at the end of September," he says. "This is because we don't over-apply nitrogen. When that happens, the corn plant is forced to carry excess water at the cellular level. Nitrogen in excess also pushes out calcium, which reduces test weight and increases moisture.

"When we can come straight from the field with our 114-day corn with several percentage points difference in moisture, that's a huge financial benefit because we're getting a better market price and saving on dry-down costs."

Overall savings varies by elevator and regional dry-down costs, but Darrington says another benefit is that his trucks seldom get caught in the wet corn line for hours.

Sustainable Growth

While Darrington acknowledges that his conservation-tillage system and fertilizer philosophy are increasing corn and soybean yields, he's more comfortable talking about how his program has set up the farm for long-term sustainability.

He soil tests his fields every 2-3 years and since first moving to a "hybrid" tillage system with split-applications of fertilizer, Darrington is seeing marked improvement in soil health and biological activity.

"When we started this endeavor, organic matter levels on our sidehills were about 1.7% and the best spots on our farm were about 3.2%," he says. "Two years ago we soil tested and we didn't have a spot on the farm below 2.1%, and our high points are up to about 4.1%."

Darrington admits his system isn't perfect, and what works for him won't work for everyone. But he's learned that there are some general guidelines that farmers can follow to reap the most productivity and profitability from their farms.

"There's not a perfect nutritional program," Darrington says. "It's about having the ability to implement and manage equipment capabilities, product availability, soil and plant requirements, yearly environmental fluctuations, budget allowances and a willingness to continuously make adjustments."

Trial and Error Leads to Strip-Till Success

Switching to 30-inch corn and experimenting with cover crops and strip-tilled soybeans is showing a promising payback for Indiana strip-tiller Jason Wykoff on his 4,500-acre operation.

By Jack Zemlicka, Technology Editor

With the majority of their acres dedicated to seed corn, a crop that requires intense management, strip-tiller Jason Wykoff and his wife, Gretchan, can't afford to waste time and money on unnecessary field passes.

For years, poor water infiltration and soil erosion proved to be regular challenges, especially on their seed corn acres, which make up 80% of their 4,500-acre operation in New Carlisle, Ind.

"Seed-corn management is a different animal," Wykoff says. "We're making numerous applications throughout the growing season that often adds up to 15 passes in a year, which can lead to severe rutting, especially from the sprayer and detasseler."

For years, three or four of those trips through the field were conventional tillage passes, ripping up the soil in fall and then finishing it in the spring.

"Some fields would just be lakes after a hard rain during the spring," he says. "They were essentially bare, and even on flat fields the soil just moved around because there was nothing to hold it in place."

With seed corn, they would sometimes have to replant a delayed male or female hybrid, then fertilize the field that had been freshly tilled. If it was wet, they would have to wait an extra day or two.

As they added acres and became more spread out across three counties, the window for planting and fertilizing crops decreased. Building a consistent seedbed also became a challenge, which in turn hurt crop emergence and yields because they couldn't perform field operations in a timely manner.

"We we're going backward with soil quality and health," Wykoff says. "As we became more profitable and less short-sighted, those things really began to irritate me."

PHOTO COURTESY OF JASON WYKOFF

COVER CROP TEST. The Wykoffs planted oats and radishes between the rows in mid-August into standing corn so they could irrigate and get the covers established by harvest. They immediately noticed firmer soil structure the following spring.

Limiting passes through the field and building soil structure became priorities for the Wykoffs, and their motivation for moving to strip-till.

Through personal research and on-farm experimentation, they've been able to save time and money by reducing passes through the field, and they're beginning to address soil health by adding cover crops to their strip-till system.

"A big benefit with my system now is being proactive to what our crops need, as opposed to being reactive, running around with my hair on fire handling field operations," Wykoff says. "A lot of times I felt like a fireman, and now I feel much more like a farm manager."

20-Inch Experiment

The Wykoffs began no-tilling their commercial corn and soybean crops several years ago, and in 2010 started strip-tilling their seed corn, which they grow for Monsanto. Today, about 80% of the Wykoffs' seed-corn acres are strip-tilled.

With Monsanto's support, the Wykoffs first foray into strip-till was with 20-inch rows. They field-tested different strip-till rigs and settled on

a 12-row, 20-inch Orthman 1tRIPr to build strips into about 60 acres of corn stalks, during both fall and spring.

The shank setup on the row units featured row cleaners and narrow firming baskets in back to smooth out the berms. Every other row unit was offset to help with residue flow.

They set up their 24-row John Deere 1790 planter on 20-inch spacings and their John Deere 8320 planter tractor on narrow tires, and also installed Deere's StarFire RTK system for guidance.

"The goal with the 20-inch setup was to get more plants in the ground per acre, increase the number of female plants and also increase ear counts on the plants," Wykoff says. "Specifically, with seed-corn inbred varieties, we felt the root structure was so much smaller than with regular hybrids that creating a consistent seedbed would give them the best chance for even emergence and superior growth."

But the ambitious attempt at 20-inch strip-till proved to be more trouble than it was worth, Wykoff says. One early challenge was building a good berm through heavy residue. With narrower rows, there was nowhere for the residue to go except back onto the strip, Wykoff says.

After planting, they also ran into pinch-row compaction because subsequent passes through the field with the sprayer and sidedress rig on narrow-row tires left deep imprints on the field.

"The tires would go through the field like pizza cutters," Wykoff says. "We were able to solve some of those compaction problems by putting tracks on the planter tractor, but we still needed some wheeled machines to sidedress and spray.

"On wetter ground, we simply couldn't take the sprayer in there because it didn't have flotation tires. We thought about hiring someone to come in, but the timeliness wouldn't have been there."

Wykoff abandoned the 20-inch experiment and traded in the Orthman rig, moving to a 16-row Orthman 1tRIPr with 30-inch row spacings.

"I know some farmers have had success with 20-inch strip-till, but for us it was a lot of headaches," he says. "Operationally, it was too limiting. Our guys wanted to do a good job, but when you're knocking down corn it's frustrating and mentally fatiguing."

PHOTO COURTESY OF JASON WYKOFF

STRIP-TILL EFFICIENCY. New Carlisle, Ind., strip-tiller Jason Wykoff's main objective with strip-till is to reduce passes through the field and improve soil health. He's been able to save nearly 20% in fuel costs by eliminating at least three passes in the field.

Making Progress

With his equipment setup decided, Wykoff is beginning to meet his strip-till objectives — specifically, reducing field passes and improving soil health.

With some fields 30 miles apart, Wykoff says a priority is reducing the time and cost spent managing their acres. While Wykoff hasn't crunched the numbers, he estimates about a 20%-30% savings in fuel, and the ultimate goal is to slash fuel costs by at least half.

"We've seen some clear savings in fuel by simply having to make fewer passes with strip-till," he says. "It may seem trivial when we make as many passes as we do, but they all have to be made in a short window and we're saving time and money."

At minimum, they're making two fewer passes through the field, having eliminated a fall and spring tillage pass. But Wykoff says they can also achieve their savings goal by being more accurate with fertilizer placement.

With conventional tillage, they relied on broadcast application of potassium and phosphorus in the fall, which Wykoff admits wasn't very efficient.

"From a quantity standpoint, I don't think we've increased or decreased the amount of fertilizer we're applying," Wykoff says. "But we've moved it into the strip so our plants can more readily access it rather than wasting it."

Fall Works Best

The Wykoffs prefer to build strips in fall, typically about 10 inches wide, banding fertilizer in the strip about 7

Early Success with Strip-Tilled Soybeans

Along with incorporating cover crops into his strip-till system in 2013, Jason Wykoff also strip-tilled about 200 acres of soybeans into corn stalks.

He built berms in the fall and the only fertilizer he applied was 100 pounds per acre of potash with the strip-till rig.

"Typically, we're in the 55-60 bushel-per-acre range, but we yielded 75-80 bushels per-acre last year," Wykoff says. "It was the best soybean crop we've ever grown, so I felt that strip-tilling was a game-changing experience."

On corn ground going to soybeans, Wykoff planted cereal rye, which he hopes will preserve moisture and increase microbial life beneath the soil's surface. In the two highest-yielding strip-tilled soybean fields, Wykoff also planted cereal rye as a cover crop in the fall, which he did again in 2013.

They plan to increase the number of soybean acres to near 1,200, with close to 800 of those strip-tilled, according to Wykoff.

"What I like about cover crops on soybeans is I have a lot more confidence letting that cover, in particular cereal rye, develop some biomass and get the roots going," he says. "When we go in to plant, we have a better chance of getting a good stand or the ability to play with a lower seeding population in the future."

inches below the surface.

But they've also had to build spring berms due to wet fall conditions, in which case they place fertilizer only a few inches below the surface so it will be readily available at planting.

They typically apply 100 pounds per acre of potash and 100 pounds per acre of monoammonium phosphate (MAP) with a mounted Atlas dry fertilizer cart on the Orthman rig.

"If it's spring strip-till, we'll add a little bit of nitrogen for a boost and then come back with the planter to apply our starter package," Wykoff says. "But if we've got everything done in fall, we'll just roll with the planter."

Accurately placing fertilizer in the fall has given Wykoff a wider window to plant in spring, rather than having to make a tillage pass first. The fall field work allows them to "do more with less equipment," Wykoff says.

With the planter, they apply about 15 gallons of liquid 19-17-0, an even split of 28% nitrogen and liquid ammonium phosphate, in 2-by-2-inch placement. Also mixed in are micronutrients, including zinc and manganese. Wykoff then sidedresses the balance of 28% nitrogen in crop.

During the season on seed corn, they make seven spraying passes with their Miller Nitro sprayer, applying herbicides, insecticides and fungicides. Then they make two passes to detassel and cut or pull the stalks.

"We're looking at doing some variable-rate application with the strip-till rig, which has two bins that allow us to vary products if we want," he says. "Most of what we're doing now is straight-rate, but as we identify some hot spots through field testing, we'll want to up those rates to push productivity.

"At the very least, we'll want to maintain the minimum removal rate to replenish the soil."

Cover Crop Quest

While strip-tilled corn yields are consistent, Wykoff sees an opportunity to improve them with the assistance of cover crops. Strip-tilled seed corn yields on irrigated land averaged above 200 bushels per acre in 2013, with some fields pushing 240-250 bushels.

Strip-tilled commercial dryland corn was closer to 150 bushels per acre on average, Wykoff says. He hopes adding cover crops will help preserve moisture and increase overall yields in the future.

In 2013, they used a RoGator high-clearance seeder to custom seed three different combinations of cover crops — oats and radishes, cereal rye and rapeseed, and annual rye and crimson clover — into standing corn-on-corn fields.

This was done in mid-August so they could irrigate and get the covers established by harvest.

"It was only our first year," Wykoff says, "but one thing we noticed immediately is that our soil structure was a lot firmer. So we're expecting that when we go in to plant, we'll be running on more solid ground, which will reduce compaction and minimize erosion."

But Wykoff is somewhat anxious about managing annual ryegrass for spring strip-till. In some cases, the cover crop didn't establish itself in the old row and left a natural strip, but for areas where it blanketed the whole row, Wykoff says they may have to find a more creative solution to build an ideal seed bed.

"If it's well-established, we'll have to get really aggressive with the row cleaners to create a clean, black strip," he says. "Emergence is crucial with seed corn, and ideally we want to go in as early as we can and strip-till while the ryegrass is getting established. Then only the roots in between the rows will penetrate the strip and this should help hold it together."

Other options Wykoff is considering is using a narrow-row diffuser on the air seeder to force the annual rye into certain spots, or banding a herbicide application with the strip-till rig to make sure the annual ryegrass is dead.

"We haven't figured it out yet, but my ideal system would be annual rye and crimson clover planted in with RTK, then come back and strip in between those rows," he says.

"The rye and clover roots in the non-stripped areas could penetrate into the strips, but I'd still have a nice clean surface to plant into."

The Wykoffs have been soil testing for years, but have yet to see measurable improvement in their organic matter and pH levels. But this is an area of emphasis for Wykoff going forward with cover crops.

"We don't have all the answers yet, but we're committed to strip-till," he says. "And we're not afraid to try different things to get where we want to be in the future."

PHOTO COURTESY OF JASON WYKOFF

PREPARED TO PLANT. Since moving to strip-till, Jason Wykoff says he has more flexibility and a greater planting window with his 24-row John Deere 1790 planter. This allows the farm to be more proactive, rather than reactive when managing their cropping operation.

Fighting Compaction with Strip-Till and a Controlled Traffic System

A move to strip-till by Ray and Dave Delhotal has helped them better time fertilizer applications, reduce machinery fuel costs and improve soil health on their central Illinois farm operation.

By Ian Gronau, Associate Editor

Over the five generations the Delhotal family has farmed in West Brooklyn, Ill., it's been important for them to produce high quality crops while caring for the land in an environmentally sustainable way.

The father and son team of Ray and Dave Delhotal have spent the last few years taking aggressive strides toward those goals by adopting a two-pass strip-till system, as well as precision technology and a controlled-traffic system.

"Operation-wide, switching to strip-till has saved almost $80,000 in labor, fuel and machinery costs," says Ray. "All of a sudden you start putting this together and those pennies add up to dollars."

In addition to the savings, they've also seen some yield advantages moving to strip-till.

"We saw a 10- to 40-bushel-per-acre yield advantage with corn when we switched to strip-till," Dave says. "In some spots last year, we raised some of the best corn we've ever seen."

SMOOTH TRANSITION. West Brooklyn, Ill., strip-tillers Dave (left) and Ray Delhotal have saved nearly $80,000 in labor, fuel and equipment costs. They run a coulter setup on a 16-row SoilWarrior from Environmental Tillage Systems in a two-pass system.

Justifying the Change

Part of the push behind the switch from primarily conventional tillage to strip-till came when the Delhotals realized how healthy the soil was in the small portion of their operation where they used to no-till.

However, issues they faced with their no-tilled corn, such as cold soils in the spring and reduced stands, dissuaded them from implementing the practice on a larger scale.

But Dave adds they couldn't deny how much they preferred the simplicity, increased soil health and biological activity of a no-till system, and that, coupled with their increasing difficulties with conventional tillage, eventually spurred a change.

"We were fighting root balls all the time," Dave says. "In order to get ready to plant we had to do two passes with the cultivator. We just got to a point where we were so fed up with everything and said we had to do something different."

Their first attempt at strip-till was with a homemade shank-type machine in the fall of 2009, which fell short of their expectations. They felt the shanks were smearing their soil, and they often ran up against rocks as well.

Currently, the Delhotals run a coulter setup on a 16-row SoilWarrior strip-till rig from Environmental Tillage Systems.

"We have quite a few rocks, and the big cogs on the row units will just roll right over them and never bring them up," Dave says. "We're also able to literally run minutes behind the combine.

"We don't ever have to worry about getting our strips done in the fall, and this year we finished building them and combining on the same day.

The Delhotals have preferred splitting their fertilizer application, applying

PRECISE PATH. A major contributor to the Delhotal's strip-till success is implement steering and a reliable RTK signal. The combination of strip-till, controlled-traffic and a targeted fertility program has contributed to a yield advantage of 10-40 bushels per acre.

about three-quarters of the crops' needs of potash and monoammonium phosphate (MAP) in the fall strips, 10-12 inches deep, and then the remaining phosphorus (P) and potassium (K) with urea in the spring during a strip-refreshing pass with the SoilWarrior.

"We mix the P and K with the urea because it has a tendency to be kind of sticky and clump up," says Dave. "Urea is a lot lighter so it's harder to meter, so we wanted something to flow along with it."

The Delhotals experimented with a pre-plant sidedress application of 32% nitrogen (N) using a Fast Mfg. nitrogen applicator. They applied roughly 1/3 of the total N needed this way, 4 inches deep and 7 inches to the side of the strip.

The experiment worked well, and Dave noted that in a few check strips the corn sidedressed pre-plant was one or two collars ahead in most places during the early growing season. However, they also planned on applying Environmentally Smart Nitrogen (ESN) with the spring strip-till pass and banding the nutrients 5 inches deep in the 10-inch-wide strips.

One of the concerns Dave has about the repeating the pre-plant application is the potential for burn in the root zone ahead of planting.

"We'll have the option with ESN, so we'll really up the rate of nitrogen in the strips without having to worry about burn. So, we'll be able to eliminate the pre-plant nitrogen pass," he says. Based on the increased accuracy and placement they feel they're getting with strip-till, they're hoping to scale back application rates of most of their fertilizer in the future.

Pathway to Productivity

Dave says using a two-pass system with the SoilWarrior also helps them deal with tough clays soils and compaction problems.

"We're at the start of the inlet swamp, so a lot of our continuous corn ground is blue clay and it really doesn't want to dry out in the spring so it's kind of nice to have the option to make the second pass and fluff the soil and warm it up," says Dave. "It's great to split up our phosphorus and potassium as well. We can go as deep as 10-12 inches in the fall where we have some compaction problems."

As soil health improves with strip-till, Dave says he may consider switching to a one-pass system in the spring on the majority of their ground. But for now, they prefer a two-pass system to get rid of all the compaction from years of conventional tillage.

Strip-till has helped them solve some of their compaction problems, but Dave says they wanted to take it a step further with a controlled-traffic system. With some careful planning, they have already seen results.

"We've tried to commit to controlled traffic as much as we can, but sometimes it's limited by the guy running the grain cart," says Dave. "The strip-till rig, pre-plant applicator and our 24-row Kinze planter all run down the same rows, and then with the combine we got an extended auger put on so the grain cart can run on the same tracks, but you can only control so much."

The Delhotals also switched from dual tires to single 710s with a lower PSI on their planter tractor because they were having pinch row problems that hurt yield. Dave says that he wouldn't doubt that the duals were costing him about 10 bushels of corn per acre.

"We'd go out on the field and back and see the two pinch rows all year long," says Dave. "Now, when we're sidedressing, we've got two tracks in the field and that's it, rather than a fully dualed-up tractor butchering the end rows."

Precision Payoff

Plotting an accurate path through the field is essential to the success of the Delhotal's strip-till system. They use Trimble's TruTracker active implement guidance system on their strip-till rig, run through the FMX receiver in their John Deere tractor, which is guided by a DigiFarm RTK correction signal.

"For us, it would be impossible to strip-till effectively without implement steering and a reliable RTK signal," says Dave. "Anyone who's going to get into strip-till, especially corn-on-corn, the biggest recommendation I'd have is make sure that last year's corn was planted with RTK, because that's the challenge of your first year — following the previous year's rows."

Implement guidance was a substantial investment, but one which is paying off — especially in fuel savings.

In fact, the Delhotals had a convenient barometer for their early success. They were able to measure the amount of fuel they were using directly against some custom work they were doing for nearby farm managers.

"We disc-ripped about 400 acres because we still have a couple of farm managers who want conventional tillage, and I used an equal amount of fuel ripping those 400 acres than I used strip-tilling about 1,000 acres of our corn-on-corn," Dave says. "That's just in one year."

Fine-Tuning Fertility Makes Strip-Tilling More Profitable

Using precision technology, Paul and Mike Schweitzer continue to evolve their strip-till and fertilizer systems to slash input costs, preserve soil and water quality and achieve higher crop yields.

By Clair Urbain, Contributing Writer

Paul and Mike Schweitzer don't see the sense in tilling every inch of every field of their 1,200-acre farm operation.

Working on flat and gently rolling fields, the father-son partnership has found that strip-till is a better fit for their mostly continuous-corn operation near Malta, Ill.

After several years of strip-till, the Schweitzers find their yields are similar to conventionally tilled, continuous-corn acres in the area — but the real benefit comes from reduced input costs and better soil health.

The Schweitzers strip-till 80% of their corn ground, only tilling when they're working in lime or incorporating high rates of manure.

"Our tillage has changed dramatically," Paul says. "We've gone from moldboard plowing to chisel plowing to ridge till, which didn't work. Then we tried no-till and now strip-till, which seems to be the best solution."

Mike says if farmers switch to strip-till, they won't see a huge jump in yield, "but you will see a decrease in input costs from less tillage, and more efficient use of fertilizer.

MELLOWING OUT. With a healthy dose of precision technology, Mike and Paul Schweitzer grow continuous corn on 1,200 acres near Malta, Ill. A fall strip-till pass leaves a 7½-inch seedbed that mellows by spring. "Unlike fall chiseled ground, the seedbed is uniform throughout the strip," Paul says.

Right Place

The Schweitzers have found strip-till is more environmentally sound than other tillage practices, and that variable-rate technology has helped them get more out of their fertilizer applications.

"Until recently, we've been using variable-rate broadcast fertilizer to manage fertility, matching rates to soil needs," Mike says. "We're finding that we're using about the same amount of fertilizer, but applying it more selectively to areas that need it, without wasting it on areas that don't need it."

They continue to evolve their strip-till practices, and in getting ready for the 2013 season, they found a way to band-apply variable-rate phosphorus and potassium with their fall strip-till pass with an 8-row Orthman 1tRIPr strip-till rig.

They mounted a Concord two-tank air seeder on a cart that bolts to the Orthman strip-till toolbar. The tanks hold phosphorus and potassium and they use Rawson dry-fertilizer rate controllers to variable rate-meter fertilizer into the air system. From there, it flows to the Orthman's stainless-steel tubes mounted behind each ripping shank.

"The strip-till rig runs about 10 inches deep and places the phosphorus and potassium 6-7 inches deep," Mike says. "We also have blockage sensors on each tube shank, so if a tube is blocked the dry fertilizer will blow out of the top of the air diffuser.

"It's rarely a problem. Usually it's a piece of gravel that was mixed in with the dry fertilizer."

The Schweitzers don't use rolling baskets to further smooth the bed.

"It's really not necessary. The tillage pass builds a slight berm and the lumps have all winter to melt away," Mike says.

Better Seedbed

Compared with fall chiseling, Paul likes this strip-till approach because the chiseling takes a lot of horsepower and it's a struggle to get fieldwork done

"We can pull the 20-foot strip-till rig faster than a 12-foot disc chisel," he says. "We can use a 220-horsepower tractor to pull the 1tRIPr at 6-7 mph and cover about 12 acres per hour vs. 5 acres per hour with the disc chisel. Using the 1tRIPr costs about half as

"Soil that is strip-tilled in the fall mellows and has a more consistent seedbed by spring…" — Paul Schweitzer

much per acre, and we get phosphorus (P) and potassium (K) applied as well."

Running at the proper speed and depth is essential in building the berm in strip-till, Paul says.

"We can go faster with the 8-row unit than with a 12-row unit. We build the berm in the fall, offsetting 15 inches from the previous row," he says. "We tried running in the old row, and 7½ inches from the old row, but we had plugging problems and accuracy issues.

"Soil that is strip-tilled in the fall mellows and has a more consistent seedbed by spring," he adds. "We've found that soil in the strip is always in excellent condition vs. no-till soils or conventionally tilled fields. There is less variability across the field."

With strip-till, Paul reasons that every seed is over a spot that has been ripped, so the seedbed is more consistent.

"With chiseled ground, soil quality varies based on whether it was planted over where the chisel point passed or didn't pass, creating a variable seedbed. It's the same as with conventional tillage, but with strip-tillage, it's a consistent 7½-inch band."

Right Machine

Before settling on the Orthman 8-row 1tRIPr, the Schweitzers evaluated and demoed several strip-till rigs. They also talked with other farmers trying strip-till on soil types similar to their own. The Schweitzers have mostly silty loam soils with clay hilltops.

Although their equipment line is predominantly John Deere, color isn't the primary factor in their equipment selection.

"We don't believe in just buying equipment because it is green or red. We like to learn from others who are doing it and work the same soil types as we do," says Paul.

The like the rig they're using because it's solidly built.

"We have a lot of rocks that can damage the rippers or the toolbar. This unit is somewhat rock-resistant and develops a good seedbed," Mike says.

Auto-Steer is Vital

The Schweitzers have found that Trimble's AutoPilot RTK auto-steering program is the most important link in their strip-till system.

"I don't think we would even try strip-till if it wasn't for precision auto-steering," Mike says. "With strip-till you have to be meticulous to find your guidance line and make sure the equipment follows it closely. It assures your rows will align from year to year. There is a lot of difference if you have even 3- and 4-inch variances."

The Schweitzers offset the rows 15 inches from year to year, which is another key to their success.

"We tried doing a 7½-inch offset from last year's rows, but prefer a 15-inch offset because it's easier to manage tire traffic and there are fewer plugging problems with the strip-till or planting pass," Paul says.

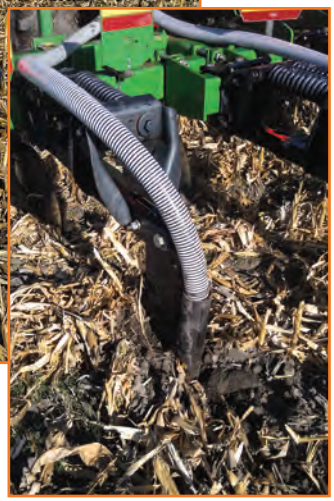
Having auto-steer also lets the Schweitzers keep a better eye on what's going on with their planter.

"With 24 rows running, it's a lot to watch, and the auto-steering does a much better job of accurately following the line than an operator can," Mike says.

The Schweitzers maintain sub-inch accuracy because their Trimble GPS system relies on the Russian GLONASS and the U.S. GPS satellite system, which can pinpoint the rig's location from up to 13 or more satellites.

"RTK is more accurate than the WAAS wide-area satellite system, which could only see three or four satellites," Mike says. "Under the old system, we'd have the signal drop out, depending on the field and time of day, and it took what seemed like forever for it to regain its position.

"When we switched to the Trimble FmX system, and a GPS unit on the tractor and on the planter or strip-tiller, we can



WORK IT IN. Working with a nearby hog producer, the Schweitzers will fall-apply liquid hog manure on up to half of their fields, then come back and plant corn with their 24-row corn planter that's outfitted to plant in strip-till, no-till or conventionally tilled fields.

"Scouts don't always know everything that you've done, so it's best to at least understand the process of building fertilizer-rate prescriptions…" — Mike Schweitzer

achieve sub-inch accuracy."

Auto-steer will also help the Schweitzers find answers to fertilizer-application issues that could eventually benefit all strip-tillers.

They're working with the University of Illinois on a field study that compares variable-rate applications of phosphorus and potassium in bands vs. broadcast applications of those nutrients in no-till, strip-till and conventional tillage systems.

Some plots that get no fertilizer will serve as a check plot for a control.

"The study is replicated and randomized, and the RTK helps us accomplish that," Mike says. "It would be difficult or impossible without RTK."

Controlling Traffic

GPS programs have an added benefit on their farm: They help the Schweitzers keep equipment tires on the same rows throughout the growing season.

"We aren't controlling traffic, but we're managing it without making it a huge logistical issue," Mike says. "Our strip-till unit is 8-row, our combine is 12 rows and our planter is 24 rows.

"We lock in the GPS guidance to assure that even the grain cart, at harvest, runs only down rows where tire tracks have passed that season.

"We also dump the grain cart with every round to help keep weight off of the field," Mike adds.

Spring Field Work

Before or just after planting, the Schweitzers apply acetochlor and a low rate of atrazine for pre-emergent weed control in corn, along with 70 units of UAN per acre.

That's followed with a post-emergent application of Callisto, Status or Roundup herbicides, depending on the weed pressure.

Although their John Deere 24-row planter made its maiden field pass in 1984, annual overhauls make it operate as good or better than new, the Schweitzers say. It's mostly stock components, but they've added components for variable-rate seeding and to better handle residue.

"We've added Precision Planting pickup meters with adjustable brushes that we really like," Mike says. "The units are driven by a Rawson hydraulic drive that allows us to variable-rate seed population. We tried variable-rate seeding in 2012, but the dry weather didn't produce meaningful yield results.

"Our planter also has Dawn row cleaners, which we like because the spools adjust easily. There are no pins to deal with. They don't float above the residue, but they also don't dig trenches, either," he adds. "We run them aggressively in strip-till and can back them off in conventionally tilled fields.

"We can also change over from conventional tillage to strip-till in 5 minutes with these units."

The Schweitzers apply 3 gallons per acre of Riser pop-up fertilizer through a tube that runs down the Keeton seed firmers on their planter.

"We use the Trimble FmX system to monitor seed singulation and skips, as well as handle the variable rates for planting population," Mike says. "It also controls the auto-steer system. The planter has insecticide applicators, which dispense insecticides at the standard rate."

The planter's closing wheels have a stock John Deere blade on one side and a Dawn curved tine on the other side.

"This closing-wheel combination is really helpful in damp soils, breaking up any sidewall compaction for better seed-to-soil contact," Paul says. "We have a drag chain behind each unit that we think increases the consistency of the seedbed and aids in closing the slot. It's low tech, low-cost and makes the planting pass look more finished."

The RTK auto-steer plays an important role when they sidedress anhydrous ammonia because the sub-inch accuracy keeps knives precisely between the rows.

"In the past, we thought our sidedress pass was an infallible way to improve yield. It wasn't the case last year," Mike says. "It was dry and we think the nitrogen didn't get moved in the soil — and the soil microbes weren't active in making it available to the plants. But in 19 out of 20 years, it pays off."

Role of Manure

More than a decade ago, a neighboring farm contacted the Schweitzers, looking for a place to spread liquid hog manure, and the Schweitzers were glad to oblige.

Instead of using their strip-till rig to apply the manure, they use a John Deere 2100 ripper with straight shanks and manure tubes mounted behind them, and a dragline that feeds manure to the rig. The manure is applied at a depth of about 8 inches.

They've found the manure has a fair amount of K, but not much P.

"We tried to use minimum-disturbance wings on the ripper, but that still left the soil too rough. So we went with straight points," Mike says. "They leave the ground much less disturbed."

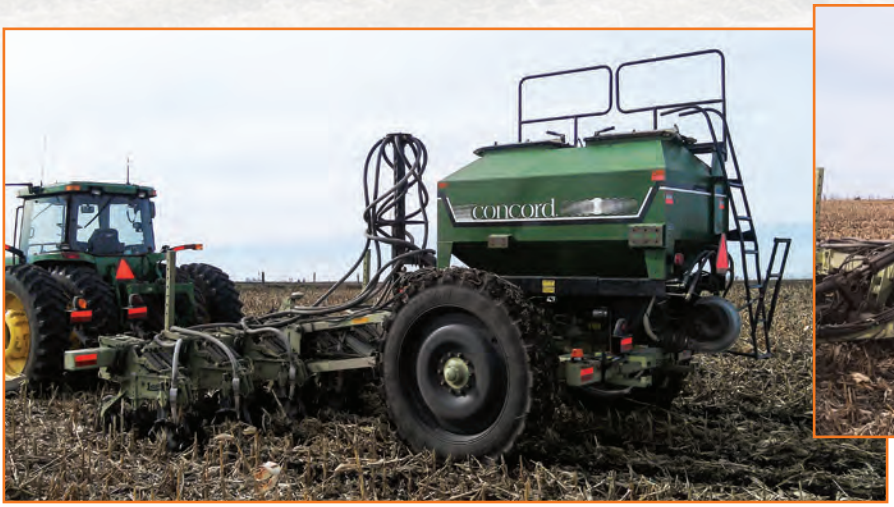
In other fields that need extensive lime applications, they will incorporate it with a disc ripper.

"We want to work the lime in so it can change soil pH faster," Mike says. "It does break up some of the good soil structure that we've developed over the past few years, but it's important to get that lime worked in so it can do its job."

Pulling Data Together

The Schweitzers have started using precision farming tools based on Ag Leader's InSight system.

When their local dealer, who was



MODIFIED RIG. Mike and Paul Schweitzer use a John Deere 8410 tractor to pull the combination 8-row Orthman 1tRIPr with a Concord two-bin air seeder, which has been modified to apply dry fertilizer. This setup performs their fall strip-till pass and bands phosphorus and potassium behind the ripper.

instrumental in their adoption of precise-placement tools, switched to Trimble equipment, they followed suit in the field with Trimble products.

But in the office they're sticking with Ag Leader SMS software to turn data from yield and soil maps into seeding and fertilizer maps.

"The Ag Leader SMS software is an open product, so we can import information from our Trimble unit seamlessly," says Mike. "It took me about a half a day to work through it and get it set up and learn how to use it. Ag Leader's tech support is very good."

With yield maps dating back to 1994, Paul says they've produced very accurate variable-rate fertilizer maps, and today, the accuracy of the fertilizer application equipment has caught up to the accuracy of the field maps.

"When we first started doing variable-rates, we would drive all over the field, trying to match up the location with maps in the tractor," Paul says. "It didn't take us long to realize that the heavier rates were needed on the hilltops, so we simply went to an extra pass on those spots. It is much more exact and automatic now."

Although the Schweitzers could develop their own variable-rate fertilizer application prescriptions for their fields, they rely on the scouting service that pulls soil samples and scouts the fields during the year.

"They do a good job with this," Mike says, "but they still don't know the fields as well as we do. They don't always know everything that you've done, so it's best to at least understand the process of building these fertilizer rate prescriptions."

Tiling Benefits

Several years ago, the Schweitzers decided to invest in additional tiling on their farm, and they believe it has paid off because yield maps quickly showed the benefits of tiling.

In the often-saturated areas in the field, they saw an immediate yield response of 15 or more bushels per acre.

"With yield maps, you know exactly where the best-yielding parts of the field should be. Tiling wet spots is the best and fastest way to increase yields," Paul says. "When the soil is saturated, organisms can't break down fertilizer and minerals and make it available to plants. It makes a difference, even in dry years."

The Schweitzers use their precision technology to pull a tile plow and lay 4-inch diameter laterals 2½-3 feet deep, and the main lines about 5½ feet deep.

"We find that laterals on 60-foot centers provide the best return," Paul says.

"Doing the tiling ourselves has helped us drain problem areas economically," Mike adds.

"It really makes you aware of how the soil drains, and it has helped us reduce runoff. We have a drier sponge and it reduces native runoff by improving drainage."

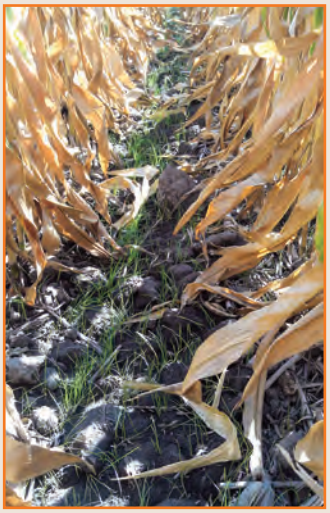
Cover Crops Could Boost Strip-Till Results

Paul and Mike Schweitzer aerially seeded annual ryegrass on about a quarter of their standing corn.

They wanted to establish a cover crop that will overwinter and help improve soil structure and capture nutrients for the coming year.

"We hit it right, getting one of the few rains right after the ryegrass was seeded. We got a good stand in the row centers," says Mike. "We will have to come back in the spring with a burn-down application before planting.

"We damaged some of the ryegrass stand with the strip tillage pass, but we think it will do some good for us. We will see how this works in the long-run."



COVERING UP. Mike and Paul Schweitzer aerially applied annual ryegrass on about a quarter of their corn ground in 2012. A rare, but well-timed rain, made a good stand. It's their first experience with cover crops and they're interested in how it will affect future crops.

Strip-Till, Precision Tools Create Better 'Balance Sheet'

Investing in a two-pass system, fine-tuning fertility and technology helped Kratz Farms hike corn yields and improve overall efficiency.

By Jack Zemlicka, Technology Editor

Farmers have many reasons for moving from conventional tillage to strip-till, whether it's minimizing erosion, being more precise with inputs, building soil health or getting more bushels per acre.

For Slinger, Wis., farmer Ricky Kratz and his family, it was a matter of getting more reliable results.

After several years of zone-tilling about 2,000 acres of corn with a three-coulter Rawson system, they found stress on the 12-row Kinze 2600 planter they were using was costing them time and yield potential.

"After about 1,000 acres, we'd break the center bearing on the planter because the cast bearings were too weak to hold that extra weight," Kratz says. "We were looking for a way to take weight off our planter and didn't want to go back to more intense tillage again. With strip-till, we liked that the fields weren't washing out like they used to with conventional tillage."

Starting Point

Kratz farms about 4,800 acres with his father, Rick, and uncles Jim and Gary Kratz and Allen Emmer.

His brother Stevie, sister Katie, and cousins Jason and Kevin Emmer are also part of the operation, which includes no-tilled soybeans, oats, wheat, alfalfa and soybeans.

The Kratzes also have a dairy farm with 450 cows and 400 acres of no-tilled corn silage.

With such a diverse operation, Kratz says they're always looking for ways to improve efficiency, and strip-till has brought precise fertilizer application, boosted corn yields and opened the door to further efficiency through use of precision technology and experimentation.

"I like where our yields are, but what does it take to get that extra 3 bushels?" he says. "It costs the same to run the rig across the field, it costs the same to plant the seed and it costs you the same to harvest it. So that 3-bushel improvement is where the margin is."

As Kratz began researching strip-till as an option, a well-timed conversation with Mark Bauer, founder of Environmental Tillage Systems, peaked his interest in the two-pass system — building strips in fall and fertilizing with the rig in spring — and it's an approach Kratz has used for the last 7 years.

Bauer showed Kratz pictures of his Soil Warrior strip-

RELIABLE SYSTEM. Ricky Kratz of Slinger, Wis., and his family began strip-tilling in 2007 with an Environmental Tillage System's SoilWarrior. Through a first-year test, they saw a 23-bushel per acre boost in strip-tilled corn compared to zone-tillage.

STEERING TOWARD PROFIT. The Kratzes use a John Deere 9520 tractor to pull their strip-till rig. They use Deere's StarFire RTK system for precision guidance and have also tried Deere's iGuide passive implement-guidance system. It took 2 years for their initial investment in strip-till to pay for itself through higher corn yields.

till rig setup, which bore a resemblance to the Rawson system, except for one major factor.

"It wasn't part of the planter and I immediately thought that I could take the fertilizer off our planter and use the strip-till rig for application," he says. "Instead of going 4 mph, we could apply fertilizer at 6-8 mph and get the job done a lot faster, then just come back and plant."

Testing the System

The Kratzes purchased a 12-row ETS Soil Warrior in 2007, but wanted to compare strip-till with zone-till before fully committing to the practice across all his grain corn acres. The first year they set up two, 25-acre test plots — one strip-tilled and one zone-tilled with the Rawson system.

In spring, the Kratzes planted the same corn hybrids on the same date in 30-inch rows in each plot on fairly consistent peat ground.

They also applied the same amounts of nitrogen, potash and phosphorus in each field, but varied the blends.

For the Kinze planter with the Rawson system, they applied their standard rates of 120 pounds per acre of a nitrogen (N), potash and phosphorus (P) blend, with small amounts of zinc and sulfur (12-21-21-4s.5z) and 20 gallons per acre of 28% N, in 2-by-2-inch placement. They then broadcast 185 pounds per acre of a N, potash, P and sulfur blend (27-7-14 4s) with a spinner spreader.

But on the strip-tilled plot, they broadcast 100 pounds per acre of ammonium sulfate with sulfur (21-0-0-6s) with a spinner spreader.

"The reason we broadcast was to apply the sulfur, because if we put that amount through the strip-till rig, it would plug up," Kratz says. "But overall, we applied the same amounts of fertilizer as on the zone-tilled plot, just in different forms."

With the strip-till rig, they applied 305 pounds per acre of a urea, potash and phosphorus blend (36-4-9). They planted the strip-tilled plot with a 12-row John Deere 1790 corn planter.

Kratz says they figured they wouldn't need to apply as much potash and P directly in the strip because they knew the soil would warm up faster than with the zone-tilled field.

"What we noticed early on was that the strip-tilled corn was a leaf-stage ahead of the other plot, which got us excited about the yield potential," he says. "The leaves were a nice, dark green, but the zone-tilled corn was more of a yellowish color and still struggling into June and July."

But the real payoff came in fall when the plots were harvested. A yield check for the inside rows found a 23-bushel-per-acre difference in the strip-till plot compared to the zone-till plot.

"We were over 190 bushels per acre in the strip-tilled field and some of the bump may have been the year and conditions. But even with corn prices at $3 a bushel, that still made a huge difference," Kratz says. "With zone-till, we'd cut out the high peaks and the lows. But

FUNNEL EFFECT. The Kratzes typically build their fall strips 12 inches wide and 4-6 inches deep — or as much as 8 inches — depending on any present compaction issues. "Walking into a cornfield that was strip-tilled after a rain, it's amazing how in the middle of the strip, right where the corn is, the leaves on the corn plant funnel all that water right to the root zone," Ricky Kratz says.

with strip-till, we keep the highs and the lows aren't there.

"That's where we're getting those 20-plus bushels, by just eliminating those lows — which isn't something we'd been able to do in the past."

Fertilizing for Stability

Sold on the initial benefits of strip-till, the Kratzes have evolved their fertility program to include split application of fertilizer with their strip-till rig.

Soil-test results indicate that applying P and potash in the fall and N in the spring is maintaining a better balance of nutrient levels, says Kratz.

"We are never looking for savings with our fertilizer program," Kratz says. "We are looking for something that benefits us in a different way, either in yield and standability or plant health. We don't ask our agronomist to save us money; we ask him what it's going to take to produce the best crop."

The Kratzes typically build their fall strips 12 inches wide and 4-6 inches deep, or as much as 8 inches, depending on any compaction issues being present. Kratz says the goal is to build ridged berms so that at planting, the gauge wheels square off the strips.

"Walking into a corn field that was strip-tilled after a rain, it's amazing how in the middle of the strip, right where the corn is, the leaves on the corn plant funnel all that water right to the root zone," he says.

While they still have the same Soil Warrior unit, the Kratzes updated from a single-rate hydraulic motor to a dual-rate motor for fall application of phosphorus and potassium. They also added an Avery Weigh-Tronix digital scale to monitor fertilizer load.

Through soil testing, the Kratzes found that their nutrient levels can be "all over the board" because the alfalfa crop tends to absorb a substantial amount of potash. With two fertilizer hoppers on the strip-till unit, they use one for phosphorus and one for potash.

"We wanted a way to adjust our rates in fall and stabilize our potassium and phosphorus levels," Kratz says. "We get everything soil tested every year, or every other year, and get our recommendations.

"We're trying to get our soils more balanced and split-applying our fertilizer seems to really help with sustainability of our corn crop from year to year."

Those recommendations are broken out into three categories — low, optimum and high.

On low-level phosphorus ground, they applied 200 pounds per acre of a diammonium phosphate (65%) and Cal-Sul pelletized gypsum (35%) blend (12-30-0-6s-8Ca). The rate was cut in half for optimum ground and reduced to zero for soil with high levels of phosphorus.

For low-level potash ground, the Kratzes applied 300 pounds per acre of a potash (65%) and Cal-Sul pelletized gypsum blend (0-0-40-6s-8Ca). Again, they cut the rate in half for optimum ground and eliminated application for areas with high-level potash. In spring, they use the strip-till rig to apply 200 pounds per acre of urea blended with zinc.

"The reason we do this is to let the phosphate start breaking down during the winter," he says. "The salt load will start diminishing, so we can come back and apply our spring nitrogen in that strip and not worry about any root burn.

"If we didn't have to put the urea down, we wouldn't be making the spring pass. So every time we run our strip-till rig, we are building something in the soil."

Despite a wet spring in 2013 which delayed or postponed planting for some farmers, Kratz was able to apply the urea blend and still have the strips dry out and ready for planting. They only had 5 acres of prevented planting acres, while some neighbors barely planted half their crops.

"Normally, we'll apply the urea in a day and a half and we can come back through and plant. The planter tires will sink 2 inches into the ground and the strip-till zones will be drying out," he says. "We're not mudding the seed in, but the rest of the field is muddy.

"Everyone probably thought we

BREAKING BAD. After trying zone-till with a Rawson system on a 12-row Kinze planter, the Kratzes ran into trouble with center bearings breaking due to the excessive weight on the planter. Strip-till allowed them to split-apply fertilizer in the fall and spring with the rig and focus on just planting into the strips.

were nuts, but some of those fields are yielding 230 bushels per acre."

Sidedress Experiment

Since moving away from applying fertilizer with the planter, the Kratzes are exploring the potential of sidedressing N more efficiently in their strip-till system.

Sidedressing isn't something they've done much of with corn, primarily because the timing conflicted with harvesting hay for their dairy operation.

But excessively wet conditions led to substantial N leaching and the Kratzes experimented with a neighbor's sidedress unit, applying 10 gallons per acre of 28% N in four different strip-tilled fields.

"We sidedressed around mid-June when the corn was about ankle-high and we did one strip, then skipped a couple and then sidedressed another one to see if it would be worth it or not," Kratz says. "The corn we side-dressed yielded about 170 bushels per acre and the plants we didn't produced 113 bushels an acre."

Kratz says they will continue to experiment with sidedressing, cutting the rate of the urea blend applied next spring from 200 pounds to 150 pounds per acre and sidedressing 50 pounds per acre of 28% N.

"We're still weighing the pros and cons, but it seems with the way the rains have been coming lately — instead of little spurts, getting 2 inches and then nothing and then 2 inches again — it's something we'll look into more," he says. "It's a lot easier for that N to leach away when we get that kind of rain pattern."

Precision Promise

As an experienced user of precision technology, the Kratzes understand its importance in strip-till. They use John Deere's StarFire RTK system on their 9520 tractor to guide the strip-till rig.

Overall, they've invested about $200,000 in their strip-till operation, including about $70,000 in guidance equipment over the years.

"We wouldn't have invested as much in the guidance if it wasn't for strip-till, so I needed to see that this technology would pay for itself in 5 or 6 years," Kratz says. "But it came much faster — our initial investment was paid for in 2 years due to the increased corn yields."

WEIGHTED DECISION. To improve their fertility program, the Kratzes updated from a single-rate hydraulic motor to a dual-rate motor for fall application of phosphorus and potassium. They also added an Avery Weigh-Tronix digital scale to monitor fertilizer load. "We're trying to get our soils more balanced and it seems to help the sustainability of our corn crop, year to year," Ricky Kratz says.

In recent years, the Kratzes have also experimented with implement-guidance technology with varying success. They tested Deere's iGuide passive implement guidance on the strip-till rig and corn planter, with encouraging results the first year.

"The tractor and implement were both where they needed to be, so those 16- or 17-hour days felt like 12," Kratz says. "I was able to cut 3 or 4 days out of my planting window that spring."

But the following year, they struggled with setting up the A-B lines in smaller, odd-shaped fields, which led to planting challenges and, ultimately, returning the system.

"It seemed like the strip-till rig stayed where it needed to be, but since the planter was longer than the strip-till rig, it would drift more than the strip-till rig," Kratz says. "I had to do more steering to try to stay in the middle of that berm."

Kratz is considering an upgrade to Deere's iSteer active guidance system in the future, but may wait until the technology is refined or spend more time testing it in the off-season.

Kratz says they are more likely to incorporate variable-rate seeding and fertilizing into their strip-till operation and recently purchased an Ag Leader Integra monitor for that purpose.

"The only way to increase our yields any more is raising populations. When I went over 34,000 plants per acre here, my plants started falling over," he says. "All the studies are saying we're supposed to be running at 36,000 or 38,000.

"I think it's more based on rainfall, so we've got to start backing off populations where the plants are going to burn up so we can still get something out of them and use higher populations where the moisture is going to be.

"If we're going to variable-rate corn, we'd better be variable-rating our urea because it doesn't make any sense to put more seeds per acre in one part of the field and have just the same rate of fertilizer there.

"If I'm going to do that, I need to be able to do both."

Strip-Tilling as Part of a Comprehensive Nutrient Management Strategy

Strip-tiller Tim Smith uses cover crops, a bioreactor and nutrient management techniques to prevent fertilizer loss and reduce application rates on his 800-acre Iowa farm.

By Ian Gronau, Associate Editor

Tim Smith has been strip-tilling half corn half soybeans on about 500 of the 800 acres he farms near Eagle Grove, Iowa, for the past several years.

Smith, who used ridge-till and conventional tillage practices in the past, was inspired by a nearby farmer who'd been strip-tilling for 8 years to pursue the strategy. Opportunity met interest when the NRCS introduced their Mississippi River Basin Initiative (MRBI) to his watershed.

The MRBI program included cover crops, nutrient management, introducing a bioreactor and strip-tilling. It's designed to reduce nutrient loads that filter into the streams that lead to the Mississippi and, ultimately, to the Gulf of Mexico.

Smith says that of the four elements included in the MRBI program, strip-till has helped improve soil conservation, nutrient placement and time and equipment savings. When it comes to quantifying his return on his strip-till investment, the biggest boon has come in the form of losing less topsoil

Smith says he adopted the practice at the perfect time, because weather conditions on his farm during the last few years would have battered his acreage if he stuck with 100% conventional tillage practices.

"The biggest return with strip-till is greatly reduced loss," says Smith. "My soil has held up better in adverse conditions. With the excessive rains we've had over the last few years, having more residue on top of the soil helps to preserve that soil structure and improve water infiltration. "

Building the Right Equipment Mix

Incentives offered by the MRBI allowed Smith to get new equipment, and retrofit old equipment he had left over from ridge-tilling. He uses a 3-point 8-row DMI toolbar on 30-inch spacings to build his strips.

"I added row cleaners onto it and I changed it to mole knives and sealers," says Smith. "The 20-inch notch blades float to help build the berm. There's a hitch on the back that I use to pull my Concord air cart.

"It's pretty simple. I know a lot of the strip-till machines are long and have lots of clearance, but every-

PHOTO COURTESY OF TIM SMITH

FIGHTING NUTRIENT LOSS. Iowa farmer Tim Smith strip-tills half corn and half soybeans on about 500 acres of his 800 acres near Eagle Grove, Iowa. For the past 4 years, he's been participating in the Mississippi River Basin Initiative. The program incentivizes strip-tillage, cover crops, bioreactors and nutrient management to reduce the amounts of nitrates that end up in the Mississippi River and, ultimately, the Gulf of Mexico.

thing on mine is pretty tight."

Smith also uses auto-steer and GPS on his John Deere 16-row planter and strip-till rig, opting for Trimble's satellite-based RTX signal.

Seeing Soil Benefits

Being in an area with erosion issues, one of Smith's main concerns is protecting his soil. But during his years of strip-tilling, he's not only seen improved water retention, but a substantial increase in soil health and structure as well.

"The first year of strip-tilling, I took my spade out and dug out pieces of the field," says Smith. "I brought up 6-8 inches off the top and it just crumbled in my fingers. The soil structure starting improving quickly and it's not loose, fine soil that drifts through my fingers and easily erodes."

He's also seen a return of the earthworm population, long absent from his conventionally-tilled acreage. This has helped significantly with residue management and decomposition.

"I can go out and kick just about any piece of residue and there are bound to be worms under it," says Smith. "NRCS did some counts and said there were about 12-18 worms per cubic foot. I guess I can get better than that, but when I did full tillage I'd have difficulty finding any.

"Now, they're going up and down the soil profile and taking the residue down deeper, and processing it. It's a definite improvement there."

Nutrient Retention

Introducing cover crops, strip-till and a bioreactor has been an exercise in tracking the nutrient cycle for Smith. A bioreactor, which is essentially a buried trench filled with wood chips through which tile water is allowed to flow, uses the microorganisms that colonize it to convert nitrates to nitrogen gas as they pass through.

Smith would like to see as little fertilizer as possible leech away, and have better control over what he applies. To reach this goal, Smith is employing a combination of strategies.

Soil testing and tile water sampling consistent with the initiative program has shown Smith that the bioreactor and cover crops have helped with nitrate loss.

PHOTO COURTESY OF TIM SMITH

SLOWING THE FLOW. As part of the Mississippi River Basin Initiative that Tim Smith is participating in, he had a 110-foot-long, 10-foot-wide and 5-foot-deep wood chip bioreactor installed on his property. A bioreactor, which is essentially a buried trench filled with wood chips through which tile water is allowed to flow, uses the microorganisms that colonize it to break down nitrates as they pass through the bioreactor.

"I sampled the water flowing into the bioreactor and then the outflow to see what sort of reduction took place," says Smith. "The level of nitrates in my tile water surprised me because I thought that I was putting nitrogen (N) on in a safe way. When I applied it in the fall in the past, I would use N-Serve nitrogen stabilizer and wait until the soil temperatures were in the low 40s."

Despite these precautions, the soil tests showed that the nitrate levels flowing to the bioreactor in the tile water were well above the EPA's safe water level of 10 parts per million. However, the tests did show that the reactor was able to bring those rates down to a much more comfortable 2-3 parts per million on the output side.

Biomass samplings of his cereal rye cover crops showed that he was able to retain a substantial amount of N in the field before it reached the tile water.

"I think the cover crops are one of the best tools we have to reduce nitrate loss," says Smith. "The biomass samples we took showed 30 pounds of N in the cereal rye which didn't go down my tile lines.

Smith says he's not sure if there's been enough research done to determine when exactly that N is available, but it's there at some level and if anything, it's not leaving the farm immediately.

Complete System

While Smith's bioreactor and cover crops work together to prevent nutrient loss on the back end, strip-till has given him added control over placement. Smith uses a single-pass system in the fall to build his strips, and he's gotten away from applying N then, in favor of doing it in the spring.

He bands phosphorous (P) and potassium (K) in an 8-inch wide and 8-inch deep strip in the fall through his strip-till rig and a Concord air cart pulled behind. After sampling, Smith has been confident enough with his P&K placement and range that he's been able to dial the rates back about 25%.

"I need to be confident with my levels before making any serious adjustments," says Smith. "My P&K are in the optimum range and it really doesn't pay to put on much more fertilizer."

Smith credits the reduction to being able to place the band so close to the root zone with strip-tillage.

He's reduced application to about 100 pounds per acre of diammonium phosphate (18-46-0) and 150 pounds per acre of potash (0-0-62).

He hasn't reduced N rates yet and applies 120 pounds of N as anhydrous ammonia in the spring, ahead of planting.

"I have used 32% at sidedress before, but it just depends on how the spring goes," Smith says. "If I can get it on, I'll put it on. But if it's too wet in the spring, then I'll just sidedress it later."

Further experiments with nutrient management may eventually develop a scenario in which he can think about reduced nitrogen rates. But for now, Smith is focused on keeping what he applies on his farm and out of the nearby waterways.

The Benefits and Pitfalls of Adding Cover Crops in Strip-Till

Iowa strip-tiller Frank Moore shares a creative approach to selecting and seeding cover crops to combat erosion on his 2,000-acre farm.

By Ian Gronau, Associate Editor

Frank Moore believes a little trial and error on his farm can go long way, and that led him to switch over to strip-tilling corn and introducing cover crops on his 2,000 acre farm near Cresco in northern Iowa.

Moore moved from ridge till to no-till in 2002, and in 2010 he began strip-tilling corn with a 16-row Kuhn Krause Gladiator unit. The move from strict no-tilling was prompted by Moore's concern about stratification of nutrients near the soil surface and he wanted more targeted application of phosphorus and potassium.

To further preserve and enhance soil health, Moore also introduced a variety of cover crops into his strip-till system. He has found that using covers on his strip-tilled fields with slopes greater than 6% has been effective in fighting back the erosion during heavy rainfall.

Some cover crops worked better than others, and he offers some advice about selecting varieties, seeding strategy and the expected return on investment.

Timing and Seeding

Moore began incorporating cover crops into his strip-till system in 2013. He says that there are some significant barriers to successful use of covers due to his shorter growing season in his location near the Iowa/Minnesota border. But this hasn't stopped him from experimenting.

"We usually harvest in early October, but we need to have our cover crops seeded around the middle of September or earlier so that limits us to mostly aerial application," says Moore.

He notes that there are a few exceptions to this. In Moore's area there are a large amount of dairy farmers, and when they chop silage they can still get out in time to drill or broadcast cover crops. Another exception — although it's certainly one Moore doesn't want again — is a prevented-planting year.

"In 2012 we had a lot of prevented-planting acres up here, so the fields were bare in July and August," he says. "But we were able to get in there early with a drill for the cover crops. That year was an exception that I hope never repeats itself because the fields were bare without having a crop planted."

In the southern part of the Midwest, the potential exists for more ideal conditions. Moore came across a farmer in southern Illinois who had fitted a Gandy air seeder on his soybean header and seeded the cover crops while harvesting in mid-October.

"It's a pretty slick way of doing it, because the ground is bare and he's seeding the cover crop as the combine goes over and spreads the plant material out the back," says Moore. "It's ideal for his area. But as far north as I am, even if I had that machine on there, that's just too late to be seeding my cover crops."

Being restricted by his cool, wet soils and short growing season, Moore has picked up a few tips that helped improve his seeding timing. He recommends aerially seeding the cover crops just as soybeans start to yellow but before they drop their leaves.

"For one thing, light penetrates the canopy down there, which is needed, along with moisture, to germinate those seeds," says Moore. "I don't want the leaves dropping off the soybeans because if I spread cover crop seed over that, and the seeds rest on top of leaves, they won't germinate. So that's the best thing for timing this far north."

PHOTO COURTESY OF FRANK MOORE

EROSION CONTROL. Experimenting with cover crops in strip-till, Cresco, Iowa, farmer Frank Moore finds that annual ryegrass works well because he gets about 4 inches of top growth and root structures 30 inches deep to help hold soil in place.

Selecting a Variety

Moore stresses that selecting the right cover crops for strip-till depends on a farmer's goals. A dairy farmer looking for a cover crop to double as forage may look at different species than a strip-tiller with an eye on nutrient retention.

"My priority with cover crops is erosion control. Secondary to that would be to hold the nutrients in place, and third is to work in some weed control," says Moore. "I think we're going to see our cover crops suppress some of the early weed growth in the spring."

With those goals in mind, Moore

finds that annual ryegrass works well for him. He gets about 4 inches of top growth and root structures 30 inches deep to help hold soil in place. Ideally, much of his annual ryegrass winterkills, saving him the effort of having to kill it himself in the spring.

"In 2014 all my annual ryegrass, except for the end rows, winterkilled, which I loved because I didn't have to kill it with an herbicide," Moore says. "I would've had to wait for the ryegrass to start growing again for it to even absorb the herbicide — that would have pushed me into a situation where I'd have to plant later and lose yield potential."

He doesn't expect that annual ryegrass will always winterkill completely, and he's still on the lookout for a variety that will, while still providing the same benefits.

In his experience with annual ryegrass and cereal rye, Moore notes distinctions in the growth and lasting effect on corn plants.

Cereal rye gets taller and needs to be killed or controlled in the spring. It also can have an allelopathic effect on the corn the following year, where annual ryegrass shows little to none of this. There are also differences in his seeding strategies, with annual ryegrass being only about 26 pounds per bushel and cereal rye at about 56 pounds.

"Cereal rye seems to be the one that new guys are trying first, and it can get fairly tall in the spring," says Moore. "The last 3 or 4 years up here, the first thing we did in the spring was plant corn into our strip-tilled fields, and there was absolutely no window to do any spring field operations or spraying.

"With cereal rye, I'd need to kill it off in the spring and then wait a period of 5 days to a week before I'd want to plant. That can delay planting to a point that's unacceptable in certain years."

Trial and Error

Moore's experiments with some other cover crops have seen varying results. During his prevent plant year he drilled some radishes into his strip-tilled fields. In the fall they were getting large and looked healthy, but by spring they were completely gone, which can help retain nutrients in the soil, more so than provide erosion control, especially on their own.

PHOTO COURTESY OF FRANK MOORE

RADISH RETURNS. During a prevent plant year, Frank Moore drilled radishes into his strip-tilled fields, which helped retain soil nutrients. However, Moore may combine radishes with another type of grass to provide a spring cover and offer additional erosion control.

"I went out in the radishes in the spring to see how they were and they had totally disappeared," says Moore. "Radishes have their place, but if I'm looking for something that's going to provide cover into the spring, they're not going to work. They may work in a mixture with some type of grass, but it all depends on what your goals are with your cover crop."

There are a few barriers that Moore faces as he continues incorporating cover crops into his strip-till system. Again, being limited to mostly aerial application, cost is a consideration.

"Airplanes are nice, but when you start throwing in the seed and the airplane you are looking at a minimum of $20-$30 an acre as a starting point," says Moore.

He is hopeful that it won't be too long before he'll be able to use other equipment to seed. "Some of the sprayers and pieces of equipment that are being developed might make it possible for us to start applying seed on the ground rather than from the air," says Moore.

Another hitch is the elusive nature of the return on investment with cover crops. Moore feels that looking at cover crops as part of an overall strategy may be more beneficial than examining it them in terms of exactly how much they will increase yields.

For example, Moore's cover crops have offered significant protection from erosion during event storms on his strip-tilled slopes over the past few years.

"I don't want to plan for yield averages anymore," he says. "I feel that these event storms are becoming more common and cover crops have definitely helped against the erosion I would have faced otherwise.

"There are a lot of intangible benefits to cover crops in strip-till. I think I can improve soil health, soil quality and reduce erosion and all those factors will eventually lead to better yields, but it's not going to happen overnight."

On The Web

Profitable Approach to Strip-Till and Cover Crops

Scan the QR code, or visit *strip-tillfarmer.com* to learn more from Cresco, Iowa, strip-tiller Frank Moore's experience incorporating cover crops into his 2,000-acre operation. With changing weather patterns and more "event storms", that can erode soil structure, Moore's goal with cover crops in strip-till is to establish the crop in winter and have it help control spring rainfall through an established root system to hold soil in place.