COVER CROPS

Power No-Till Payoff

From conservation to higher yields to reduced fertilizer and herbicide use, cover crops brought an immediate payback for Jacob Farms.

By Mark Parker

Last summer, when high temperatures in south-central Kansas spiraled above 100 F for several weeks, the benefits of cover crops never seemed so real for no-tillers like Ryan Speer.

Dryland corn and soybeans that followed a cover-crop mix on Jacob Farms actually made a crop, when many farmers who use a conventional-tillage system watched their plants and profits burn up.

So for Speer, cover crops are a short-term difference maker with long-term potential.

"The cereal rye and radishes we plant ahead of soybeans have increased our yields by decreasing evaporative moisture loss, reducing weed pressure and recycling nutrients," says Speer, who manages 3,800 acres near Sedgwick, Kan., with partners Steve and Terry Jacob. "The yield bump more than pays for the cost of planting the cover crops.

"But I think the big bang will come down the road with greater productivity due to increased organic matter and improved soil structure."

COVER-CROP ADVOCATE. Ryan Speer believes cover crops are the key to unlocking no-till potential at Jacob Farms near Sedgwick, Kan. His dedication to soil improvement earned him recognition as this year's American Soybean Association Midwest Region Conservation Legacy Award winner.

Making A Transition

Jacob Farms, established in 1896, has been a continuous no-till operation since 2003. In addition to commodity crops, the operation grows seed wheat and has a beef enterprise that includes a butcher beef business.

Prior to joining Jacob Farms, Speer was an agronomist at the Scott City co-op in western Kansas. He was hired by the Jacobs as farm manager in 2003 and joined them in an ownership role in 2007.

Cover crops became part of the no-till strategy in 2007 and in 2011, Jacob Farms planted 1,250 acres of cover crops. Due to drought conditions last year, Speer expects that to drop to about 800 acres this year. But he's bullish on the impact of cover crops.

"We started on cover crops after a wheat freeze. Before that, to be honest, I thought they were a waste of time and effort," Speer says. "The wheat froze out and we did a lot of double-cropping right back into the wheat residue and had tremendous

results with irrigation-water efficiency, yield increases and weed control. So I decided to quit being so negative and look at cover crops a little harder."

One irrigated field that had been consistently averaging 45 bushels per acre of wheat jumped up to 73 bushels following the failed wheat that became a cover crop. Since that experience, Jacob Farms has continued to increase cover-crop acres and now conducts an extensive testing program.

RYE ROOTS. Testing indicates cereal rye delivers 50% more biomass than wheat or other winter cereal cover crops at Jacob Farms. A cereal rye-oilseed radish cover crop after corn delivered an 11-bushel-per-acre increase for the following soybean crop.

Although covers are planted whenever they fit into the rotational scheme, the primary push is the radish-cereal rye mix seeded behind the combine after second-year irrigated corn in a rotation of corn, corn, soybean, double-crop, hard-red winter wheat and double-crop soybeans or grain sorghum.

The cover crop also fills the gap between corn and soybeans in the dryland rotation that features a single year of corn followed by soybeans, double-crop wheat and double-crop soybeans or grain sorghum.

> "You have to know what a cover crop is doing for you. The best choice depends on your goals…"

Soybean Yields Soar

From 2009 through 2011, Jacob Farms measured an 11-bushel-per-acre increase in soybean yields attributed to the preceding cereal-rye cover crop.

Assessed in side-by-side comparisons at various locations on the farm, soybeans following cereal rye had as much as an 18-bushel-per-acre edge. On irrigated acres, the moisture-retention effect of the cereal rye has cut irrigation water usage by 35% in a normal year. Herbicide use has also been reduced.

"Before we made cereal rye part of the rotation, we were putting on three shots of Roundup on our soybeans," Speer says. "Now we make a pre-emergence application of Authority XL and Matador, and then one Roundup application, if that's even necessary. So we're saving chemical and two trips.

"We were also having problems with marestail resistance, but that hasn't been an issue since we've added the cereal rye. I don't know if it's an alleopathic effect or if the cereal rye just makes it tough for the marestail to survive. Either way, I haven't seen any for 3 years now."

The tremendous biomass production of cereal rye — above ground and below — is a major reason Speer chooses it for a fall-planted cover crop. He's tried wheat, barley and triticale and measured 50% less biomass production compared to cereal rye.

Additionally, the rye scavenges nitrogen after corn and ties up nutrients to prevent leaching, an important benefit since most soils at Jacob Farms are sandy. The greater root mass of cereal rye, compared to wheat, probably has a role in reducing weed problems, Speer says.

Speer has also experimented with fertilizing cereal rye to increase biomass production even further, but he found that even though the plants took on a darker shade of green, there was little effect on production. The nitrogen left over from the corn crop, he says, appears to provide adequate nutrition for the cereal rye.

Speer emphasizes the importance of getting cereal rye and radishes planted as soon as possible after corn harvest to ensure adequate fall growth. Early dryland corn harvest begins in late August and most of the cereal rye and radishes are seeded by late September.

Even Distribution

To attain more even seed distribution, Jacob Farms uses a split-seeding system when planting a mixture that includes small- and large-seeded cover-crop species.

The cereal rye seed is drilled with a 30-foot CrustBuster 4030 All Plant drill. The much smaller radish seeds are broadcast by a modified Farm Star seeder/spreader mounted on the front of a Case IH Magnum 225 CVT front-wheel-assist tractor. The broadcast seeder has a 100-pound capacity and

MOISTURE SAVINGS. Drought and 55 days of 100-plus degree F temperatures last year drove home the moisture-saving power of residue at Jacob Farm. About half of Jacob Farms is under irrigation, and the combination of no-till and cover crops reduced water use by 35%.

its spinner is powered by a 12-volt battery controlled from the cab.

Radishes are seeded at about 2 pounds per acre with cereal rye at a 60-pound rate. The cereal rye typically achieves about 2½ feet in height and will be burned down with glyphosate as it begins to head. Soybeans will be planted into the standing residue from mid-May until about June 1.

"A lot of times, we're wet in the spring, so we're using up some of that moisture and making a little better seedbed to plant into. And when it turns hot and dry in the summer, it's giving us the ground cover to reduce evaporation," Speer explains.

The Jacobs and Speer have had no problems planting into the residue, but found that they get better stands when planting soybeans a little deeper than usual — at about 2 inches.

Soybeans, as well as corn and grain sorghum, are planted in 30-inch rows with a 16-row Case IH 1250 planter and an eight-row Case IH 950 planter. Both planters are stock with no coulters or attachments. The planters and the drill utilize Capstan Synchro variable-rate, liquid-fertilizer systems.

Field-Testing Covers

Cover crops are also utilized when a lack of moisture prevents double-cropping back to a cash crop — such as soybeans — after wheat. In striving to find the optimum cover mix for that situation, Jacob Farms conducts onfarm research with replicated 20-foot-wide strip trials.

In 3 years of tests, Speer has investigated a number of species, including combinations of cowpeas, sterile corn, lupins, sunflowers, pearl millet, German millet, sunn hemp and radishes.

Biomass samples reveal dry-matter production and carbon-to-nitrogen ratios, and water usage is estimated.

"We want the cover crops to reduce moisture loss due to evaporation more than they actually use," Speer says.

Speer also observes how well certain mixes work together. Harvesting with an RTK-equipped Case IH 7010 combine enables him to compare subsequent crop-yield response across the trials.

"When we started with cover crops, I didn't have any idea of what to plant," Speer says. "We're still evaluating and tweaking because every year is unique. I'm not sure there is one best mix out there for all years, and certainly not for all situations."

In 2009, he adds, sunn hemp was a standout. Growing up to 7 feet tall, Speer estimated that it produced about 130 pounds of nitrogen in just 65 days of growth. Cowpeas have also done well, and the Jacob Farms' partners really like the compaction-battling effects of oilseed radishes.

Mixes in general offer quick ground cover and a hedge against variable environmental conditions, but the key is to specifically select cover-crop species to play a needed role, Speer says.

"You have to know what a cover crop is doing for you," Speer says. "Some excel at breaking up compaction, some add nitrogen, some give you tremendous residue. The best choice depends on your goals."

This year, the farm is experimenting with February-seeded black oats. Speer saw this cover crop on a trip to Brazil. Black oats reportedly have a

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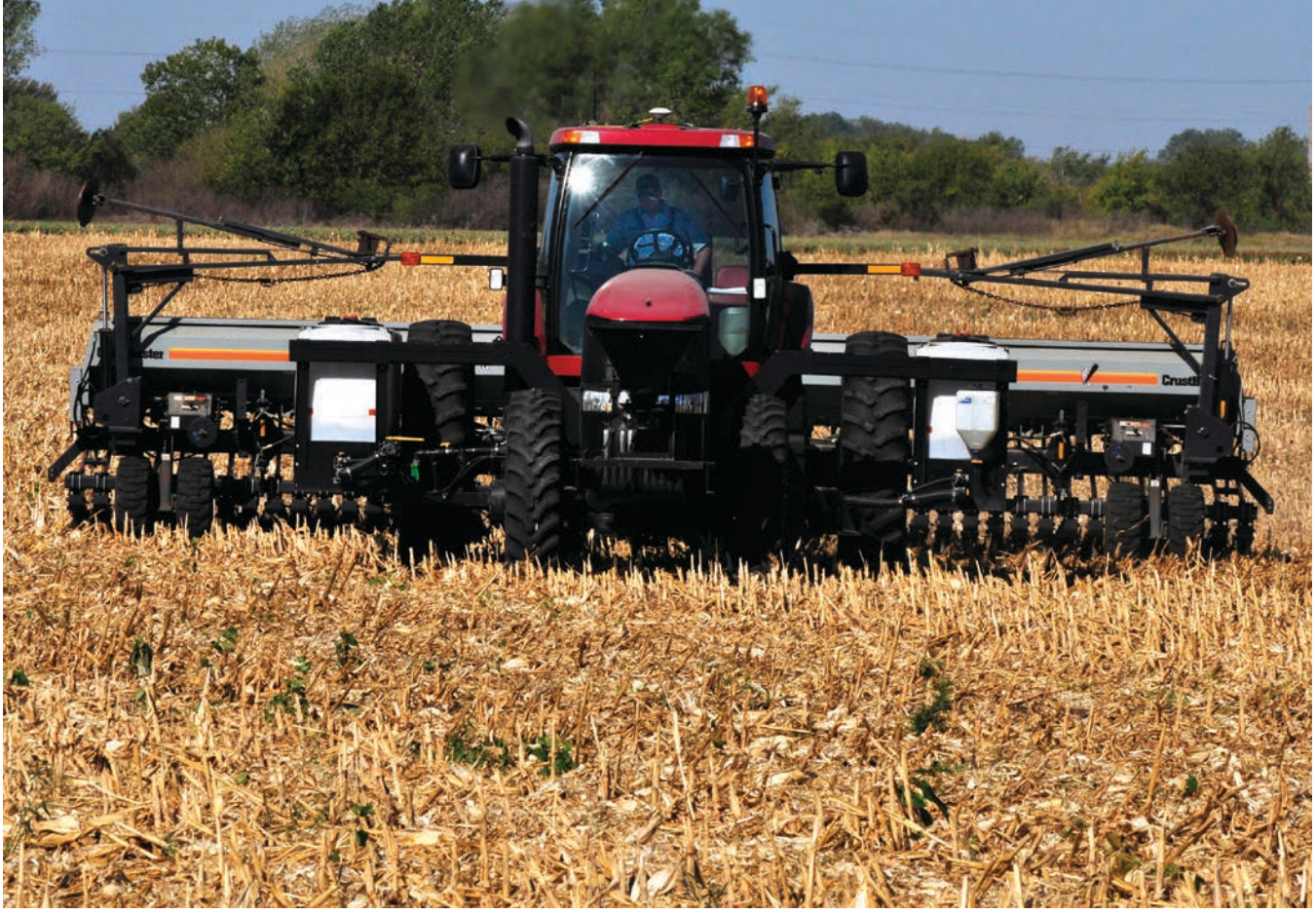

YIELD BOOST. From 2009 through 20011, soybeans following a rye-radish cover crop averaged 11 bushels per acre more than those planted into corn stalks with no cover crop at Jacob Farms.

deeper, more extensive root system than traditional spring oats and Speer is anxious to see if that benefit holds true in south-central Kansas.

Increasing Organic Matter

The partners on Jacob Farms have several goals for cover crops, but none is more important than boosting the soil-building benefits of no-till. Soil organic-matter levels vary from field to field, but continuous no-till and cover crops are moving the percentages upward.

"A lot of the soils in this area have been tilled for a century," Speer says. "No-till has stopped soil degradation and now we're moving in the other direction. Some of our farm's fields had organic-matter content below 1.5%. In some fields, we've increased from 1.6% to 2% in 4 years, with some spots now well over 3%.

"That doesn't sound like much, but the benefits aren't one to one. Things ramp up pretty fast when you increase organic-matter content by what may seem to be a fairly small amount.

"It's a long process — probably a never-ending one — but we can see the effects of that increased organic matter. We have better soil structure and that means better water-holding capacity and better nutrient availability. Ultimately, it means better yields."

Jacob Farms is transitioning from flood-irrigation to center-pivot systems. The flood-irrigated fields require a row-cleaning tool to clear residue from the furrow. Even though soil disturbance is

minimal, Speers much prefers zero soil movement, and the pivots offer reduced water use, as well as the ability to make in-season fertilizer applications.

Still, the farm wanted to gain cover-crop benefits from the remaining flood-irrigated fields. Last year, soybeans were planted for the first time on some flood-irrigated fields following a cereal rye-radish cover crop. The results were dramatic.

"There was a huge difference between the soybeans that followed the cereal rye and radishes and those that didn't," Speer says. "The yield monitor indicated a 13-bushel-per-acre advantage to soybeans following cereal rye.

"The plants were taller, had more pods and weed control was better."

The farm is also experimenting with variable-rate irrigation by probing soil for moisture content to a depth of 48 inches.

Variable-rate irrigation, Speer says, will prevent overapplication of water and help control nutrient leaching in their sandy loam soils.

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Mitigating Drought

A hot, dry summer is no surprise to south-central Kansas, but 2011 was worse than most. Annual rainfall for the area averages about 30 inches, but last year's total on Jacob Farms was 16 inches.

The lack of rain was bad enough, but the real crop killer for area farms was a record-setting 55 days of temperatures above 100 degrees F. Dryland corn yields ranged from 8 to 45 bushels per acre, and some of the soybeans that didn't follow the cereal rye-radish cover crop died in the heat.

"When it got so dry, I was really concerned that the cover crop had been a big mistake," Speer says. "I was afraid the rye and radishes had used up all the moisture, but the soybeans following the cover crop were by far the best we had.

"Controlling evaporation and weeds made a huge difference. The extra residue also helped keep the soil cooler, and that had to help. I actually think we could have raised some decent crops on very limited rainfall because of the continuous no-till. But temperatures over 100 degrees F, day after day, that's pretty tough to deal with."

Speer adds that his hot-weather concerns aren't limited to the crop growing above the ground.

"We're trying to promote better soil health and more biological activity beneath the soil surface," he says. "Cropping diversity — and intensity — helps feed that population of soil organisms, but I think the residue from no-till and cover crops probably helps protect that population from weather extremes."

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Better Soil Data

Soil is the key to crop productivity and knowing the soils Jacob Farms is relying on is a priority for Speers and his partners. All fields have been grid sampled. Now they're correlating data from those soil samples with yield data, satellite imagery and Veris-measured electrical conductivity information to get a better handle on soil variability.

Soil-sample grids for irrigated land are 2½ acres, while dryland fields are 5 acres. With better data, the farmers will probably switch to management zones to provide the basis for variable-rate seeding, fertilization and lime application.

"There is a lot more variability out there than simple soil-type maps indicate," Speer says. "Better data should allow us to get more from our more productive areas and limit inputs on areas that have less potential. It will also provide an accurate picture of where we can use management zones to streamline fertilizer management."

In addition to variable-rate fertilization, applications at Jacob Farms are split to deliver nutrients when crops need them and to prevent leaching and denitrification.

Wheat and soybeans get blended starters at planting. Nitrogen, phosphorus, potassium and sulfur are applied to wheat through the drill with one or two top-dress applications in-season.

Phosphorus and potassium go on corn acres in the early spring, with a liquid-nitrogen starter applied with the planter. The corn is sidedressed according to nutrient needs and yield potential.

Jacob Farms' tractors, sprayer and combine all have auto-steer with variable-rate capability controlled by Ag Leader Insight systems.

The Case IH Patriot 3320 self-propelled sprayer has the AIM Command system for rate control and is equipped with a 1,000-gallon tank and 90-foot boom width. The combine utilizes a Redekop MAV straw chopper to chop and evenly distribute wheat residue across the unit's 30-foot width.

"The large amount of residue we gain from wheat is a key part of the no-till system for us. It's important that we get that residue spread uniformly to get even planting depth and emergence from the following crop," Speer says.

Reducing Populations, Rates

No-till and better seed genetics have combined to increase yields at Jacob Farms. Corn yields are up by about 40 bushels per acre since 2000.

Irrigated soybean yields have remained fairly stable during that period, but dryland soybean yields are approximately 10 bushels per acre higher.

Another no-till impact, Speer says, is the opportunity to plant at lower populations and reduce seed costs. Irrigated soybean seed populations have been reduced from about 175,000 seeds per acre to about 140,000, largely due to better stands realized after the rye cover crop.

On dryland soybeans, the seeding rate has been cut to 120,000 from 150,000. Irrigated corn populations range from 30,000 to 36,000 with most being about 32,000.

Dryland corn is in the 20,000 to 24,000 range. Both corn and soybeans are planted in 30-inch rows.

Cover crops and no-till have also allowed Jacob Farms to reduce liming rates and use more frequent applications to help increase phosphorus availability.

"We were applying 3 tons of lime at a whack and we'd have a pH of 6 near the soil surface," Speer says, "but it wasn't getting down into the profile."

"The cereal rye helps move the lime down much faster and deeper and that saves us fertilizer dollars because of better phosphorus availability — particularly on dryland soybeans."

Worth The Effort

Although the farm is clearly focused on enhanced productivity, the resource-stewardship benefits of no-till and other practices have an ever-present influence on Speer and the Jacobs.

Their commitment earned them the American Soybean Association's Conservation Legacy Award this year for the Midwest region.

"No-till is a huge part of our commitment to leave the soil in better condition than when we found it," Speer says. "It's not just preventing the soil from washing or blowing away, but improving the soil right down to the microscopic level."

All three partners are dedicated to continuing their no-till strategy with constant outreach for better ways to optimize its impact.

Cover crops, Ryan Speer is convinced, will prove to be an integral part of that system.

"Cover crops have to be financially viable from the get-go," he concludes. "The benefits, at the very least, have to give you a break-even compared to the costs to be sustainable.

"You have to keep your eye on the prize, though, because if we can continue to benefit from them year-to-year in our no-till system.

"There's going to be a larger payoff down the road."