INFORMATION PROVIDED BY A GRANT FROM THE HOWARD G. BUFFETT FOUNDATION

Worst Field to Best Yield

Illinois farmers are amazed at yield changes in just three years

After decades of strip-till, no-till and conservation practices, Jeff Martin and his sons, Doug and Derek, thought successful farming changes meant making small tweaks to a well-functioning system. But after five years of using overwintering cover crops and other new soil health practices, the Martins were surprised at how much they had left to learn about these approaches and their impact on yield potential. Nowhere was that more apparent this pasr fall than the 30-acre field the Martins call "the partnership field."

The partnership field has been notorious for the worst yields on Martin Family Farms' roughly 6,000 acres. The field, which is not pattern tiled, sits on an old "buffalo wallow," Derek says, so it's wer and often has stand issues. A typical harvest looks like 2015, when the field gave up a paltry 149 bu. of corn per acre. The following year the field reaped their lowest soybean yield at an average 58 bu. per acre.

Then came 2017– and a corn yield that shocked the Martins (see yield maps below).

"That field was a surprise through the entire season. In 2015, we had two or three big red spots on the field map that showed maybe 100 bu.," Derek says. "In 2017, we received 5" to 7" of rain in late April and early May, but we had zero wet spots on that field and it was fairly uniform, which was a surprise. We averaged 226 bu. corn per acre on that field last year. Our typical best fields, with the same hybrid planted on the same day, averaged 208."

The Martins have consistently seeded cover crops on that field since 2014. And in just three years, their worst-yielding field did an about-face and became the best-yielding field on the farm.

"We're starting to change our soil structure by doing things like increasing organic matter through healthier soil and soil biology," Derek says. "Through cover crops and biologicals, we've seen improvements in soil aggregation, water infiltration, water-holding capacity and now yield."

On the partnership field in the fall of 2014, the Martins seeded oats and radishes ahead of the 2015 corn crop, and cereal rye ahead of the 2016 soybean crop. In the fall of 2016, they seeded hairy vetch and rape ahead of 2017's corn crop. In the fall of 2017, it was seeded to oats and crimson clover ahead of the 2018 corn crop. They hope to continue seeing positive changes on the yield monitor.

Previous page: After adding cover crops and other soil health practices, Doug, Jeff and Derek Martin were pleasantly surprised with the yield results at harvest.

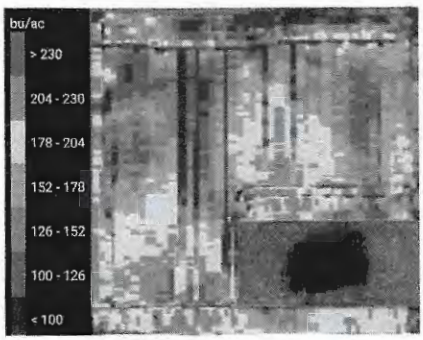
The Next Step

Jeff and his wife, Jean, have been handing the reins to Doug and Derek over the past several years.

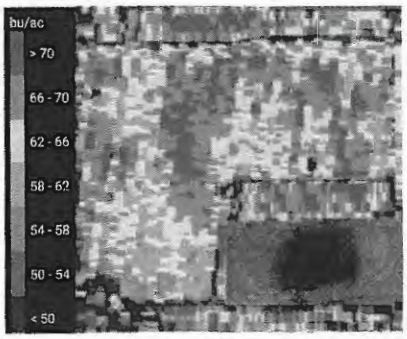
"I've tried to keep up with education and what's new over the years, but it's exciting to know that five years from now, my boys will be doing things we're not doing today," Jeff says. "I still have an active role, and part of that is educating our landlords so we can keep evolving."

The Martins are focused on using strip trials and soil tests to quantify their newfound gains. The next five years they expect to focus on improving fertility efficiency, retaining soil nutrients through cover crops, building and improving their soil structure, increasing their water infiltration and water-holding capacity and increasing roor depth and soil oxygen levels.

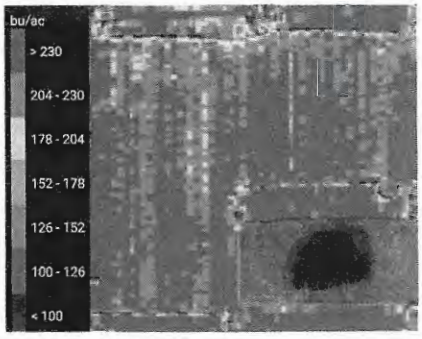
Yield gains confirm the Martins are on the right track. They are not spending less on inpurs but rather spending those dollars differently. They are also seeking ways to increase their cover crop acreage.



2015: 149 bu. per acre average



2016: 58 bu. per acre average



2017: 226 bu. per acre average

In three short years of using cover crops, this 30-acre field went from being the worst-yielding field at 149 bu. per acre corn average in 2015 to the Martin's best-yielding field in 2017, with 226 bu. per acre. The field outyielded their usual top-producing fields by more than 15 bu. per acre.

"Currently we seed 1,200 acres of covers," Derek says. "We're looking at testing some interseeding, where covers grow all year long with the cash crops. If that works for us, we could possibly reach 100 percent covers, but we'd have to ease into it and find out what works for us."

The Martins look forward to the exciting future their soil health will bring to their family farm. They see long-term benefits from investing more in soil health and less in input costs.

"I feel really comfortable with farming this way, and both my kids are on board," Jeff says. "We've been environmentalists all our lives. We'll continue on the road with conservation, no-till and strip-till and keep improving."

A Measure of Soil Health: Active Organic Matter

Most soil labs use the combustion test to measure organic matter (OM). This test measures the "stable" OM fraction (see Dan Towery's column on next page). However, the active OM test is a chemical reagent test and is fairly sensitive to changes in management and is a very good indicator of soil health. Soil is mixed with water and potassium permangate, which is a reagent that changes color depending on the amount of active carbon. A spectrophotometer is then used to precisely measure the change in color (an alternative method is to use a color chart).

Soil samples were pulled at Jeff Martin's farm in late March at 0-3" and 0-6." Typically, the highest active OM occurs in the top 3" of the soil. The use of a vertical tillage tool to seed cover crops on Martin's farm may have caused a reduction in active OM due to oxidation (additional testing is needed to confirm).

"The Martins are seeing their soils in transition," says Dan Towery, founder of Ag Conservation Solutions and an expert working with the Martins. "Cover crops increase the active organic matter, but as the neighbor's conventionally tilled field shows, any soil disturbance appears to decrease active organic matter. Soil samples from long-term covered soil with no disturbance have the highest health scores."

Towery notes this reagent test has a limited number of samples, and he's cautious about using a single test to make management decisions. However, he says there is value in this kind of test: It can be cheaply and reliably done every year and, long term, will help a grower observe changes in soil health. The Ohio State University offers a low-cost test kit that gives a health score rating based on a color chart. For information on the kit, see *ohioline.osu.edu/factsheet/SAG-4*.

As soil health improves, so does:
- Available soil nitrogen
- Microbial biomass
- Aggregate stability

Excellent soil
Total OM: >4.5%
Active carbon: >1,600 lb./acre
Available soil nitrogen: >40 lb./acre
Microbial biomass: >1,280 lb./acre
Aggregate stability: >70%

Good soil
Total OM: 2.5%–4.5%
Active carbon: 800–1,600 lb./acre
Available soil nitrogen: 26-40 lb. N/acre
Microbial biomass: 630-1,280 lb./acre
Aggregate stability: 40%–70%

Fair soil
Total OM: 1%–2.5%
Active carbon: 400–800 lb./acre
Available soil nitrogen: 12–26 lb. N/acre
Microbial biomass: 300–630 lb./acre
Aggregate stability: 24%–40%

Poor soil
Total OM: 0–1%
Active carbon: <400 lb./acre
Available soil nitrogen: <12 lb. N/acre
Microbial biomass: <300 lb./acre
Aggregate stability: <25%

Martin Farms Active Carbon Test