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HIGH-YIELD CONSERVATION

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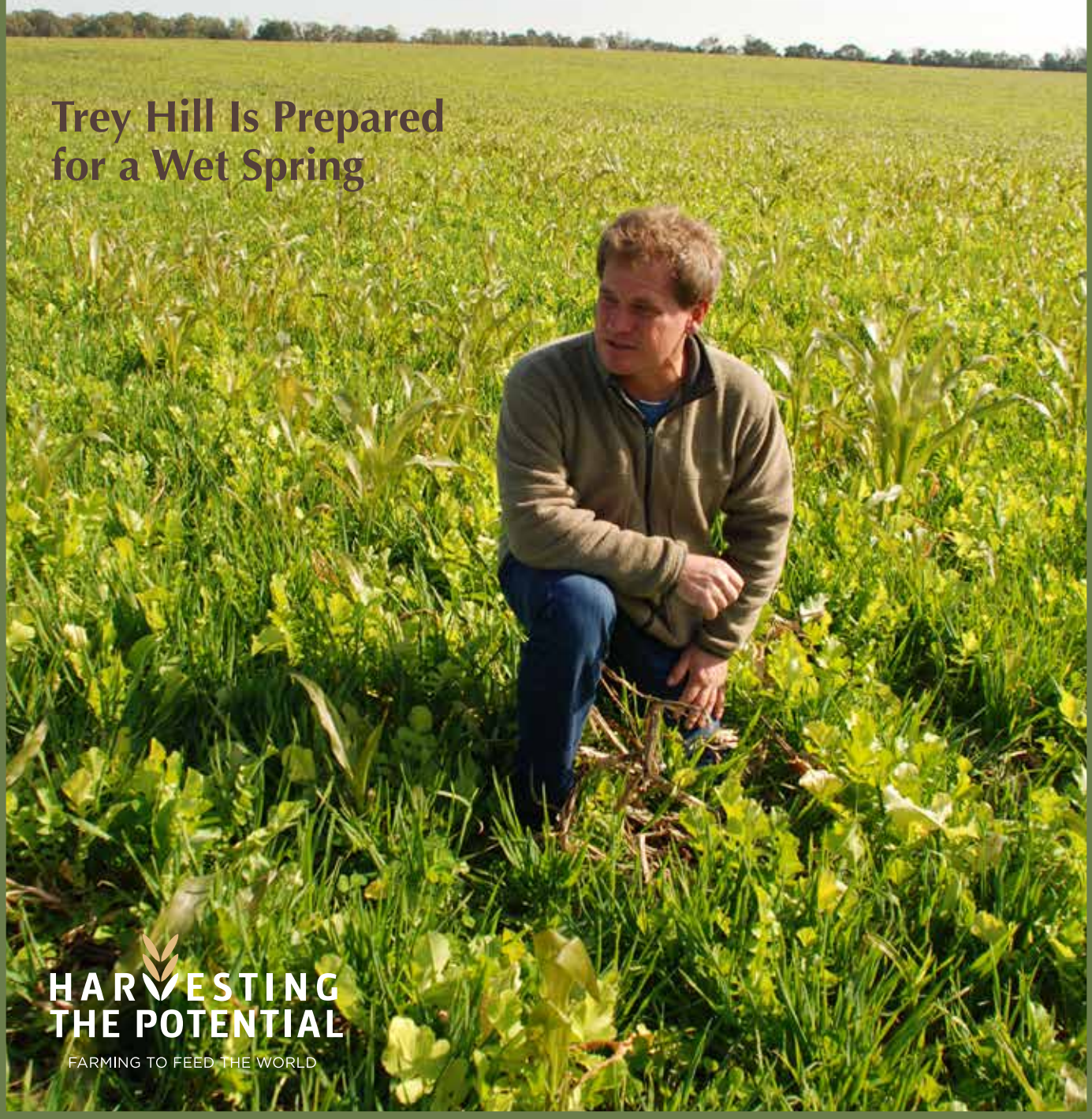
Trey Hill Is Prepared for a Wet Spring



HARVESTING THE POTENTIAL

FARMING TO FEED THE WORLD

Silver Lining

Heavy rains grow valuable lessons for Harborview Farms

If something is a good idea, Trey Hill will go for it. A fourth-generation farmer, Hill has been using cover crops for decades. He manages Harborview Farms – his family's 10,000-acre-plus corn, soybean and wheat operation near Rock Hall, MD – so he realizes every decision can have a big impact.

"I believe in jumping in and trying things. If it's a good idea for 100 acres, shouldn't it be a good idea across the whole farm?" he asks. "I research a lot, and we may even try something on a field or two first, but by implementing change quickly and on a large scale, we figure out fast how to make something work."

Already a firm believer in using cover crops to improve water quality in the Chesapeake Bay, Hill has also been working for the past three years on making changes across his operation to help him focus on how cover crops can benefit his own acres in addition to the Bay. To that end, he's tried different blends of cover crops as well as experiments such as planting into green standing cover.

Integrating changes across an operation the size of Harborview Farms quickly reveals pain points, but also how to relieve them. In the process, this seasoned cover-crop believer welcomes opportunities to learn new methods not only from research but also from challenges. His most recent eye-opening experiences have involved water quality and planting into green cover crops.

Water Quality

In the fall of 2015, Hill had the opportunity to work with Ray Weil, professor of soil science at the University of Maryland, and his High-Yield Conservation expert to create a 15-acre replicated cover-crop trial to test the effects of different cover crops on nitrate leaching. They used five different treatments plus a control (no cover, just weeds). The first cover-crop treatments, which were drilled into corn stubble on September 11, included (1) a three-species mix of triticale, clover and radish; (2) cereal rye; and (3) radish alone. A later planting of the three-species mix went in September 25. Pore water samples were collected on six dates in February, March and April.

By April 16, when the last sample was taken and corn was planted into the standing covers, the control and winter-killed radish treatments each had about 1,000 lb. of biomass (dry weight) in weeds, the cereal rye had about 1,500 lb. and the early- and late-planted mixes had about 2,000 lb. of biomass in triticale plus a few hundred pounds in clover. Pore water samples under all the cover-crop plots contained nitrate-nitrogen levels between 2 and 3 mg/L, well below the 10mg/L standard established by the Environmental Protection Agency (EPA) for drinking water, while samples from the no-cover plot contained levels between 6 and 12 mg/L.

For Hill, the most surprising result was that even radish alone – which winterkills – also reduced nitrate levels to EPA drinking water standards.

Mean and Green

A more recent learning opportunity actually arrived in the form of a weather challenge. In 2015, after six years of experimentation, Hill planted about half of his fields into various green, standing cover crops rather than teminating them two to three weeks prior to planting. He declares that planting into green cover provides better, more even emergence due to no soil crusting and fewer sidewall compaction issues. He can often get into a field sooner with more stable soil. The planter also has fewer issues running through green cover than it does with terminated cover crops.

Encouraged by the results, Hill went forward with plans to plant all of his acres into green standing cover in 2016. Then came about 21 straight days of rainfall.

"All that rain broke Maryland records. We were planting much later than we're accustomed to," Hill says. "We had tall, headed-out cover crops, the ground was already too wet and the cover was too big to work."

The rain pushed their typical mid- to late-April planting date into late May. While the cover crops were larger than they would have liked, they still decided to plant everything into the standing green cover as planned.

On his soybeans, Hill says that planting green went well; they conducted a big test plot where beans were planted into standing cereal rye.

"Where the cover crop was, we did 5 to 6 bushels better than where they weren't," he says.

Unfortunately, the same didn't hold true for corn.

"Our barley and wheat covers were at flag leaf and nearly headed out by the time we got in there to plant corn," he says. "They were at maximum growth and height and had taken the maximum amount of nutrients out of the ground. They looked ready for harvest. We adjusted our nitrogen application – putting more on with the starter – but we saw a bit of yield drag in corn."

Hill says the lack of test strips made it difficult to pinpoint the lower yields to any one factor, but late planting, excessive rain and overly tall cover crops all probably had a part to play in the 25% yield drop.

Hill realizes some folks would cringe at this setback, but it is where he learned some of the most valuable lessons for improving his cover-crop management practices for years to come – starting in 2017.

First, he hopes to be able to plant closer to his April 18 recommended planting date. He will also likely return to spraying about 30% of his cover crops on corn acres two to three weeks prior to planting. For the remaining 70% of his corn acres, he plans to crimp down the green cover immediately after corn planting. As he hasn't yet found a planter-installed crimper solution that works for his three planters, he'll acquire or build a standalone crimper for this year.

"We have some fields that we'll continually plant green. The more growth you have, the more you can improve your soil health, so we want as much growth as we can and still do a good job," Hill says.

He prefers the root mass that cereal rye can provide, but at a seed cost of $15-22.50 per acre, it's difficult to pass up less expensive options such as barley, which is $6.25 per acre, and wheat at $10 an acre. However, on corn acres in particular, Hill still plans to change up his cover-crop lineup.

"I'm still going to include cereals, but I need more legumes and brassicas than the cereals," he says. "I think that will make my corn yields come back. I need fewer grasses in my mix if I'm going to plant corn into it."

As for soybeans, Hill will plant 100% green and isn't worried about crimping, as his 2016 soybeans did well.

"I'm getting much better weed control in my beans with the cover crop," he says. "There's a mat on the ground, and a lot of those weeds aren't getting through. We have triazine-, ALS- and glyphosate-resistant weeds, so we need to maintain a robust mode-of-action program in our corn to continue to grow soybeans."

The storm clouds of 2016 turned out to have a silver lining, as Hill was able to bang out three critical solutions for using cover crops in corn in just one year: including more brassicas and legumes in his cover-crop mixture, using a crimper to knock down tall cover post-planting and terminating covers on 30% of their acres as a preventative measure.

"I don't plan on ever going back to not planting green," he says. "Prior to harvest, we had pride in how we planted over 95 percent of our acres into green standing cover last year. We've figured out the environmental factors and we'll be back to a high-yield environment this year."

Allelopathy or Nitrogen Robbing?

There are two additional issues that may occur with planting green: chemical interactions and nutrient interactions between a cover crop and a newly planted cash crop.

When one plant releases a chemical into the soil that may be toxic or inhibitory to another plant, the phenomenon is called *allelopathy*. The allelopathic compounds may act much like herbicides do against other plants, inhibiting germination and growth.

Cover crops may release allelopathic chemicals in several ways. The chemical may exist in the cover-crop leaves or roots and simply wash out with water after termination. In some cases, the plant-inhibiting compounds result from microbial degradation of precursor chemicals in the cover-crop tissues.

Generally, these chemicals have two characteristics that make them manageable. First, their effects are usually quite specific. Only certain species or varieties of cover crops will produce a specific compound, which may affect only certain species of cash crops. Second, the compounds are easily broken down once released into the soil and therefore exhibit their herbicide-like activity for only a short period of time.

In young cereal rye, living tissues contain certain "benzoxazinone" compounds that are allelopathic against corn (and certain weeds). The amount of these compounds depends on the rye cultivar and the growing conditions. Fortunately, the tiny seeds of weeds are much more susceptible to the chemical's effects than the larger – and usually more deeply planted – corn seeds. Allelopathy is one reason why cereals are best used ahead of soybeans rather than corn. (For best practices, see next page.)

Tied-Up Nitrogen

On-farm research in the Corn Belt, as well our research in Maryland, indicates some significant yield penalties when corn is planted into cereal cover crops. Rather than allelopathy, soil and plant nitrogen (N) data suggest that cereals tend to tie up N in a manner that starves the corn crop. Using mixed-species cover crops with substantial amounts of legumes and brassicas, such as a mix of radish and crimson clover with a low seeding rate of cereals, are excellent solutions to precede corn. The radish, if planted early enough, is particularly effective in collecting nutrients in fall, and the crimson clover fixes a great deal of N if allowed to grow long enough in spring. We have regularly observed this combination to boost corn yields, especially as compared to plain cereal covers.
–Ray Weil, professor of soil science at the University of Maryland and High-Yield Conservation expert

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Planting Green?

Best Practices to Make It Work

Ray Weil, Professor of soil science, University of Maryland

Planting green is an "advanced" cover-cropping technique used by some of the most innovative farmers around the country. It involves planting a cash crop into a field that already contains a living cover crop, which is terminated in close proximity to the planting operation. Planting green offers the potential for both advantages and challenges.

The main advantages of planting green are that it allows for convenient, timely planting of cash crops in spring while also allowing extended time for cover crops to grow and produce more biomass. Because the cover crop is allowed to keep growing for an extra few weeks while the soil and air are warming, above- and below-ground cover-crop biomass production can double or even triple. This means more organic matter for the soil with greater long-term benefits for soil health, water-holding capacity and nutrient cycling. If cover-crop species are chosen carefully, the extra residue will also translate into immediate benefits of greater weed suppression and better water conservation.

Although running a no-till planter through a knee-high cover crop may seem daunting, experience shows most no-till planters work better in standing, live cover crops than in dead, drooping residue. The standing living cover crop provides insulation that holds in heat escaping from the soil at night, thus preventing frost damage to sensitive seedlings such as soybeans. This frost protection potentially allows for earlier planting. Decades ago, my students and I at the University of Maryland did this and produced excellent crops from soybeans that were planted green into wheat at the earliest normal planting dates for corn.

There are also several benefits to using roller-crimpers on cover crops, either as a separate implement prior to planting or as attachments in front of each planter unit. Rolling-crimping is most effective on cover-crop plants in the flowering or stem elongation growth stage. The rolling process creates a mat of stems all neatly parallel to the planting direction, which maximizes weed suppression, protects soil from raindrops and minimizes evaporation loss. Ridges or blades crimp plant stems, killing them and preventing them from "turning up" and continuing to grow after rolling.

It is important to use row cleaners on the planter, however. Otherwise, a rolled cover crop can more completely shade the soil, promoting a cooler seedbed and slower early crop growth. The rolled mat of cover can create insulation *between* the soil and the seedlings that have grown above the mat, leaving the soybean seedlings vulnerable to frost.

If rolling-crimping is performed on a cereal cover crop that contributes 6,000 to 8,000 lb. dry matter per acre, the operation may eliminate the need for most, if not all, herbicide applications. This is of special interest to farmers wanting to meet the growing demand for certified organically grown grains.

Among the more challenging issues associated with planting green is the potential for chemical interactions between the cover crop and the newly planted cash crop, a phenomenon called *allelopathy*. Plant-inhibiting compounds may act much like herbicides do against the cash crop, inhibiting seed germination and seedling growth. For a full explanation, see sidebar, "Alleopathy or Nitrogen Robbing?" on the previous page.

Finally, a word about slugs. The residue cover so important to no-till farming does provide a good habitat for slugs to hang out. So far, research results are mixed as to whether planting green increases or decreases damage in slug-infested fields. Under wet conditions, be ready to make multiple slug-control applications.

Will the benefits of planting green outweigh the challenges on your farm? If you have a field with a well-established cover crop of a cereal or mixed species, why not try planting soybeans "green" on a few strips before terminating? You will likely be amazed at the extra amount of cover-crop biomass – and you are likely to see better soybean yields, too.

In the longer term, larger and more diverse cover crops are very likely to improve soil health, productivity and profits.

THE HOWARD G. BUFFETT

The Howard G. Buffett Foundation has invested over $150 million in research to improve agriculture and invested an additional $350 million in agriculture-related programs globally. Howard G. Buffett, the Foundation's Chairman and CEO, has farmed for over thirty-five years, including more than 20 years using no-till and cover crops.

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