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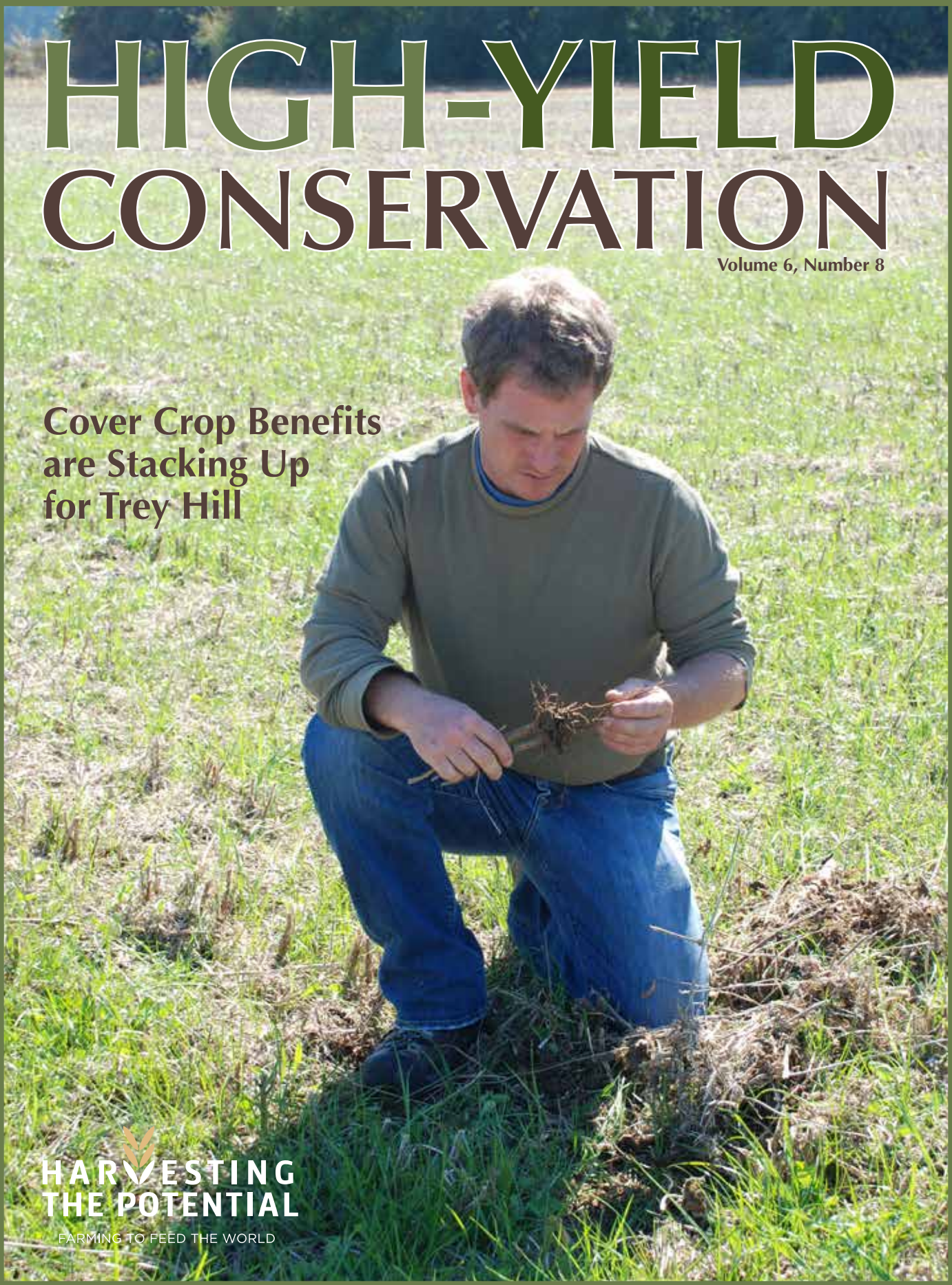
HIGH-YIELD CONSERVATION

Volume 6, Number 8



Cover Crop Benefits are Stacking Up for Trey Hill

HARVESTING THE POTENTIAL

FARMING TO FEED THE WORLD

Beyond Water Quality

Trey Hill finds cover crop values extend to soil health

Nestled in the heart of the Chesapeake Bay watershed, Harborview Farms overlooks the water from much of its 10,000 owned and rented acres. This view is a daily reminder to Trey Hill, a fourth-generation farmer from Rock Hall, MD, of water's critical importance. While Hill harvests corn, soybeans and wheat from the land, he knows that many of his neighbors are watermen who harvest their living from the Bay. This gives Hill a unique appreciation for the wise management of local resources.

"These people are my neighbors and friends," Hill says. "What I do can impact their livelihood. That's a big responsibility, and I take it seriously. I'm pro-environment; sometimes people don't associate that with farmers, but they should. "

An early adopter of cover crops, Hill began experimenting with them more than 20 years ago during the launch of the Maryland Water Quality Cost-Share (MACS) program, which provides farmers with grants to plant cover crops in an effort to prevent soil erosion and reduce nutrient pollution in the Bay. The MACS program is funded primarily by the "flush tax" of about $60/year levied on Maryland households that are connected to municipal sewers or use on-site septic systems. The taxes have funded upgrades of state sewage treatment facilities as well as cover-cropping programs.

While Hill has always known the value of cover crops in protecting the Bay, he also began to investigate their secondary benefits when he saw unexplained changes in his fields over the past few years, such as field pockets yielding 300 where they should have yielded 220.

Until recently, Hill managed his farm in a variety of ways. Some farms had been no-tilled for more than 20 years at the landlord's insistence, while others were still under conventional tillage. Based on the changes he's seen in his farm, however, Hill has shifted to almost 100% no-till over the past six years. This year, in fact, he tilled only one of his fields.

Now, Hill is managing cover crops as an input variable for his next cash crop, not just water quality.

Four Realizations

Four critical changes prompted this decision. First, Hill realized that over his two decades of cover crop use, soil organic matter had increased by 0.5 to 1.5 percentage points, according to soil tests.

Second, Hill noticed that corn and soybean yields have historically been higher on farms where he has grown wheat. Harborview Farms has not baled wheat straw for 20 years due to the negative effects removing the residue has on potash levels and organic matter.

"We have better organic matter where we've grown wheat," he says. "That alone was enough to talk me into using cover crops. Now we don't sell our wheat straw because it's too valuable where it is, in the field."

Third, Hill has learned to plant into green cover crops for smoother planting and more even emergence. Six years ago, when terminating a wheat cover crop prior to planting, they were only able to make one 90-ft. pass on the outer edge of the field before spring rains drove them out. When they were able to return, Hill decided to plant the entire field, then burn the unsprayed, standing green wheat with a post-emergence application.

"We were amazed. Where it was green, it was planting twice as good," he says. At the end of the year, after adjusting for the outliers (end rows), the yields were no different between the two treatments.

Fourth, Hill realized that in most cases, tillage actually cost $3 more per acre than in fields where cover crops did the work.

"I've noticed where we use vertical tillage and then get spring rains, in every track or bump, every place there's no cover crop, the soil gets hard and crusted over. That effects my emergence and explains why I get much more even emergence in my green-planted cover crop fields than my tilled fields," Hill says. "Plus, if you ribbon the soil between your hands in a tilled field versus one with cover crop roots, you immediately see how the tilled field is wetter, ribbons easier and is more likely to get sidewall compaction from the planter sealing off the furrow."

He notes that his soil is more stable, too. "Long-term, if I can plant green every year, I think I'm going to see some pretty drastic changes in my soils. My residue breakdown now is unbelievable," he says.

Jump In

"This year, everyone on the farm agreed, 'Let's do it.' I'm pretty well determined this is the future of Harborview Farms," Hill says. "If I'm going to be a progressive and responsible farmer and change the way I think, then we need to jump in. We're not the dip-your-toe-in-the-pool-types; we're cannonballers. Hopefully, this will change the way others think as well."

During the conversion to no-till, Hill's type-A personality began chafing with the idle time in the spring. "Everybody was working ground but us, and we were out of stuff to do," he says. This spring, he decided to test how cover crops could help him plant earlier than

his area's recommended planting date of April 18. He started planting corn on March 30 and finished May 9.

While he admits that the earliest-planted corn took about two weeks to emerge, it did fetch a small early-harvest premium from local chicken-feed buyers.

The cover crop may have helped dry the soil down a bit allowing it to warm up faster. Hill plans to collaborate with University of Maryland researchers to monitor changes in soil moisture and temperature next spring to shed some light on why the early planting worked as well as it did.

They planted about 10 percent of their acres early. "If it didn't work, we had time to replant, but if it did work, we had a jump on planting. We haven't run all the yield numbers yet to decide if we'll do it again, but we took a calculated risk."

Harborview Farms may be aggressive, but they're not reckless. Perpetually data driven, Hill was determined early on to prove how much of his nutrient load he was saving from runoff (see sidebar below). The next item on his agenda is to determine when nutrients from decaying residue are available for his cash crop. He is already experimenting with the amounts and timing for his spring split-fertilizer applications.

"In theory, we will get everything back that we put into the soil, so we just have to figure out how to maximize that," Hill says. "Money is one of the primary drivers here. I'm not completely altruistic in thinking I'm going to change the world, but I can change my piece of it."

Cover Crops Reduce N leaching up to 75%

How effective are cover crops at reducing N loss through leaching? In September 2015, Ray Weil, professor of soil science at the University of Maryland, worked with no-till innovator Trey Hill in Rock Hall to put out a 15-acre replicated trial with 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. A later planting of the three-species mix went in September 25.

In February, Weil and his students installed 45 suction lysimeters, which measure the percolation of water through soils and determine the soluble constituents removed in the soil pore water, at 3' under each of these plots. They collected pore water samples on six dates in February, March and April.

"As the graph shows, the results were surprisingly consistent despite the living cover crop biomass being quite different among the treatments," Weil says.

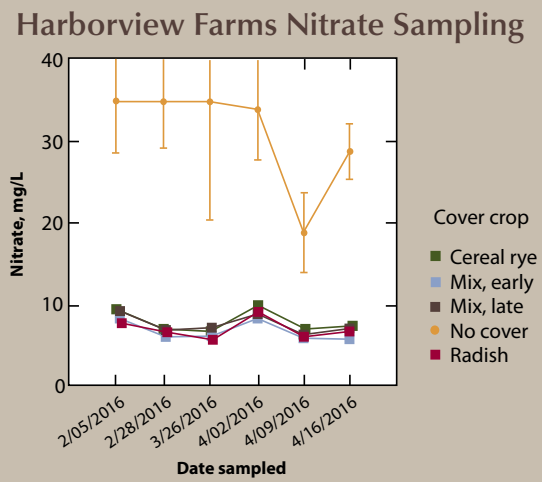
By April 16, when the last sample was taken and corn was planted into the standing covers, the control and winter-killed radish treatments each had about 1,000 lb. of biomass (dry weight) in weeds, the cereal rye had about 1,500 lb. of biomass and the early- and late-planted mixes had about 2,000 lb. of biomass in triticale plus a few hundred pounds in clover. Nonetheless, the pore water samples under all the cover crop plots contained nitrate levels between 8 and 10 mg/L while samples from the no-cover plot contained levels between 20 and 40 mg/L.

"These values only tell part of the story – that is, representing the N leaching losses," Weil says. "However, the topsoil and pre-planting green vegetation contained more N where cover crops were planted."

Will the farmer get that N back? "The evidence says yes, but the timing depends on species and management," Weil continues. "Over time, the use of high-biomass cover cropping (more than 1,500 lb. dry matter per acre) should allow for reduced N application rates as the captured N eventually returns to the available pool. With brassicas and legumes, the return is rapid (sometimes too rapid) and observable in the first year; with cereals and other grasses, the return may take longer, depending partially on how mature (and therefore how carbonaceous) the cereals are allowed to become before termination."

Weil notes that modern corn hybrids need more N late in the season during ear fill than their predecessors. "With the right carbon/N ratio and combination of species, cover crops should be able to deliver captured N in late July and August, when high-yielding hybrids are still looking for more N," he says.

See Weil's column on the next page for more information on cover crops and nutrient cycling.



Cover Crop Trials
Reveal N Reduction

Ray Weil, Professor of soil science, University of Maryland

Nitrogen (N) is a great thing. Plants can't grow without it, and it's the nutrient they're most often running short of. Nitrogen builds grain protein, makes plants green and is certainly necessary for high yields. On the other hand, we should not lose sight of the facts that N is expensive and accounts for a large part of the fossil fuel energy that goes into producing a corn crop. It can also make plants more susceptible to diseases and pests and cause all kinds of mischief in the environment, both locally and globally. It is a well-established fact that Corn Belt farms lose a great deal of expensive N each year, creating a huge dead zone in the Gulf of Mexico. Recent lawsuits and political pressures remind us that nitrates in local groundwater and stream water can make the water unfit for drinking by livestock and humans. You may be less aware that part of your N goes up in the air, sometimes as "greenhouse gases" such as nitric oxide (NO) and nitrous oxide (N_2O), which help cause global climate change. In fact, pound for pound, N_2O is about 300 times more active than CO_2 in trapping heat in the atmosphere. The point is, there are compelling economic and environmental reasons to avoid overapplying N.

No farmer would intentionally throw money down the drain by applying more N than they thought was necessary, but it's quite clear that many farmers do in fact apply more N than their crops really need, even for high yields. Some of this overapplication can be traced to the inappropriate interpretation of yield response data by farmers and their advisors. Some N overapplication is probably due to "insurance" applications – farmers wanting to be sure there's plenty of N for the ideal season so they won't miss out on top yields when everything else turns out perfect. That may seem sensible, but if that ideal season comes only once every five or 10 years, it would make more economic and stewardship sense to fertilize for average rather than optimistic yield goals.

In Maryland, environmental concerns have driven significant reductions in N application rates during the past 25 years. These pressures to reduce N application rates from 1.2 or higher to 0.9 or fewer pounds of N per bushel of expected yield understandably caused much grumbling among Maryland farmers – until it became apparent that yields were continuing to go up while fertilizer bills were going down.

Back in the 1990s, we in Maryland also realized we had to do more on the output side to reduce the amount of N reaching the Chesapeake Bay, where N as well as phosphorous were causing water quality problems that were destroying the seafood industry and the health of the Bay. Maryland citizens put their money where their values were by voting for a new "flush tax" on septic systems and sewage bills in order to finance the Bay cleanup. Although agriculture was (and is) only a part of the problem and much was done to build better municipal wastewater treatment plants, it was soon determined that planting cover crops was one of the least expensive options per pound of N kept out of the Bay. Initially, many farmers were skeptical, but the new taxes enabled the state to pay farmers quite generously for the environmental service of planting cover crops that capture N. As a result, Maryland is on track to achieve its ambitious water quality goals for the Bay, and Maryland farmers became quite used to having something green growing all winter, years before the cover crop revolution took off elsewhere in the country.

The dynamics between cover crops, nutrient cycling, high yields and reduction of nitrate leaching are not yet thoroughly researched, but there is data and farmer experience out there to suggest there are some realistic goals to shoot for. One promising study was undertaken in September 2015 (see sidebar on previous page).

If further research is successful, it would certainly please both the regulators and the bank.

THE HOWARD G. BUFFETT

The Howard G. Buffett Foundation is a private family foundation working to catalyze transformational change to improve the world and the lives of the most impoverished and marginalized populations. The Foundation has invested over $150 million in research to improve agriculture and an additional $350 million in agriculture-related programs globally.

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