Harvesting Sunlight, Feeding No-Till Soils

By Martha Mintz
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Jim Harbach and Schrack Farms Partnership is using a diverse no-till, cover-crop system to build up organic-matter levels in rocky limestone soils.

Our farm perplexed our crop advisor, Gerard Troisi. He consults with many farms in our area of Pennsylvania with a diverse range of production practices. But he struggled to explain how we increased our soil organic matter by 1% in just 3 years while consistently removing virtually all biomass.

Confusing as it was, the results of 80 soil samples in a 400-acre field are hard to argue.

Conventional thinking says the key to increasing soil organic matter is to leave residue in the field, which we didn't do. It's also generally thought to be impossible to see such a significant increase in soil organic matter in such a short time. What we've achieved, we believe, is due to the fact that the soil doesn't only feed the plants — the plants feed the soil.

The acres we've achieved such impressive results on are in close proximity to our 1,000-cow dairy. We reserve those acres for silage crops, so we don't have to haul the sheer mass of harvest so far.

Every year we plant corn, harvest it for silage and then immediately drill a cereal rye-triticale cover crop. We harvest the cover mix as silage in the spring and seed the acres right back to corn. A few days later we use a drag-hose system to spread low-solids, separated manure on the fields. The manure gets the corn to rocket right out of the ground. We've been following this system for about 9 years.

We believe this has resulted in a dramatic increase in soil organic matter, because we have something growing at virtually all times. We're harvesting sunlight and, therefore, feeding the soil pretty much 365 days per year.

This thought process comes from what we've learned from Christine Jones, an Australian soil scientist. She explained to us her theory that there is a liquid carbon pathway and that it flows in the direction of the plant using photosynthesis to harvest the sun and atmospheric carbon and return it to the soil, which in turn builds soil health and helps the soil better support plant life.

We're not the only instance where this phenomenon has been observed. There was a case where they were growing switchgrass for ethanol out in the Dakotas. They grew it for 3 years, removing all of the biomass every year of a crop that grows 8 feet tall.

Surprisingly, their soil organic matter went up. It's the same thing that's happening here. It's not about growing something and leaving the biomass: It's about keeping something growing and feeding the soil all year long.

The 1% increase in soil organic matter that we've seen on our farm is extremely valuable to us. Do you want to know how cover crops pay? In that 1% increase we're getting a 4-fold increase in water infiltration and double the nitrogen-holding capacity due to increased cation exchange capacity (CEC).

That means the manure and other inputs we apply are staying put and being used by our crops. The average soil organic matter around here is 2%, but our fields are 4.5-5%. That's a big difference.

Mandatory Practices

My wife's family has been farming in the 1-mile wide, 12-mile long Sugar Valley in Pennsylvania's Appalachian Mountains since 1773. I currently farm with my wife, Lisa; my children, Andy and his wife Tori, Doug and wife Angie, my daughter Angela and her husband Mike Garcia; my brother-in-law Kevin Schrack, and my nephews, Dan and Nathan Schrack.

Our children are the 10th generation on the farm. I started working for my father-in-law in 1972 when I was 11 years old, which is about when he started no-tilling.

Here we have very shallow limestone soils, which means every time you plowed you had to spend days with a crew of boys — i.e., me and my friends — picking up stones. We hated to pick stones. The fact that it could be avoided with no-till was the primary reason my father-in-law adopted the practice.

Of course, since then we've found there are so many other advantages.

We've watched our soils change significantly over the last 40 years thanks to no-till. We had clay ridges that if it was a little wet when we planted would ball up in big clay lumps. You could hit those lumps six times with a heavy harrow and they'd still be the size of baseballs. Now, the soil color and texture has changed and we can plant even when conditions are a little wet without worrying about balling up soil.

Initially, our old Allis Chalmers air planter struggled to get the seed in the hard soils, but over time they mellowed and soil structure formed. We don't even run a no-till coulter anymore. We just don't need to.

Our soils have changed so much, especially in the last 5 years or so with the addition of cover crops, that a couple years ago when we got 18 inches of rain at corn silage harvest time we were able to harvest all of our acres and only put ruts in a half acre that had a spring. Water infiltration has been amazing.

At our last Pennsylvania No-Till Alliance field day, we dug a soil pit as part of a soil health seminar. The soil expert, NRCS's John Chibirka, did a water infiltration test that revealed the field could absorb an average steady state rate of 4.7 inches of water per hour. That means we can absorb 100 inches of rain in a day without any water leaving the field.

We wouldn't have those rates without no-till and cover crops improving soil structure, supporting soil life that builds porosity and increasing organic matter. People always ask how can I afford to plant cover crops. I say I can't afford not to. No-till and cover crops are not optional for us.

Because of this increased infiltration, we've been able to make bigger fields without buffer strips (and therefore use larger, more efficient machinery) because we have no washes, no runoff and no muddy water leaving our farm.

Covers For All

Cover crops have been instrumental in the changes in our soils. While they're an afterthought for some people, they're mandatory for us and it's essential that they're planted in a timely fashion. Cover crops are planted on all of our soybean and grain corn acres, not just the silage acres.

Directly after harvest we seed the cereal rye and triticale mix with a drill. We run the wheels off of our 15-foot John Deere 1760 no-till drill every year, running off and on from July through mid November. To ensure timely seeding, we no longer plant corn with more than 100-day maturity. We're able to plant 85- to 90-day corn without much of an impact on yield.

We like to use the drill to seed our cover crops, especially on the corn acres because we're dealing with fodder from 200-bushel corn. We quit using a stalk chopper 10 years ago because it was creating a big, heavy mat that kept soils wet and cold in the spring. We wanted the residue bridged up off the ground instead.

When we come through with the drill to seed covers, it sizes the residue and pins it to the ground to help the residue break down before spring planting — although these days we have issues keeping residue on the fields thanks to an extremely active and plentiful earthworm population.

Our soils are riddled with earthworm holes. In fact, when we dug our soil pit recently, the soil specialist, John, showed us we had built 2 inches of worm castings on our soil surface in the last couple of decades. That might not be a big deal to a guy farming in the Midwest, be we only have about 6-8 inches of topsoil, so that means we've increased our topsoil dramatically.

The earthworms dig deep, too. We've found worm burrows 30 inches deep, and you can see the dark topsoil actually moving down into the clay where the roots go. Cover crops help further open that deeper layer of soil, too.

The cereal rye/triticale mix we plant after corn doesn't grow much in the fall due to late planting. But overall, it goes back to keeping something growing all the time to feed the soil. Imagine having a factory that only ran 6 months of the year: It wouldn't be very profitable. So we grow something to harvest the sun. The cover does survive the winter, though, and is usually about knee-high at planting.

Up until about 10 years ago, we would chop corn silage and leave a bare field, even spraying it to make sure it was brown and bare so it would warm up fast in the spring and not have weed competition.

This is completely wrong. Now we're harvesting sunlight from September to May and apply manure, and then harvest and plant again. We're basically growing a whole other crop while most people have their feet propped up for winter.

The result has been a significant increase in forage for our livestock, improved soils and crop performance, and in the spring we don't have weeds because they've been out-competed. We're able to plant right into the growing cereal rye and triticale in our grain corn and soybean fields without issue and burn the cover down after planting.

These and our other covers also allow us to apply manure to a growing crop both in spring and fall. Many farmers think you have to incorporate manure, but we never do on our farm. We simply spread it with our drag-hose system to grow crops that will use it right away. We'll apply it to the cover in the spring, chop the cover for silage 2 weeks later, plant silage corn and apply manure again. It makes for a great use of the resource.

No Playing Favorites

In this farming community, as in so many others, we have lots of friends that sell seed and everyone wants you to buy from them. Friendships aside, we want the seeds that are going to perform on our farm.

Our solution for the last 20 years has been to put out a test plot. Anyone who wants to sell us seed can put out a few of their best varieties, and the ones that perform the best are what we plant. It takes the emotions out of the buying decision completely.

There have been some surprising results, too. In recent years we've planted 50 different varieties of grain and silage corn. It's a lot of work, but very eye opening. In those plots we've seen a 75-bushel yield difference from the top-yielding hybrid to the bottom-yielding hybrid in grain corn and a 10-ton difference in yield in silage.

That's a big swing in profit and I'm glad we're able to make an informed decision and not find our yield limited by poor seed selection.

Small But Diverse

Because of the number of acres we're seeding to cover crops we also grow our own cereal rye/triticale blend for seed, about 100 acres per year.

Growing our own seed is what led us to the cereal rye/triticale mix, the reason being that their maturity at harvest is about a week apart. So when grown together they widen our harvest window in case of weather issues. The triticale also is a leafier plant with more nutritional value than cereal rye, which we like for our silage.

This little project provides us with cover crop seed, bedding for our dairy cows and opens yet another cover crop opportunity in our rotation.

When those 100 acres are harvested in July, we immediately seed a multi-species cover crop that includes buckwheat, radish, cereal rye, sunflowers, turnips, clover, peas, soybeans and corn. The sole purpose of this planting is to create biomass and feed off the synergies in the soil and your crop rotation that come with planting a diverse mix of plants.

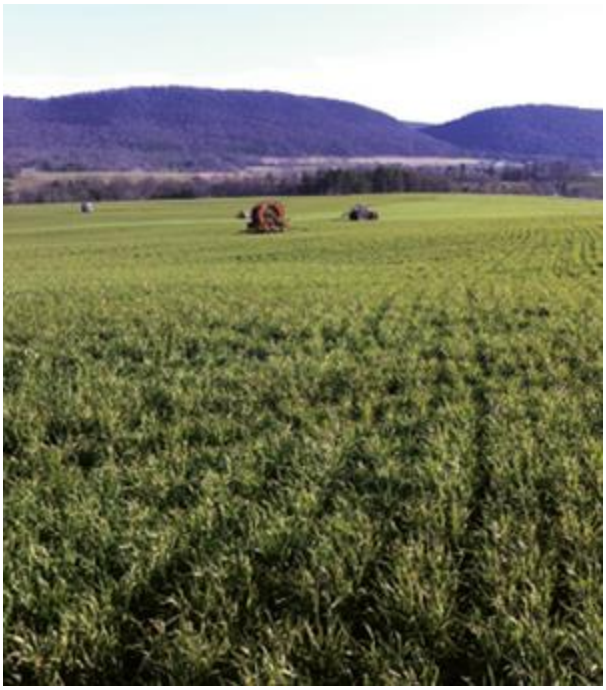
The mix grows 6-7 feet tall, creating a lot of biomass to help boost organic matter. Everything but the rye winterkills and we're able to plant into it easily in the spring. We see a great benefit in boosting soil quality on our seed corn/soybean/alfalfa acres from this combination, and even if it's only 100 acres it only takes 10 years to cover 1,000 acres and make a difference.

It's definitely worth the effort and we certainly aren't going to let even 100 acres sit idle for months at a time. We know better now.

Getting Skinny

Recently we made the switch to a 15-inch planter, once again looking to harvest more sunlight. We initially thought we'd use it to plant both corn and soybeans, but we're short on time so the soybeans are still being drilled. In corn, however, we've been pleased with the results.

We're right on the line separating where research says 15-inch rows pay, and it's certainly proven to be a worthwhile practice on our farm. We use a 32-row Kinze 3660 no-till planter to seed all of our corn, both silage and seed.



The last few years we've seen at least a 10% increase in yields. I think that's partially because with 15-inch rows we're harvesting more sunlight. Very little sunlight hits the ground on our farm.

With so little sunlight hitting the ground we also seem to have reduced weed pressure. The corn canopies faster, stealing all the sunlight the weeds would like to capitalize on.

This was further proven when we adjusted our planter to leave a tramline for our sprayer. Where we picked up the one row unit, leaving 30-inch rows, we had more weeds. But due to the overall reduced pressure, we're able to reduce chemical inputs on those acres.

There have been some challenges, too, with no-tilling 15-inch rows. When we originally set up the planter we installed Martin row cleaners with shark tooth wheels, but found they were throwing trash too far for the narrow spacing, resulting in trash being spread to the neighboring row and causing issues with seed placement. Our solution was bolting a small piece of metal from Needham Ag Technologies to the row unit that shifted the row cleaner angle. With the row unit running a little straighter, it didn't throw the trash as far and the problem was solved.

Originally the planter also came with reduced inner diameter (RID) gauge wheels. We replaced those with a narrower gauge wheel. The reason being that the wider gauge wheels would ride up

on the trash between the rows and incorrectly change seed depth. The narrower gauge wheels run in the cleared path to avoid the problem.

During our first years of 15-inch rows we had to spray across the rows to control the few weeds. We didn't want to run down corn, so we lifted two planter units to create a tramline for the sprayer. The seed that would have gone into that row was diverted to the two adjacent rows and the sprockets were set to run a little faster to manage the extra seed.

Despite this tinkering, the seed population stayed the same and the spacing has worked well. In 30-inch corn you would have a seed every 6 inches. In 15-inch corn you have one every 12 inches. In the rows adjacent to the tramline, the seeds are placed about every 9 inches, which splits the difference. They also have access to more sunlight due to the 30-inch row in the middle. We haven't seen any negative yield impact with this setup.

Natural Balance

Diversity is a good thing. And I don't just mean crops. That goes for all the creatures in the field, both above and below ground. We do our best to promote that diversity, which means limiting our use of various pesticides.

We decided years ago that we weren't going to spray for leaf hoppers in our alfalfa. Our crop consultant swept one of the fields and said I needed to spray due to the counts. But I didn't want to. In my mind, there was something missing from the standard practice of sweeping a field and counting leaf hoppers in the net. Nobody was counting the beneficial insects that were in there, too.

A week later, our consultant came back and asked if we had sprayed, since he couldn't find any leaf hoppers in the field. We hadn't sprayed. The beneficial insects caught up and took care of the problem. It just proved to us that if you promote diversity, some problems will solve themselves.

We have not sprayed any insecticides for the last 9 years. The only thing we still use is nematicides in our seed treatment, but we want to move away from that, too.

I was interested to see that John Lundgren of South Dakota State University did DNA analysis of the stomach contents of many organisms found in fields. He found that many of the organisms were in fact beneficial species and had the DNA of pest species in their stomach. They also had weed seeds in their stomach. If we kill these species, we also remove the good they do in our fields.

We do plant insect-resistant corn varieties, but we don't really know that they're necessary. As we build our fields in Mother Nature's image, we hope to take advantage of the symbiotic relationships that are seen in nature, too.

We've also reduced other inputs. We do not use a traditional pop-up fertilizer in corn. Especially with all the dairy manure that goes on our fields, it just isn't necessary. We do dribble 15 gallons per acre of a mixture of 30% UAN and ammonium thiosulfate between the rows at planting. We used to apply 30 gallons and we've cut back to 15 gallons. We didn't apply any fertilizer at all to a few passes, and while we don't have the technology to determine exact yield in the field, we didn't see much of a difference. With that information we're going to keep cutting back.

Once soils start to function the way they're supposed to there are so many sources of nitrogen and Mother Nature knows how to gather it. Our atmosphere is 78% nitrogen and she can get it in the soil. We ruin that with tillage and our cropping rotations. But, if we can get things closer to what Mother Nature is used to, that system starts working for us again.

Our soils are becoming very active with microbiology and we're able to produce a lot of crops with little fertilizer. We take 25-30 tons of corn silage off our fields and 9 tons of ryelage every year with no applied phosphorus or potassium, and mostly manure as a nitrogen source. Our soils are working for us.

- See more at: http://www.no-tillfarmer.com/articles/4261-harvesting-sunlight-feeding-no-till-soils#sthash.zqQNdYzi.dpuf