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SOLVING THE RESIDUE RIDDLE

By Howard G. Buffett

Turning the soil in your field over after every harvest may look nice and feel good, but it speeds topsoil run-off at a pace neither you—nor U.S. agriculture–can afford. That's why our foundation advocates for conservation farming, which avoids tillage and uses other techniques that promote soil health. In my 35 years of experience growing corn, soybeans, and wheat, I can produce equivalent or better yields while saving money and soil with no-till farming.

But I do understand some farmers' hesitation in changing to no-till and strip-till. In particular, farmers growing continuous corn often tell me they have tough corn stalk residues they can't break down without tillage. Tough residues are a very real problem, but I want to share with you the experiences of a successful farmer who has found a way to battle tough corn stalks using conservation techniques.

John Agee's track record using strip-till speaks volumes about the soundness of conservation farming methods, and he is generous about explaining his approach.

John Agee farms a large amount of continuous corn in Central Illinois, not far from my own farms. Like a lot of us, John has found that Bt traits, heavy fungicide use, and better overall plant health have created challenges after harvest: tough corn stalks that don't decompose quickly.

Many farmers take to the field after harvest with discs, rippers or other big iron tillage tools. Unfortunately, that can swap long-term problems including soil erosion and unbalanced soil biology for a short-term "fix." Instead, John uses strip-till, aeration, and cover crops to keep his soil intact and help to speed up the decomposition of the stalks.

John explained to me his basic process. He starts preparing for next year's continuous corn immediately after harvest. He plants cover crops up to around October 20th to give the plants a chance at a good stand. He makes sure his combines spread corn residue evenly; and then he runs an aerator to make stalks more manageable. "We use an Aer-Way–it's like a yard aerator on steroids. It churns and mixes the stalks but doesn't bury them." John owns two Aer-ways, and he tries to use them on every acre after harvest.

After that step, John and his crew apply ammonia with an applicator that includes coulters and knives that create elevated mounds, or strips where seed will be planted the following spring. The ammonia includes N-Serve, a nitrogen inhibitor. The aerated corn residue between these strips keeps soil firmly in place. "We aerate to break up the stalks enough to get through with the ammonia bar, and still hold the residue so we don't lose soil," he explains. The result of this process works well. The fields hold partially shredded corn stalks that decompose faster, but the base of each stalk is rooted firmly in the ground so it keeps soil around it from washing or blowing away.

In the spring, with the help of GPS and autosteer, John's team will plant precisely on top of each exposed strip where soil is warm and dry and where fertilizer lies waiting for seed. John admits this approach involves a trade-off: "This makes the fall busy, but it streamlines spring fieldwork. In spring we'll apply 28 percent liquid N with weed control, plant, and then side dress after emergence with dry urea based on site-specific mapping, so the added fertilizer only goes where it's needed."

John is 59 and farms in partnership with his 35-year-old son Justin. John wants to leave a legacy in healthy, high quality, productive soil. "I'm doing everything I can to keep soil in place for my kids' sake and their kids' sake," he says.

MAKE THE MICROBES WORK FOR YOU

Mike Plumer is a soil conservationist and consultant, and Dwayne Beck is Manager at the Dakota Lakes Research Farm in Pierre, S.D. Mike and Dwayne are well-versed in the actual biology we need to keep in mind to understand these processes. "Before we really understood microbial action, we typically thought you had to mechanically break the stalk and have dirt inoculate it for decomposition," says Mike. "That was a common practice 10 years ago."

As the combines roll through the field, Agee runs the aerator directly behind the harvesters to ensure the job is completed in a timely manner so the stripping operation can follow.

It turns out that some of the techniques we've used on continuous corn to solve other problems, such as fungi and insects, have disrupted the soil biology. And that is an element that is undermining the decomposition of the stalks. Also, Dwayne explains, "If a producer is using broadcast insecticides or a high-rate seed treatment insecticide, it may also be reducing the population of beneficial insects that begin the residue decay process."

The trouble is that the value of using tillage to solve these issues is deceiving. The kind of decomposition we want breaks residue down slowly through bacteria and fungi–a process that sequesters carbon and creates organic matter. On the other hand, tillage can cause stalks to decompose more quickly, but it promotes aerobic bacteria. Consequently, tillage releases carbon back into the atmosphere and not back in the soil where it can be used. In Minnesota, Agricultural Research Service studies show just one tillage pass will burn or oxidize 80 percent of the corn stalks, leading to carbon released in the air. Dwayne notes that tillage creates another problem: "All tillage tools reduce water infiltration. The chance of water moving residue increases with their use."

Corn stalks are high in carbon, but low in nitrogen, or protein. They cannot be "eaten" biologically unless something provides the nitrogen. Therefore the rate of desirable cornstalk decay depends on the soil biology and the amount of protein available. The best way to provide high protein material is through crop rotations, cover crops, or by supplemental applications of protein. "Those who go into no-till and a cover crop system don't have problems losing carbon to the air because they've learned there are other ways to break down residue," says Mike. "You can create a better environment for soil biology through a cover crop, or adding nitrogen to increase biological activity."

Mike also believes that to create the ideal conditions to speed up natural decomposition, one important consideration is raising the humidity level over the stalks to balance the Carbon: Nitrogen ratio. A cover crop works well especially in areas of moderate temperatures and high winter humidity. Cover crops increase humidity, keep soil warmer into the fall for more decomposition and promote a higher population of microbes, earthworms, and some of the shredder arthropods.

The aerator lifts the soil like a wave under a rug, setting it back down while moving minimal soil on top of the ground. It fractures surface compaction, yet it leaves the roots of the corn stalk firmly in place. It also creates thousands of small pockets to hold water.t

Also, a cover crop like hairy vetch can scavenge nitrogen and perhaps produce some of its own nitrogen through fixation, for a balanced C:N ratio.

Cover crops using annuals work best in the central and southern parts of the U.S. Corn Belt because there is more time at moderate temperatures for the biology to function between corn crops. Further north requires more creativity to extend the time available for biology to be active. More research is now being completed in getting cover crops established in standing corn. High-boy seed distributors, aerial seeding, and clay seed balls are often the focus of these efforts. Many of the techniques are in their infancy and researchers are trying to improve on their effectiveness.

Cover crops that grow tall enough to provide canopy conditions over the residue will enhance decomposition. Once established, the cover crop also will limit erosion. Mike explains, "Last year we harvested 200 bu. corn and had no residue by planting time this June, because we had a three-foot tall crop of hairy vetch supplying so much nitrogen it totally dissolved the stalks. This is a 12-year continuous no-till corn field, with the Bt trait, that has had a hairy vetch cover crop every year. It routinely yields 170 to 200 bpa (dryland)."

"As soils develop and build their own microbial population, you'll start seeing more natural ability to break down residue," he adds. This can even work in colder, northern environments where there's little time for biological activity after fall harvest. "If we have a cover crop with some size, it's collecting nitrogen and increasing the warmth of the soil, which makes biological activity last longer. Then it provides nitrogen in the spring, especially when we kill it, to break those stalks down."

John Agee has strip-tilled continuous corn for over 20 years and has made believers out of those who said strip-tilling simply wouldn't work on several thousand acres of continuous corn. He says autosteer and GPS mapping are critical tools in the process, but it's also important to train employees to do it right.

From a farm point of view there are two important keys to soil management," says John Agee, who farms in partnership with his son Justin. "One is economics and the other is conservation, so the soil is here for future generations."

The bottom line is that enhancing soil biology leads to better soil health, more active organic matter, higher productivity, and more profitability. If you can save soil and build organic matter all at once, that's a win for today and tomorrow. What's more, John and many others have found that not only can you strip till continuous corn on a long-term basis, but that over time as the organic matter grows, yields actually increase. "From a farm point of view there are two important keys to soil management," concludes John. "One is economics and the other is conservation, so the soil is here for future generations. The more residue you can leave in the top two or three inches of soil, the more it holds the soil and soaks up water like a sponge."

To me, it is important to highlight farmers who are successfully using no-till and strip-till because we are faced with more demands from consumers, regulators and companies in terms of our environmental footprint. There are profitable solutions to these challenges and farmers are proving it.

Howard G. Buffett is a farmer and Chairman and CEO of the Howard G. Buffett Foundation. He has farmed for over thirty-five years and the foundation has invested over $100 million in research to improve agriculture and invested more than $250 million in agriculture-related programs. Visit www.HarvestingthePotential.org and www.BrownRevolution.org to learn more about the foundation's efforts to improve farming techniques in the United States and around the world.