soil health matters: DON'T TILL IT, COVER IT!

Natural Resources Conservation Service

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Most farmers with experience in improving soil health have converted from conventional tillage to no-till farming, then over time, added cover crops into their farm operations.

Many farmers have experienced yield drops, at least in corn, in the transition years to no-till. But that doesn't have to be the case, and there's no need to master no-till before you use cover crops with no-till, says Jim Hoorman, an assistant professor and Extension educator for Ohio State University.

"No-till corn yields typically lag conventionally tilled fields by as much as 10 to 15 percent for five to seven years," Hoorman says, "until the microbial populations recover in the soil. That's because in the transition years, as microbes increase in numbers and build organic matter and humus, the corn crop has competition for nitrogen—microbes take up nitrogen faster than plants, so if nitrogen is limiting, the crop will suffer."

Jump-start microbes with cover crops

You may be able to shorten – or eliminate – a yield drop in the short term while you're on your way to increasing yields long term by using cover crops from the start with no-till, Hoorman says.

"If you grow only a corn crop, you're feeding your soil's livestock, the microbes, through living roots for only four months of the year," Hoorman says. "But those microbes with active living roots are what build organic matter. You can speed up microbial activity significantly with cover crops. The literature says there are 1,000 to 2,000 times more microbes associated with living roots than in soil without live roots. If you want to build soil, you need to leave it undisturbed and keep it covered with living plants as much of the time as practical."

"You wouldn't want to feed your family or your livestock only four months out of the year," Hoorman says. "Those microbes in the soil need food year round, too. By growing a cover crop in the winter, you feed them carbon, which they use to build organic matter.

Cover crops for a purpose

Hoorman says each cover crop is designed for a special purpose. Legume cover crops, for instance, are typically used to produce homegrown nitrogen. Grass cover crops are used to increase soil organic matter, recycle excess nutrients, and reduce soil compaction. Brassica covers are grown to loosen the soil, recycle nutrients and suppress weeds and plant pathogens. Other covers are grown to suppress harmful insects or attract beneficial insects.

Some cover crops may attract insect pests or become hard to kill, while others require little management. There are hundreds of crop rotations to consider with cover crops, so there's quite a lot of thinking to do when you introduce cover crops into your operation. For conventional tillers who want to begin a no-till program simultaneously with a cover crop, Hoorman suggests two cover crop rotations to consider:

1. Wheat, sorghum sudangrass, early maturing soybeans, winter pea or crimson clover with oilseed radish, corn, cereal rye, soybeans, back to wheat.
2. Corn, cereal rye, early maturing soybeans, brassica (oilseed radish) plus legume (crimson clover or winter pea).

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The living roots also recycle nitrogen and phosphorus in the soil profile during this off-season. That's significant because nitrate leaching into water supplies typically occurs after the crop is harvested, in the fall, winter and early spring, after microbes have released nutrients when there are no living plants to recycle the excess nutrients."

Create fields with soil-like fence rows

"Any farmer can tell you his or her fence rows have the best soil on the farm," Hoorman says. "The organic matter there, where the soil was built naturally, may be 5 to 6 percent or higher depending on soil type. Early Ohio settlers said 'the soil was black as midnight.' It's not that dark any more. Organic matter levels have been cut in half on tilled soils. And the critical part of what's missing is the active organic matter that comes from live roots. So what we're trying to do is create farm fields with soil like the fence rows."

That means eliminating tillage and creating continuous living cover on the land. Hoorman has worked with farmers who have regained organic matter to levels as high as 5 percent with the system, which is called ECO Farming or "ecological farming" in Ohio.

Start no-till in alfalfa

"Three of our primary goals for healthier soils and sustained yields are to get rid of compaction (improve soil structure), add organic matter, and jump-start microbial activity in the soil," Hoorman says. "With that in mind, the best place to start no-till is in a long-term alfalfa field or in a CRP grass field where you already have healthy microbial populations.

"On the other hand, if you start in fields where you've been tilling for years, you have layers of compaction with the wrong microbes. The transition can be made, but it takes longer and it takes more nitrogen."

To soil, tillage is like a tornado

Hoorman likens tillage to a tornado. "Tillage to the soil is like a tornado taking the roof off your house," he says. "The storm destroys your house (soil structure) and it takes away your protection until you can get cover again. You have 50 percent air and water (pore space) and 50 percent mineral and organic matter in an ideal soil, but those pore spaces collapse or are destroyed with tillage."

More farmer interest

Research on using long-term no-till with cover crop combinations is limited, Hoorman says. Most of his work with farmers has been for only six or seven years. "But I do know farmers who have used cover crops and long-term no-till for more than 15 years, and their results are impressive," he says. "They have not only increased yields but they also reduced inputs. By increasing the biodiversity and natural predators on their farms, they may decrease weed, insects, or disease causing organisms."

Contrary to what you might think, the idea of continuous living cover on the ground isn't limited to warmer climates. "I've talked with farmers in Canada who do this," Hoorman says. "It's tougher in colder climates, but it's really just a matter of finding the right cover crop."

Hoorman says farmer interest grows each year. "Dave Brandt, a farmer who's been doing this for years, had 330 people show up at his farm for a field day on ECO Farming (cover crops and long-term no-till). I'd say we're moving in the right direction."

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