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## Getting to the Roots of Cover Crop Benefits

Philip Gruber Staff Writer Nov 8, 2014



HOLTWOOD, Pa. — When you look at a tillage radish sticking 6 inches out of the ground, it is hard to imagine the plant growing taller than a person.

When following the plant's thinnest roots down the side of a 7-foot-deep soil pit, the humble brassica starts to look a little more imposing.

Attendees of the Oct. 30 Cover Crop Solutions field day looked at cover crop roots with University of Maryland researchers Ray Weil and Natalie Lounsbury on Steve Groff's research farm.



Those roots can gather a lot of nutrients for the next year's cash crops. Tillage radish, a Cover Crop Solutions specialty, can put 150 pounds of nitrogen per acre into the soil, Weil said.

About half of that nitrogen will be available to next season's crop. Radishes winter-kill around January and promptly start releasing nutrients, a few months earlier than farmers might like, he said.

Oats, by contrast, also winter-kill, but they tie up nutrients longer. “You can kind of control” how nutrients get released by varying the cover crop mix, Weil said.

Radishes can contain 150 units of nitrogen, but the soil nitrogen only drops 40 units while the plant is growing. Weil thinks the nitrogen near the surface decreases but concentrations increase deeper in the soil.

There has been concern that cover crops might tie up moisture, especially in drier climates, but tillage radishes create unusually perfect conditions, Lounsbury said.

Almost immediately after they die, the soil surface becomes drier, but the water infiltrates deeper into the soil. Farmers can drive on their fields, and the water is stored for use during the growing season, she said.

Radishes also produce lots of sugar, which attracts microbes. In turn, earthworms eat the microbes. Farmers think they are feeding corn, but they are really feeding the soil life, Weil said.

Radishes provide 10 to 15 pounds of sulfur per acre and 10 times as much calcium as other crops. All cover crops help with phosphorus numbers, though radishes are particularly good at making it more available and useable to crops, he said.

The cover crop is an option for vegetable producers as well as grain farmers. “Radish seems to have a really nice relationship with spinach,” Weil said.

He suspects this relationship occurs because neither species makes mycorrhizae, a colony of fungus around the roots.



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The exact mechanism remains unclear, but this sort of cover crop-cash crop pairing could become more common as precision planting makes it easier for farmers to plant different species in different parts of the field, he said.

Phacelia, one of Lounsbury's favorite cover crops, has a more favorable carbon-to-nitrogen ratio than grasses. It will not immobilize nitrogen like rye. “It's about like radish” in that respect, she said.

Bees like phacelia's purple flowers, but the plants are very sensitive to the nutrients already in the soil. If nutrients are low, “it's a total fail,” she said.

Mixing with crimson clover helps ensure the phacelia gets the needed nutrients, she said.

Fall cover crops go in at an ideal time for breaking up compaction, when the soils are moist.

“In spring, to a large degree, it's too late” because the cover crops will cut into the main crop's growing season, Weil said.

The cover crops at the soil pit were planted early, on Aug. 6, he said.

Over years of tillage, a plow pan can develop, making it hard for water, nutrients and roots to break through to deeper soil. “That keeps your crops in the top 6 to 8 inches,” he said.

While a pan can endure for a long time after a farmer stops tilling, “Steve's farm is somewhat exceptional” because it has been no-till for decades, Lounsbury said.

Along with tillage radish, a famous compaction-breaker, canola and alfalfa are good soil breakers, he said.



The alternative to cover cropping is deep ripping with machinery — a slow task with short-lived benefits that requires a high-horsepower tractor, he said.

The long, hairlike roots actually do much more than the bigger roots to fight compaction. These narrow guys often drill 5 feet deep or more, Weil said, pointing out roots of radishes and sorghum sudangrass that reached to the bottom of the pit.

Once a hole is established, earthworms and future roots will continue to follow that “path of least resistance and most nutrients,” Lounsbury said.

“Those channels then stay open,” Weil said. “You often see bundles of roots, generations of roots” that collect nutrients and microbes.

Despite all of the benefits for compacted soils and microbes, questions linger about whether cover crops actually increase yields. Previous research is “not all that encouraging,” Weil said.

Some studies have shown that yields fall after cover cropping, and not all studies factor in cover cropping as part of an entire suite of practices like no-till. “This is not modern cover cropping, I would say,” Weil said of one study.

It seems clear that cover cropping’s effectiveness varies by region, and it is beneficial in the Mid-Atlantic. Soybeans typically yield four to five bushels more after cover crops are used, he said.

Legumes usually provide the greatest yield increase, though even for these crops the results range from dazzling to disappointing.

“We need to do better,” Weil said.

Getting cover crops on earlier could go a long way toward improving their effectiveness. Interseeding cover crops into established cash crops might do that, but the covers do not grow much before the season ends, he said.



Philip Gruber

Phil Gruber is the news editor at *Lancaster Farming*. He can be reached at (717) 721-4427 or pgruber.eph@lpnews.com. Follow him @PhilLancFarming on Twitter.



