

# Soil health and productivity benefits of low-tillage organic systems

## The common ground between organic and no-till farming practices

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Journal of Soil and Water Conservation 63(1):19A-21A www.swcs.org

**“W**e have very good yield stability. It’s generally at or above the county average on corn and beans,” says Ron Rosmann, an organic farmer from Harlan, Iowa, when asked how he would best illustrate the health of his soils after more than a decade in organic production.

Rosmann stopped using pesticides on his 300 ac (121 ha) of row crops in 1983 and converted to ridge-till in 1987. The farm was certified organic in 1994.

“I went organic to survive. To get the profits,” he says. Stewardship and health issues also played a significant part in the decision. He might have converted sooner, but he was initially reluctant to give up synthetic nitrogen to meet organic standards.

Dave Campbell, who raises Indiana Certified Organic row crops on his 224-ac (91-ha) farm in Maple Park, Illinois, has seen similar benefits though he relies more heavily on tillage. Campbell says he “went cold turkey organic” when he took over operation of his wife’s family’s cash-grain farm in 1988. After growing up on an organic farm in the late 1960s and 1970s and running an organic dairy in Wisconsin during the 1980s, he says, “I’d done it before; I thought why not do it here.”

Campbell knew he’d face some challenges with soil health and weed pressure in the early years on the farm. “But, I knew in the

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long-term plan it would be better for the soil and would benefit my crops down the road.” Plus, “it’s nice to reap the benefits of better prices,” he says.

Economic benefits are the dangling carrot many farmers, like Rosmann and Campbell, look at when considering a switch from conventional practices to organic. Lower inputs and the ability to eventually capture premiums in the market add up to attractive profits, particularly for smaller scale growers willing to take on



Ron Rosmann, Harlan, Iowa, cites yield stability as one of the tangible benefits of his low-tillage organic farming system. His soybean harvest this year averaged 55 bushels per acre, in line with county averages.

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larger risk. Conservation, stewardship, and sustainability are ethical benefits attractive to many organic growers. New research from the USDA Agricultural Research Service (ARS) shows they may offer tangible benefits to soil quality and productivity as well.

The nine-year study by the ARS Sustainable Agricultural Systems Laboratory found that organic practices used with light tillage in corn, soybeans, and wheat built soil better than no-till practices in the same crops. The organic system included applications of manure and use of cover crops. The news may take some conventional growers by surprise. Many believe organic farms deplete soil by using tillage for weed control. That's not necessarily the case according to the study.

Further, a three-year follow-up study at the ARS Beltsville farm showed the organic plots had more carbon and nitrogen in the soil. In the follow-up study, corn was grown in a no-till conventional system on all of the plots that had been used in the longer study. The formerly organic plots realized an 18% yield advantage over the rest of the plots.

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**All that nitrogen in Rosmann's "closed loop" adds up to attractive yields, especially in corn.**

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Ron Rosmann isn't surprised by this news. His six-year rotation looks like this: two years in nitrogen-fixing alfalfa or orchard grass, a year in corn, a year in soybeans, which also fix nitrogen, another year in corn, and then barley or oats for a year. He primarily uses ridge tillage between crops—with some chisel or shallow moldboard plowing in the year he plants to alfalfa. He applies composted manure from his certified organic livestock operation in the fall, as time and weather allow. He rotationally grazes his 80-head cow-calf herd on the land in pasture. All that nitrogen in his "closed loop" adds up to attractive yields, especially in corn.

"Corn in the first year coming off alfalfa pasture is great," he says. One year he reached 190 bushels  $\text{ac}^{-1}$  (11,915  $\text{kg ha}^{-1}$ ). While that's not typical, his results are generally in line with yields on conventional farms in his area of the state. His soybean yields this fall averaged 55 bushels  $\text{ac}^{-1}$  (3,695  $\text{kg ha}^{-1}$ ); corn averaged 155 bushels  $\text{ac}^{-1}$  (9,720  $\text{kg ha}^{-1}$ ).

Rosmann, who has received numerous awards for his commitment to soil conservation, admits it's hard to show exactly why his yields have improved. He says better genetics and better management both probably play a part on his farm. Nevertheless, he believes using ridge tillage in an organic system has been beneficial over the long haul.

On Dave Campbell's farm, corn and soybean yields were not particularly good in the early years. But this crop year, as he was tuning up his combine, Campbell was expecting 150 bushels  $\text{ac}^{-1}$  (9,407  $\text{kg ha}^{-1}$ ) of corn. "Across the board yields have gone up; I wouldn't say dramatically, but enough," he says.



**Ron Rosmann composts manure from his hog and cattle operations in a long, uncovered windrow that lies in a protected area between fields. He land-applies the manure in the fall as time and weather allow.**

In his three-year rotation, Campbell typically plants a third of his ground to small grains, seeded down with red clover as a cover crop. Fields spend a year in corn before soybeans and a year in oats or soft red winter wheat after soybeans. Before planting corn he typically makes two passes with a chisel plow to incorporate the red clover cover crop that was under-seeded with his previous small grain crop.

In early May of the year, a field is planted to soybeans; he'll make a pass with a moldboard plow for a cleaner seedbed. That ground may lay fallow for only two or three weeks before planting. Ahead of small grains, he'll do a light disc pass followed by a pass with a field cultivator, and plant immediately after.

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**An added benefit from the oats in Campbell's rotation is that the crop is allelopathic, which means it can reduce weed establishment.**

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**Rosmann's conservation tillage and organic practices offer a glimpse at the fertile common ground between organic growers and proponents of no-tillage.**



**Dave Campbell raises certified organic row crops on the farm his wife Mary's ancestors homesteaded. Sustainability, stewardship, and conservation are key reasons he chooses to farm organically.**

"Any time I'm working the ground, I try not to leave the soil exposed for very long. My goal would be to have a crop or a cover crop growing most of the time," he says. "In the years when a cover crop of oats is planted, the seeding would take place in early September, so the oats provide a good cover going into the winter. An added benefit from the oats in his rotation is that the crop is allelopathic, which means it can reduce weed establishment.

When presented with the idea that some conservation-minded no-till producers might look askance at his tillage practices, his gut reaction is to tell them this:

"Go out and look at your fields, and look at my fields. Look at what is happening when you get a strong wind or rain." But there's more to it than that, he says, after some thought.

"In a no-till system, much of the organic matter from the plant residue oxidizes into the air, wasting potential nutrients and humus. In most situations, biological activity is much higher in an organic system, which builds humus levels in the soil. Allowing air into the soil stimulates roots and soil life. Humus is increased by recycling crop residues such as green manure crops," he adds.

"In general you're going to see an increase in soil health," says Campbell, who soil tests on his farm every three years or so. He explains, "There's a reason almost every farm had livestock on it years ago. It's a sustainable system. If I had my own source of manure I would have been better off. I used to buy bulk quantities of phosphorous and potash, which have become very costly in recent years, especially the trucking cost to my farm.

"I'm using more compost in the last few years." He also applies calcium products such as gypsum and limited amounts of phosphate and potash, which are present in the certified organic corn starter fertilizer he uses.

"The soil tests haven't changed much recently, but overall soil health has improved," he says.

As an early cooperator in the N-Trak late-spring nitrate testing system developed by Alfred Blackmer at Iowa State University, Ron Rosmann has been tracking nitrogen response in his corn

fields for more than a decade. The test has allowed him to fine-tune his fertilizer applications accordingly.

Rosmann adds that, in his experience, it's the crop diversity that leads to better overall soil health, with less insect and disease pressure.

"The longer rotations lessen all the negative factors of monoculture," he says. "Pesticide-dependent systems bring weed and insect resistance, and kill beneficial fungi and soil microbes."

Rosmann is a strong proponent of reduced tillage for organic row crops for many reasons. Among them, he's convinced that ridge tillage dramatically decreases weed pressure.

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#### **Rosmann demonstrated that ridge tillage beats discing and plowing by a wide margin in terms of weed control.**

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In on-farm test plots conducted for the Practical Farmers of Iowa, Rosmann demonstrated that ridge tillage beats discing and plowing by a wide margin in terms of weed control. He participated in the study in part to convince other organic growers to consider using ridge-till.

If soil conservation and high productivity are the goals of a farming system, Rosmann's low-tillage, diversified farm may well represent the fertile common ground between organic and no-till conventional farming practices.

#### **ORGANIC PRACTICES FOR SOIL HEALTH**

- Crop rotations include a soil-building legume or small grain/legume mixture following row crops to break weed, insect, and disease cycles. Legumes also fix nitrogen and recycle nutrients like phosphorus and potassium.
- The same row crop is not grown in consecutive years in the same field.
- No synthetic pesticides or synthetic fertilizers are used for three years prior to harvest.
- Certain approved rock phosphate and naturally mined potassium chloride fertilizers are allowed if needed.
- Organic certification agencies recommend, but don't require, manure to be composted prior to land application.
- For grain crops, manure is applied at least three months prior to harvest and is not applied to frozen or snow-covered ground in order to prevent runoff into waterways.
- Irradiated products, biosolids, and sewage sludge are not used.

Note: Some of this information was adapted from Iowa State University Extension publications "Soil Quality in Organic Agricultural Systems" (PM 1882) and "Fundamentals of Organic Agriculture" (PM 1880).

All photos courtesy of Cheryl Rainford.