



The traditional choice for cover crops has been red clover underseeded to winter wheat, but that's changing.

Reset on cover crops

Research is shining new light on when – and why – to make cover crops part of your routine field management

Much of what is known about specific practices in agriculture has been constructed then modified and sometimes deconstructed altogether. It's an ongoing process that applies to virtually every cropping practice, from the use of moldboard plows to no till and from planting depth to fertility rates.

Cover crops have been studied extensively across many parts of North America. Researchers often use rotations of corn, soybeans and winter wheat underseeded with red clover in their presentations on fertility or soil health. Dr. Bill Deen of the University of Guelph has conducted long-term studies on the impacts and benefits of cover crops, with a special focus on red clover.

The use of legumes and the adoption of grass species, multi-blends and inter-seeding are seeing increased usage and scrutiny, be it by growers, researchers or organizations. Farmers who support the use of cover crops — or “nurse crops” or “service crops” — are often dedicated proponents of the practice. They make cover crops work because they want them to work.

Now, some researchers are trying to determine the actual value of cover crops,

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Multi-species blends can do many things for soil health but finding the right recipe can be a challenge.



In regions like the Prairies or the Great Northern Plains, cereals are a typical cover crop, mainly due to a short growing season, colder temperatures and limited precipitation.

from the costs of managing them to evaluating actual fertility levels released in the soil. In many cases, each answer generates another series of questions.

One common thread with cover or service crops, though, is that growers often grow them for more than one reason. Planting a legume for the nitrogen credit the following season is one while keeping the soil covered or reducing erosion may be another. Maintaining a root system or helping break up compacted layers, and breaking disease or pest cycles or smothering weeds are some other rationales. The reasons can be as varied or as unique as the farm, its rotation, weed, insect or disease pressures, soil types, climate, soil health qualities (including organic matter), even its history.

Woody Van Arkel has a unique outlook with his on-farm practices. As dedicated as he is to no till and improved soil health, he is also a sugar beet grower. It's a crop that

is tillage-intensive as a rule but he limits his tillage to one strip-till pass and another post-harvest to level the soil, which includes incorporating cereal as a cover crop.

Van Arkel's primary goals for his cover crops are to keep the soil covered and to maintain a root system, and for that, he uses a multi-species blend that includes legumes, grasses, brassicas and sunflowers. Whether he sees a significant nitrogen credit is harder to determine, other than red clover which he says works.

"I do see some benefit to adding legumes to a blend after wheat," says Van Arkel, who farms near Dresden, Ont., and is a member of the Soil Health Network. "I believe that improved soil health, with very little tillage and cover crops, cycles nutrients differently. And with improved nutrient cycling, we have a less leaky system and are not losing as much out the tile drains. I'm still skeptical that we can reduce fertilizer inputs with the use of cover crops."

One thing he's more certain of is that shorter rotations challenge the use of cover crops. It's not the production of corn, soybeans, wheat and sugar beets that confounds the use of cover crops. Thinking through a "total systems" approach to crop plans and being determined to make cover crops work are also essential.

"I think it's much easier to find fits for cover crops in a larger rotation," says Van Arkel. "Trying to find a place for cover crops in a corn-soybean rotation is more difficult."

WHAT ABOUT YIELDS?

Cover crop usage has taken on a fervent following among growers, much like no-till management, and it takes that commitment that Van Arkel refers to. Yet among the reasons cited for not growing cover or service crops, at the top of the list is often yield drag. For most, yield is the only metric that counts and many cover crop advocates are quick to concede that the enthusiasm surrounding their use doesn't always match actual impacts. For instance, the idea that cover crops will release nitrogen to the soil the following spring is one notion that doesn't always hold up to analysis.

Two recent studies have attracted attention regarding the use of cover or service crops. In one, Iowa Learning Farms (ILF) and Practical Farmers of Iowa (PFI) combined on a 10-year project involving farm-scale research and real-time decision-making by grower participants. Its primary goal was to determine how cover crops affect yield in a corn-soybean rotation. In both crops, yields were unaffected or showed slight improvement. Yields in both corn and soybeans declined slightly during the final eight years of the project.

The other is a two-site project conducted by Dr. Dave Franzen, a soil specialist with North Dakota State University. He set out to measure the N-release from cover crops on two very different farms. One has a 40-year history of no till with 20 years of cover crop management while the other is a recent conversion to no till but

without a history of cover crop use. Specifically, he wanted to determine if there was an optimum carbon:nitrogen (C:N) ratio with cover crops as it relates to N-release.

According to documents from the United States Department of Agriculture (USDA) and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), the lower the C:N ratio, the greater the opportunity for nutrient release. Corn stover can run as high as 80:1 by OMAFRA's standards while the USDA cites a rye cover crop as having a 26:1 ratio.

For Franzen, a C:N ratio of 10 using sugar beet leaves left behind after harvest and then returned to the soil before the ground freezes in fall will provide a measurable N credit in the spring.

"But we haven't seen that yet with our cover crop mixes," says Franzen, noting that on one of the farms, they had fababeans one year plus volunteer spring wheat, some flax and some forage radish. "If you figured all of the dry matter and all of the nitrogen that was in there, the C:N ratio combined would be about 18:1 and you'd expect that you'd have some release from that, but we didn't."

Instead, it took the nitrogen from the soil as it was supposed to, but at 18:1, there was no contribution of nitrogen to the next crop the following spring. That surprised Franzen.

"There's a lot of talk in North Dakota about cover crops and what they'll do, but nobody had any replicated research, so that's why we did it and we're still doing it," says Franzen. He adds that different conditions will affect a grower's rationale and their commitment to any cropping consideration, including cover crops. "Before we started this work, I thought maybe there'd be some variation one way or another but I really thought C:N ratios would answer all of our questions. And that hasn't worked out."

Instead, he's found regional differences and applications relating to crop rotations, cover crop options, soil types and climate, all of which have an impact on a grower's willingness to add cover crops. Much of North Dakota mirrors the dryland prairie environment of Canada's western provinces, so it's not a simple matter of planting legumes in search of nitrogen credits or significant N-release in spring.

"One of the things places like Maryland or areas around Chesapeake Bay can do that we can't is that they can grow vetches and legumes of fairly high nitrogen contents and

fairly low C:N ratios (around 10:1) that will winter there," says Franzen. "Before they grow the crop in the spring, they continue that growth and have nitrogen released from those legumes. If we put in red clover or other legumes, we're just wasting money."

"All soil fertility is local," he adds.

Franzen's research results also create an interesting profile of grower reasoning behind planting cover crops. As his colleague, Dr. Abbey Wick, pointed out in a AgWeek.com piece in late August, the fact that cover crops in the Northern Plains don't have a strong N-release in subsequent spring doesn't mean they're bad: there are many benefits. The key is to understand the goals for a particular farm based on rotation, soil type and overall soil health.

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— *Woody Van Arkel,*
Chatham-Kent grower

UNDERSTANDING COMES FIRST

That kind of understanding really has to come first, according to Cameron Ogilvie, communications and outreach co-ordinator with Soils at Guelph. The use of cover crops, or "service crops" as he prefers to call them, requires a grower to answer one fundamental question: What do I want to accomplish. Ogilvie maintains there is no single primary reason that a farmer cites for growing cover crops. In his experience, it's usually a multi-pronged approach.

"Some people are growing them as green manures, trying to get a fertility benefit from them or to reduce compaction in the soil," says Ogilvie. "Some are growing them for soil cover, so there it's appropriate to call them 'cover crops.'"

He acknowledges the concerns about any potential yield losses in employing service crops, for the same reasons a grower would be concerned about the yield of next year's crop if they didn't have a good rotation established. It's always a challenge to try to fit something new into a system, whether it's introducing a crop to the rotation, trying a new piece of equipment or incorporating

a service crop. If it doesn't fit in easily or it causes concern with its inclusion, there's the potential for a yield hit or at the very least, added stress on the grower.

There are a couple of provisos that Ogilvie adds as part of the decision-making process: based on the research that he's seen, in order to make no till work well, a grower needs to include service crops. Conservation agriculture, that system that so many talk about, includes no till, service crops, keeping the soil covered and having living roots in the soil year round, and a good rotation.

"These are some of the keys to making this system work and I'm not sure that no till works very well if you don't incorporate some of these other elements of the system," says Ogilvie.

Asked if some of the reluctance regarding service crops is a reflection of their increasingly complex uses — from simple red clover after winter wheat to multi-species blends to inter-seeding into standing crops, he believes the reluctance is due to shortened rotations. He echoes Van Arkel's observation about shorter rotations, adding that the move by some growers to drop winter wheat from standard rotations is actually serving to complicate matters.

"Winter wheat is a great crop to be able to fit in a service crop and as we've seen wheat acreage decrease, we're grasping at straws to see how we can get the mix in the rotation," says Ogilvie. He concedes the difficulty in getting winter wheat planted some years, but statistics reflect an added shift in attitudes towards longer rotations. "Now we're having conversations about inter-seeding and you're potentially looking at new equipment, and I believe that makes it more complicated."

IT'S ALL IN THE ATTITUDE

Still, the decision behind growing cover crops comes down to a simple commitment on the part of the grower, and here Ogilvie adds his voice to Van Arkel's observations. It's the attitude and desire of the grower to change their management practices and to make service crops a part of their cropping system.

"If service crops are going to work it's essential that farmers are determined to make them work," says Ogilvie. "I would even say that an openness to using service crops is a great thing. But if you're open to it and then you have a really bad year, you get a bad yield loss to your production crop, that open door can close pretty quickly."