soil health matters:
INNOVATE TO IMPROVE SOIL HEALTH

Natural Resources Conservation Service

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Cover crops, a traditional conservation practice considered old-fashioned by many in modern agriculture, are being used in new ways by innovative farmers to improve their soil's health.

"Modern agriculture's cover crop pioneers have figured out how to make them work on their farms, with some impressive results," says Joel Gruver, Western Illinois University's (WIU) go-to guy in cover crops. "It's going to take home-grown innovation by farmers who haven't used cover crops to really ramp up their use. I say that because everyone's situation is different; cover crops aren't an 'off the shelf' practice that can be done the same way on every farm."

While the basic principles of cover crops may stay the same, the best genetics, establishment, and termination methods for your operation can vary widely with respect to objectives, location, weather conditions, crops, soil types, and more.

In and out of favor

Gruver, an assistant professor of soil science and sustainable agriculture at WIU, points out that before World War II, most farmers included forage legumes like alfalfa and red clover in crop rotations ahead of nitrogen-demanding crops like corn. Forage grasses and small grains were also commonly used to curb soil erosion.

"Cover crops fell out of favor during the rise of mechanized agriculture in the 1950s and 1960s," Gruver says. "In the 1970s, growing public concern about the environment combined with spikes in input costs sparked renewed interest, both by farmers and the research community. Many USDA Ag Extension publications in the 70s and 80s promoted the use of cover crops as key components of conservation cropping systems, and lots of work was done on using cover crops to protect water quality."

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What a cover crop may do for your soil

Farmers have found many advantages to using cover crops. A fairly recent entry into cover crop mixes—radishes—demonstrates some of those benefits. "Radishes are NOT a silver bullet," Gruver says, "but they are a cover crop with much potential and few residue management challenges." One caution, he says is that opportunities for fitting radishes into corn and soybean cash grain systems are limited compared to systems with crops that are harvested earlier like small grains, vegetables, or corn silage.

Advantages for using large-rooted daikon-type radishes in a cover crop mix include:

1. Robust roots can extend more than 3 feet deep in 60 days—after the radishes winter-kill, the channels created by the roots tend to remain open at the surface, improving infiltration, surface drainage and soil warming, as well as improving root growth on following crops.
2. The radish roots are a biological alternative to deep ripping to alleviate soil compaction.
3. A good stand of radishes can eliminate nearly all weed growth during and for some time after active radish growth.
4. Because radish residues deteriorate rapidly after winter kill, there are few residues to deal with at planting time.
5. Rapid, deep extension of radish roots makes them excellent scavengers of residual nitrogen following summer crops, both from the topsoil and deeper layers.

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6. Because radish residues decompose and release nitrogen rapidly, the next crop may get an early boost in nitrogen uptake and growth, similar to following a legume cover crop.
7. Full canopy closure in as little as three weeks after planting offers rapid soil protection against erosion.
8. Lab tests show radish residues reduce the survival of root knot nematodes and soybean cyst nematodes.
9. On-farm comparisons in four states have shown significant increases in corn and soybean yields following radishes compared to fallow or other cover crops.

But interest in cover crops waned in mainstream agriculture again during the extended period of depressed crop prices and relatively inexpensive inputs from the late 1980s to the mid-2000s. Despite that, Gruver says, cover crop research and on-farm innovation continued, linked to soil quality initiatives and growing interest in organic agriculture.

Over the last five years, interest in cover crops has begun to surge again, driven by many interacting factors:

- High crop prices (farmers have more money to spend)
- Higher input costs (farmers are motivated to find ways to use inputs more efficiently)
- Growing concern about compaction especially in no-till farming systems
- Interest in carbon sequestration to mitigate climate change
- Cover crop cost-share programs
- Regional collaborations like the Midwest Cover Crop Council
- High profile articles about cover crops in mainstream farm publications
- The arrival of radishes as a novel cover crop with few residue management challenges
- Aggressive marketing of cover crops by new vendors of cover crop seeds
- The rise of farmer participation in internet forums, facilitating discussion by cover crop innovators
- The widespread use of digital cameras, allowing farmers to easily share photos of giant radishes and other impressive looking cover crops
- The arrival of technologies like GPS guidance that facilitate new ways of using cover crops

Low on the learning curve

"We're still relatively low on the learning curve of figuring out how to get millions of acres of cover crops planted and managed effectively," Gruver says. To make cover crop use mainstream, he believes, many more farmers will have to adapt the practice to their farms, not just adopt the practice.

"Fortunately, many of the farmers trying cover crops now are experienced no-tillers or strip-tillers who have a track record of doing the type of trouble shooting necessary to make cover crops work consistently," Gruver says. He says he thinks a lot of progress can be made by researchers in cover crop genetics through dedicated breeding programs.

Gruver also sees a need for research on complex cover crop mixtures, so there will be a scientific basis for designing optimal mixtures. " Innovative farmers seem to be achieving impressive results using cover crop cocktails—complex mixtures of cover crops—but the scientific basis for these results is limited," Gruver says.

Untapped potential in precision cover cropping

Gruver also sees management opportunities within a strategy he calls "precision cover cropping." That could mean planting cover crops with precision planting equipment like a corn planter, or using GPS guidance to target placement of cover crop rows relative to where subsequent crop rows will be planted. "It can also mean fertilizing cover crops or using other practices specifically targeted at improving crop performance," he says.

"Cover crop management today isn't just a revisiting of old practices abandoned by the fathers and grandfathers of today's farmers," he says. "Innovative large-scale grain farmers have started integrating cover crops into their production systems in ways that were never even considered before."

Cover Crops reduce nitrate leaching at low cost

"Many farmers in the Corn Belt are currently deficit spending on P and K," Gruver says. "They're harvesting more P and K than they are returning to the soil in commercial fertilizer, manure, or other nutrient sources. Simply reducing nutrient application rates isn't a sufficient strategy for minimizing nutrient pollution."

While practices including constructed wetlands, bioreactors, alternative ditch designs and others are being promoted to remove nitrates from ground and surface water, Gruver says science clearly points to cover crops as a more economical alternative. "Those practices generally cost more per unit of nitrate removed, plus they don't build organic matter, increase water holding capacity, suppress pests, diseases and weeds, or offer the other in-field benefits associated with cover crops."

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What to look for in a cover crop

If you're considering cover crops, Joel Gruver recommends you consider those with:

1. Fast germination and emergence
2. Competitiveness with weeds
3. Tolerance to adverse climatic and soil conditions
4. Ease of suppression/residue management
5. Fertility/soil quality benefits
6. Acceptable cost

Important questions to ask yourself before you begin

Gruver has worked with many farmers who are using cover crops, and he has tested cover crops on university plots. He has a long list of questions a farmer should consider before the first cover crops are planted. Five of the most important are:

1. What equipment is available (owned, available for rent or custom hire) to seed cover crops in my area?
2. What windows of opportunity exist as defined by weather and climate, current cropping practices, cover crop genetics—and can current windows be expanded by acceptable adjustments like shorter season crops or alternative cover crops?
3. How will I terminate the cover crop and achieve an acceptable stand of the next crop?
4. Will I have the time and labor to make this work?
5. What's my contingency plan—and risks—if the cover crop doesn't establish or doesn't die on schedule?

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