

## *The Pluses and Minuses of Today's Most Popular Cover Crops*

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- 'Covering Up' For Better No-Till Soil Biology, Profits
- Covering Up: 'Part 2.' Taking Soil Heath, Profits To A Higher Level

*By Martha Mintz, Contributing Editor*

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# Annual Rye Grass

Description: Erect, cool-season annual grain that can grow to 36 to 72 inches tall at maturity. Roots typically reach 18 to 24 inches, but may have difficulty penetrating compaction.

Uses: Weed suppression, nitrogen scavenging, erosion prevention and increasing organic matter.

Planted With: Can be paired with legumes to offset nitrogen tie-up, but may have an allelopathic effect on many potential companion crops.

**W**ITH FIBROUS ROOTS THAT stretch to great depths, a big benefit of an annual ryegrass cover crop is what it can do for soil quality.

“The roots grow through compaction. I’ve even seen them grow through glacial pans, claypans and fragi-pans soils,” says Michael Plumer, University of Illinois agronomist. “It can make a huge difference in soil quality for growing crops.”

Benefits build from year to year, Plumer says. In poor soils, the roots may reach only 28 inches to 36 inches deep the first year annual ryegrass is planted.

“You get some benefit initially, but as you continue to use annual ryegrass in no-till, for additional years the rooting depth gets deeper,” Plumer explains.

As it roots deeper, crops follow suit.

“I’ve had corn roots go to 75 inches deep and soybean roots go 30 inches deep in claypan soils where soybean roots don’t typically get more than 12 inches deep,” Plumer says.

The massive fibrous root increases soil organic matter, improves soil tilth, breaks compaction, improves water infiltration and paves the way for crop roots to reach deeper for moisture and nutrients.

## Holding Nitrogen

Annual ryegrass is also what Plumer calls a luxury feeder when it comes to nitrogen. Whatever nitrogen is put on the

field, it will take up.

It’s been documented to take up more than 800 pounds of nitrogen per acre when nitrogen was severely overapplied and the annual ryegrass grew to flowering.

“The nice part of that is if you kill it before it’s jointed in the spring, it will return from 60% to 85% of the nitrogen to the growing crop,” Plumer says. “The actual amount of nitrogen taken up can vary quite a bit, 20 to 100 pounds per acre, because the nitrogen is being scavenged not fixed.”

“There has to be residual nitrogen in the soil, which will vary by soil type and field history, for the annual ryegrass to take up.”

The usually dense cover also offers some weed suppression, but unfortunately also is capable of outcompeting companion cover crops when early planted.

## Establishment

Getting annual ryegrass established before cold weather sets in is critical to ensuring it survives until spring, thus providing the most benefit possible.

“It’s crucial that annual ryegrass is planted early. If it doesn’t get to two or three leaves in the fall, you will have winter hardiness issues,” Plumer says.

“You have to be careful with aerial seeding because annual ryegrass is not

shade tolerant,” Plumer says. “Corn needs to be drying down and soybeans need to be yellowing before seeding.

Also, annual ryegrass is lighter than many other crops. It only weighs 26 pounds per bushel as compared to 56 pounds per bushel for cereal rye. Swath width needs to be decreased accordingly to avoid gaps. Wind may alter the spread pattern.

For best establishment, producers should drill annual ryegrass 3/8 of an inch deep.

“It will be out of the ground in 5 days with moisture if you drill it and if you really want it to run hard, apply 20 to 35 pounds of nitrogen. It will speed establishment and get some winter hardiness,” Plumer says.

The benefit to this is that annual ryegrass returns nitrogen fairly quickly. Plumer says in an experiment he conducted, he cut annual ryegrass in January, applied 2 inches of water over it (simulating rainfall) and leached out more than 80 pounds of nitrogen in 24 hours. That’s with no decomposition.

“It returns most of the nitrogen 30 to 45 days after it’s killed,” he says.

When drilled, Plumer recommends 12 to 15 pounds of seed per acre or 20 to 25 pounds when broadcast aerially.

### Spring Management

If conditions are wrong, controlling annual ryegrass in the spring can be a challenge.

“It’s not hard to kill if it’s in the vegetative state and you pay attention to weather. You can get 98% to 99% control in reasonably warm conditions with a full rate of herbicide and the appropriate

amount of AMS to handle water hardness,”

Plumer says. “But once it starts jointing or the weather is cool, it becomes more difficult to kill. It’s a forage grass, so it tends to re-tiller.”

He says producers can see as much as 10% to 15% re-tillering if conditions aren’t ideal. For this reason, Pierceton, Ind. no-tiller Jamie Scott recommends no-tillers follow an annual ryegrass cover with glyphosate-tolerant soybeans to allow for in-crop escape management.

“It’s best to apply your burndown when annual ryegrass is actively growing during warm days,” Jamie says. “What we don’t want are the cool nights. Make sure you quit spraying in the early afternoon to give the glyphosate time to translocate.”

### Need To Know

While there are more than 50 varieties of annual ryegrass available, Plumer warns only about five or six have good winter hardiness for the Midwest. More varieties are being developed.

He says a few producers are planting very early using Gulf varieties and plan on getting good rooting by winter. With this method, the ryegrass winterkills, eliminating the need to kill it in the spring.

# Cereal Rye

Description: Erect, cool-season annual grain that can grow to 36 to 72 inches tall at maturity. Roots typically reach 18 to 24 inches, but may have difficulty penetrating compaction.

Uses: Weed suppression, nitrogen scavenging, erosion prevention and increasing organic matter.

Planted With: Can be paired with legumes to offset nitrogen tie-up, but may have an allelopathic effect on many potential companion crops.

**R**ELATIVELY EASY TO ESTABLISH and manage, cereal rye is often the go-to crop for no-tillers making their first foray into using cover crops.

It's an excellent cover crop for building organic matter, producing approximately 4,000 pounds of residue per acre throughout much of the Corn Belt though it's capable of producing up to 10,000 pounds per acre.

Cereal rye is good for scavenging nitrogen, controlling erosion and is highly allelopathic – a bonus for no-tillers struggling with winter annual weeds. A Maryland study found cereal rye reduced weed density an average of 78% when rye residue covered more than 90% of the soil.

"Cereal rye has a wide fall planting window," says Michael Plumer, University of Illinois agronomist.

Cereal rye can grow at 38 F and will germinate at temperatures down to 34 F. Once established, it's among the most winter-hardy of small grains and can withstand temperatures below 0 F.

Used often after corn, cereal rye will tiller fairly quickly in the fall, Plumer says. In spring, it will grow quickly and mature, depending on the variety, at 5 to 6 feet.

Some growers will spray burndown when cereal rye reaches knee high to reduce the amount of biomass produced.

"There are some varieties that can get 7 feet tall in just 30 days," Plumer says.

This can be concerning for no-tillers due to the sheer mass of organic matter, but the cereal rye cover can be burned down long before it gets to that point

## Establishment

Establishing cereal rye is simple, which is part of its appeal.

"I usually see cereal rye being established by broadcast seeding," Plumer says. "Aerial seeding is fairly common and works well, but it also can be broadcast seeded with fertilizer. It comes up fairly well on the surface with adequate rainfall."

"Most people don't drill cereal rye due to time and expense. but it's drilled in erosion areas like hillsides and waterways."

Seeding rates, he says, depend on how early the crop is planted and how dense producers want the stand to be.

"The earlier it's seeded, the lower the seeding rate needed since there will be more time for tillering," he explains. "If you drill it, you can also cut the rates quite a bit."

If broadcast early on flat ground, Plumer suggests 60 to 70 pounds of seed per acre. Increase rates to 70 to 90 pounds for aerial seeding and where erosion control is needed. Drop drilled rates to 45 to 50 pounds.

You can fertilize cereal rye. Plumer says many no-tillers incorporate cereal

rye into their fall fertilization program for a one-pass application. Cereal rye will take up and hold nitrogen, but plan properly if you want nitrogen returned to next year's crop.

"If cereal rye isn't killed at 10 inches or less, you won't get much nitrogen back," Plumer says. "As it starts jointing, the plant becomes high in cellulose and lignin and requires a lot of nitrogen to break down."

This isn't as much of an issue in soybeans, which don't need the same nitrogen levels as corn. But, cereal rye can tie up nutrients for a year or more if allowed to mature.

"You will get the nutrients back, but it takes time to decompose," Plumer says.

### Spring Management

A benefit and danger of cereal rye is its ability to dry out the soil in the spring.

"If you manage it carefully, cereal rye can take up extra moisture and get you in the field quicker," Plumer says. "But if left too long, it can dry out the soil severely to a depth of 2 feet. I've seen instances where it dried the soil to the point that soybeans wouldn't germinate."

When to kill cereal rye in the spring depends on conditions and the grower's comfort level. Glyphosate, Gramoxone or grass herbicide applications work well for controlling cereal rye. Mowing or rolling are also effective, but must occur at or after flowering to prevent regrowth.

"I have some no-tillers that let cereal rye grow until they plant soybeans even if it heads out," Plumer says. "Others never

let it get over 18 inches tall. When allowing it to grow later, farmers should carry a spade to make sure the soil isn't getting too dry."

Hallsville, Mo., no-tiller Frank Martin deals with moisture issues yearly due to 8 inches of topsoil sitting on a clay layer. He's had success no-tilling corn into a living cereal rye cover. However, he does kill the cover crop sooner in dry years.

"When you plant into a living cover, you're letting it manage moisture until the crop gets up a few inches and

can manage the moisture on its own," Martin says.

He's never had to replant when no-tilling into a living cover crop, but he relies on GPS for no-tilling due to the height of the cover.

One risk when letting cereal rye grow to maturity is that its allelopathic tendencies have a greater chance of impacting the following crop, especially corn.

"You can get stunting and germination reduction in corn if the weather is cool and damp after planting," Plumer says. If killed when 12 inches tall or less, he says the allelopathy should dissipate in 2 to 3 weeks with 1 inch or more of rain.

"It doesn't have any effect on soybeans," Plumer says. "It seems to stimulate soybean growth and reduce weed pressure."

**"If you manage cereal rye carefully, it can take up moisture and get you in the field quicker..."**

# Clover

Description: Perennial, biennial or winter-annual legumes often used for grazing.

Uses: Nitrogen fixation, weed suppression and soil conditioning.

Planted With: Works well with multiple other crops, including legumes, to maximize nitrogen benefit and with small grains for root diversity.

CLOVERS ARE AN EXCELLENT choice for cropping rotations that include short-season small grains, such as wheat, oats and barley. Depending on the variety used, clovers are typically frostseeded into already-planted small grains.

“When frost-seeded, clover will come up in the growing crop and work on building a root system,” says Dale Mutch, covercrop specialist for Michigan State University. “When the companion crop is harvested, clover kicks in and grows to about 2 feet tall before fall.”

Referred to as green manure as a cover, clovers can fix significant levels of nitrogen. An Ohio State University fact sheet says crimson clover frost seeded into oats produced 78 pounds of nitrogen per acre by mid-April to mid-May as measured in plant tops and roots. Sweet clover yielded 115 pounds.

“We’ve seen red clover that we frostseeded into wheat and mowed in the fall yield a 100-pound nitrogen credit,” Mutch says. “No-tillers typically follow clovers with corn to take advantage of that nitrogen benefit.”

According to a Wisconsin study funded by Sustainable Agriculture Research and Education, red clover was the most profitable of five legumes either planted after oats harvest or with oats in early spring.

## Establishment

How clover is established depends on the variety. Mammoth red clover and intermediate red clover are perennials and are best suited for frost seeding.

“In Michigan, we frost seed in March,” Mutch says. “Try to time seeding with when you think the snow is going to break. If you broadcast seed on 6 inches of snow, it will all end up where the water takes it.”

He suggests broadcasting 15 pounds of clover seed per acre on 1 inch of snow.

“That small amount of snow will melt and help incorporate the seed,” he explains.

When frost seeding into wheat, no-tillers need to be mindful of fertilizer applications. Mutch says nitrogen should be applied as usual, but to be careful not to overapply the normal rates for good wheat production or it could hurt clover establishment.

An annual red clover variety, crimson clover is best suited to drilling after a shortseason harvested crop like wheat or barley.

“Evaluate weed pressure before planting, as crimson clover does not compete well,” he says. “Clean up weeds with glyphosate and no-till drill crimson clover.”

When drilling, the seeding rate can be backed off to 10 to 12 pounds per acre. Seed costs run around \$20 to \$24 per acre.

Mutch does not recommend seeding

clovers into standing corn or soybeans.

“We are looking into this practice, but hybrids grow so tall that there is no light getting between the rows. That makes establishment difficult,” he says. “We are looking at species that can tolerate shade.”

As for white and sweet clovers, Mutch says they do have their place.

“Sweet clover puts out great roots, but can get a big woody stem and isn’t as good as a forage crop as red clovers,” Mutch says.

“I’ve seen good success with white clovers in blueberries in acidic soils.”

“It’s just hard to beat red clover. It’s adaptable and often outperforms sweet clover when planted in a mix.”

Sweet clover is widely adapted to many temperature and rainfall zones and is credited with mining nutrients like potassium and phosphorus from deep in the soil profile. The mycorrhizal fungi that surround its roots also increase phosphorus availability.

## Management

The perennial clover species can be mowed and even harvested for forage in the fall with no apparent impact on nitrogen fixation.

“Mowing stimulates growth of red clover in the fall. We’ve seen excellent nitrogen returns from mowed crops,” he says.

He says no-tillers will get more nitrogen by allowing clover to grow all winter. While crimson clover, an annual, is likely to winterkill without good snow

cover, controlling the perennial clovers requires some decision making.

“Some farmers are planting from April 1 to mid-April and want soils warm,” Mutch says. “With cover crops, the soil can be cooler, so some no-tillers may want to control clovers with a herbicide in the fall.”

If controlling in the fall, Michigan State recommends mowing clover, allowing it to regrow for 4 weeks and then treating with 2 quarts of glyphosate.

Its Web site notes no-tillers have had luck controlling red clovers in the spring with glyphosate plus 2,4-D 7 to 10 days prior to corn planting. They warn that clover escapes can be an issue in soybeans and therefore are best suited before corn.

No-tiller Scott Flanders of Liverpool, Pa., burned down his red clover cover crop on April 26 at 14 to 18 inches tall, then planted corn 10 days later.

“Planting went fine, but burning down a little earlier might get the residue a little crisper instead of green and make it that much easier to work with,” he says.

Corn after red clover yielded 120 bushels per acre using only starter fertilizer. The yield is on the high side for his farm.

## Need To Know

If clover hasn’t been grown on a field for a long time, inoculating the seed becomes very important.

“Use an inoculant if clover hasn’t been grown in the last 2 years,” Mutch says. “It will improve nitrogen fixation and overall plant growth and health.”

**“It’s hard to beat red clover. It’s adaptable and often outperforms sweet clover when planted in a mix...”**

# Hairy Vetch

Description: Summer- or winter-annual legume producing up to 12-foot vines and an extensive taproot.

Uses: Nitrogen fixation, weed suppression and erosion prevention.

Planted With: Field peas, crimson clover, buckwheat and small grains, including cereal rye, oats and winter wheat.

**A**N EXCELLENT ROOT SYSTEM, LARGE biomass and nitrogen fixation of about 80 pounds per acre in some no-till systems make hairy vetch a great cover-crop option where it works –and a profitable one at that.

A University of Maryland study found that when compared to Austrian winter peas, crimson clover, wheat and fallow, hairy vetch was the most profitable cover when used in a rotation before no-till corn.

“Hairy vetch provides winter cover and has a root system that leaves the soil in excellent condition,” says Ron Mulford, retired University of Maryland Poplar Hill research farm manager.

It also produces significant biomass, with vines that can grow up to 12 feet long and effectively smother weeds. However, most of that growth occurs in the spring, making it essential to get hairy vetch well established in the fall so it doesn’t winterkill.

“For Maryland’s Eastern Shore, you need hairy vetch in the ground by Oct. 6 to get it established and get the growth and nitrogen benefit in the spring,” Mulford says.

But it may not be the best bet for all no-tillers. Ohio State University says it’s critical to plant earlier for Ohio’s climate. Seeding there must take place in July or early August to produce adequate growth, making it an option after small grains.

Ohio State research indicates hairy vetch seeded in September will yield only about 35 pounds of nitrogen by mid-May, if allowed to grow that long.

“In harsher environments, it does need to be planted early,” Mulford says. “It doesn’t start fixing nitrogen until 3 to 4 weeks after planting and would fix very little, maybe 10 pounds of nitrogen, if it doesn’t survive the winter.”

Hairy vetch is often paired with cereal rye or another small-grain cover, he says.

“Cereal rye has a more fibrous root system, so both cover crops add to the structure of the soil,” he says. “The vetch will wrap itself around rye and stand up more, which some claim makes it easier to plant into because it doesn’t create such a mat.”

## Establishment

One method of establishing hairy vetch is to aerially broadcast it into soybeans when leaves are about 50% yellow, but before leaf drop.

“This rotation gives producers nitrogen from the soybeans and the hairy vetch for their corn the next year,” Mulford says.

It also can be aerially broadcast into standing corn or drilled after harvest of wheat, oats or any other short-season crop.

When drilled, seeding rates should be 15 to 20 pounds per acre or 25 to 30 pounds per acre when broadcast, according to the Sustainable Agriculture

Research and Education Web site. Higher seeding rates may be needed if seeded late in the fall.

“If drilling, calibrate the drill to the manufacturer’s recommendation for a small-seeded legume and place it no more than 3/8 inch deep,” Mulford says. “I always inoculate hairy-vetch seed. Some don’t, but it’s cheap insurance for good growth.”

He notes that like other legumes, hairy vetch prefers a near-neutral pH of 6.5. Mulford may check pH and lime if necessary for the benefit of the cover crop and the following crops.

### Management

To get the most nitrogen benefit, Mulford says no-tillers need to let hairy vetch grow as late as possible in the spring.

He adds corn can be no-tilled into living hairy vetch and no-tillers can use Gramoxone and a residual herbicide for one-pass control of the cover and weeds.

“You can either plant into the living cover, or you need to kill it and let it get brown prior to planting,” Mulford says. “If you kill it ahead of time and don’t let it get brown, it lays down and you can have issues getting the planter unit into the ground.”

If planting into live hairy vetch, he does recommend applying herbicide immediately after planting.

“The longer you let it go, the more chance it will pull too much moisture. In a dry year, the corn may not germinate,” he says. “A good date to push for is April 10 to April 15 to get good nitrogen production.”

Once killed, the dense cover creates a

mat that can help conserve moisture and suppress weeds for the crop.

### Watch Outs

“Vetch has hard seed, so if you plant corn into vetch and then follow with wheat, hairy vetch can show up in the wheat field,” Mulford warns. “We strongly caution no-tillers growing wheat for seed not to plant hairy vetch.

“It’s easy to kill, but if you miss it, it doesn’t take many plants for wheat seed to be turned down.”

Harmony plus 2,4-D is effective on small vetch in the spring and can be used before wheat is 8 inches tall.

# Brassicas

(Oilseed radish, forage radish, tillage radish, forage turnips)

Description: Radish taproots can penetrate 32 inches into the subsoil and produce up to 5 tons of organic matter.

Uses: Soil conditioning, compaction alleviation, nutrient scavenging, forage and weed suppression.

Planted With: Austrian winter peas, Canadian field peas, hairy vetch, sunhemp, crimson clover, cereal rye, annual ryegrass or as part of a cover-crop cocktail.

**A**LONE OR MIXED WITH OTHER covers, brassicas are a great option for improving soil quality, holding over nutrients and adding organic matter.

The impressive taproot of radishes, depending on the species, can extend 32 inches into the ground, breaking compaction, increasing water infiltration and scavenging nutrients. The large root contributes up to 5 tons of organic matter per acre.

“Radishes make the soil mellower by opening and loosening it,” says no-tiller and cover-crop pioneer Steve Groff of Holtwood, Pa. “It also picks up nutrients, carrying them over and giving them back to the following crop.”

He notes radishes have been shown to increase yields by about 12 bushels in corn and 8 bushels in soybeans. Not all radishes are created equal, however, Groff warns.

“We get higher yields with our tillage radish brand because they’ve been selected for cover-crop purposes, not forage,” he says. “They produce a longer, straighter taproot that goes deeper into the soil profile.”

Brassica covers are often used to hold over nutrients from manure applications.

“Radishes don’t need fertilization, but in poorer-quality soil, you can add 40 to 60 pounds of nitrogen to help the radish express its genetic potential and root down better,” Groff says. “Whether

synthetic or manure, you will get that nitrogen back the following year.”

Ohio State University data shows oilseed radishes are capable of recycling 184 pounds of nitrogen per acre.

## Establishment

For best results as a cover crop, radishes should be planted 4 to 10 weeks before the first killing frost.

Groff says they are typically established between July 15 and Sept. 15 in the Corn Belt, making them a good fit after wheat or short-season corn or soybeans. Drilling is the preferred method of establishment.

Once seeded, radishes will grow aggressively, which helps to suppress winter annual weeds.

“Broadcast or aerial seeding can work, but it’s inconsistent. The weather really has to cooperate,” Groff explains. “You need wetter conditions and results range anywhere from total failure to complete success with about a 70% success rate.”

If taking that risk, Groff says seed needs to be broadcast just prior to leaf drop in soybeans and after drydown starts in corn.

Radishes should be planted  $\frac{1}{4}$  to  $\frac{1}{2}$  inch deep, or up to 1 inch if conditions are dry. Seeding rates can range from 6 to 20 pounds per acre depending on the type of radish.

For tillage radish, Groff recommends

6 to 8 pounds per acre with an average seed cost of \$2.50 to \$3 per pound, depending on the quantity.

“It can be a challenge to get the calibration accurate for lower seeding rates with the small seeds,” Groff says. “Some farmers are mixing in either another cover crop or something benign, like cracked corn.”

“An emerging practice is to use planters with small plates, such as sugarbeet or small milo plates, for precision planting. You can cut seeding rates in half because you’re getting better seed singulation.”

With a 15-inch planter, no-tillers can plant every other row with peas.

“This combination is nice since peas give nitrogen and radishes store it over winter to give back to the corn,” Groff says.

Radishes have been successfully grown with cereal rye and many other cover crops. Groff has combined radishes in a cocktail mix of up to nine different species.

## Management

A few nights in the teens will kill radishes, making management simple in most climates. In some southern climates, there is the risk that radishes will not winterkill. In that situation, Groff recommends spraying radishes with glyphosate plus 2,4-D when they start to flower.

“At that point, they’ve accomplished everything you want. You don’t want them to go to seed because that seed will volunteer the following year,” Groff says. “There is no benefit in leaving them to grow longer.”

Decomposing radishes return nitrogen to the following crop. In the mid-Atlantic region, Groff says nitrogen starts becoming available in mid-March through May 1.

“If a field was planted to straight radishes, it should be planted first because the nitrogen has the potential to leech away. We want to capture it,” he says. “Radish fields are good candidates for early planting. The holes made by the taproots provide drainage and create a warmer, drier field earlier in the season.”

No-tillers desiring a more winter-hardy brassica can go with forage turnips.

“The root is narrower than radishes, but forage turnips still get a good long taproot that can penetrate compaction layers and scavenge deep nutrients,” says Thomas Bjorkman, Cornell University horticulturist. “I’ve seen forage turnips survive near-zero temperatures, which means they can last through a mild winter.”

By living longer, forage turnips hold nutrients longer and reduce the risk of nutrients becoming soluble and leeching away before planting, Bjorkman says.

## Watch Outs

Odor can be an issue with radishes, making them less than ideal for some closely populated areas. When they winterkill, decomposing radishes can put up an unpleasant smell.

“I put it on par with manure,” Groff says. “The intensity of the smell is related to how quickly the radishes were killed and how much it warms up afterward. If it’s a gradual winter, you may not notice an odor.”

**“Radish fields are good candidates for early planting...”**

# Small Grains

(Winter wheat, oats, triticale, barley)

Description: Winter or cool-season annual cereals.

Uses: Erosion prevention, nutrient recycling, organic-matter builders, soil compaction reduction and weed suppression.

Planted With: Legumes and other small grains.

**W**ITH THEIR FIBROUS ROOTS, SMALL grains are ideal for holding soil and nutrients in place. Iowa State University research found that an oats cover crop overseeded into no-till soybeans reduced inter-rill erosion by 26% and rill erosion by 65%.

Small grain covers reduce erosion, but each species has different strengths. Winter wheat and triticale are a no-tiller's best bet if they want additional benefits from spring growth. Rapid spring growth of overwintering cereals can suppress weeds and provide additional erosion protection.

Small grains such as oats, spring wheat and spring varieties of triticale will winterkill, so they are more effective in the fall. They do, however, tend to grow faster than fall cereals, achieving quicker ground cover and fall weed suppression.

Barley is a good fit for no-tillers struggling with dry conditions. It's more drought tolerant than some small grains. According to the University of California, barley tillers more than oats for excellent weed suppression and tolerates alkaline soils.

## Spring Oats

Oats are often used as a cover crop in a corn-and-soybean rotation.

"We worked almost exclusively with oats in no-till initially because it's readily available and inexpensive," says

Tom Kaspar, USDA-ARS research scientist in Ames, Iowa. "Another advantage is that oats winterkill in most places, so you don't have to worry about a herbicide application."

Through his research, Kaspar found that waiting to drill oats until after soybean or corn harvest in the Midwest meant not getting enough growth before fall to make the cover worth growing.

"We like to broadcast oats into soybeans about the time leaves start to yellow, usually in late August," he says. "The bean leaves fall on top of the seed and keep it moist. The oats are up and growing by harvest."

He says oats usually reach 2 to 3 inches by soybean harvest. Oats can be broadcast into corn, but it's not as effective.

When successfully seeded, oats usually achieve 6 to 8 inches of growth before winterkilling. They can be used as a nurse crop for winter cereals.

"We pair oats with cereal rye because they tend to grow better for quicker ground cover in the fall because they're not working on developing roots like the cereals that intend to overwinter," Kaspar says. "We broadcast a 50-50 mix and the cereal rye fills in after the oats are gone."

## Winter Wheat

"Winter wheat provides erosion protection and scavenges some nitrogen that is in the soil profile," says Keith

Johnson, Purdue agronomist and forage specialist. "It's great after soybeans or corn harvested for silage where little residue remains to hold soil in place."

University of Maryland research found that winter wheat seeded in September took up 40 pounds of nitrogen per acre by December. It can scavenge and hold phosphorus and potassium for the next crop.

"Another advantage with wheat is if a no-tiller decides to let it reach full maturity, it can be more easily marketed than winter rye or winter triticale," Johnson says.

This could occur if wet conditions persist during corn or soybean planting times. He notes that winter wheat can be harvested as a forage crop in the spring or, if planted early enough, for fall and early winter grazing if soil conditions permit animal traffic.

"Winter wheat breaks dormancy around the third week of March in Indiana and can be grazed in the spring prior to corn planting if soil conditions are not too wet," Johnson says.

Winter wheat fits as a cover following corn harvested for silage or after soybeans.

According to Iowa State University, winter wheat and other winter-hardy small grain covers should be planted immediately after harvest and no later than Oct. 15. That date shifts earlier in northern climates and later in southern climates.

"Due to the seed size, it's best to drill small grains," Johnson says. "They can be broadcast, but that requires consistent

rain during germination and establishment."

Drill 1.5 bushels per acre of high-quality seed ½ to 1½ inches deep. The 1½-inch depth should be used when soils are dry.

It's best to let wheat grow as long as possible without letting it get too large, or it can be difficult to get the crop killed.

If a no-tiller wants to harvest the wheat as hay or silage, try to harvest it in the boot stage or early heading. Soybeans or corn for silage are excellent crop choices when the winter wheat is harvested as forage.

If controlling a wheat cover crop with herbicides, the crop needs to be out of dormancy and actively growing.

According to the Sustainable Agriculture Research and Education Web site, winter wheat is growing in popularity over cereal rye because it's cheaper, slower to mature in the spring and easier to kill. Because it's easier to kill, it is less likely than barley or rye to become a weed in subsequent crops.

### Watch Outs

Small-grain residue can result in immobilization of nutrients for a period in the spring while microorganisms work to decompose the residue. Iowa State University recommends a starter fertilizer that includes nitrogen to hold corn over until nitrogen is released back into the system.

They also suggest that if no-tillers apply 150 pounds of nitrogen or less per acre that they increase their rate by 10% following a small-grain cover crop.

**"Winter wheat offers erosion protection and keeps nitrogen in place..."**

# Peas

(Austrian winter peas,  
Canadian field peas and cowpeas)

Description: Summer- or winter-annual legumes.

Uses: Nitrogen fixation, surface compaction alleviation, nitrogen scavenging and forage.

Planted With: Excellent companion for tillage radishes or small grains, including wheat, rye triticale or barley.

**NITROGEN IS THE BIG PAYOUT WITH** these legume cover crops. Each species is capable of producing up to and, in some cases beyond, 150 pounds of nitrogen per acre. While similar, each species has its own fit as a cover crop.

## Cowpeas

A native of Africa, cowpeas do well in dry conditions and are usually planted in mid- to late July after wheat harvest and ahead of corn.

“Cowpeas can be planted immediately after wheat harvest,” says Jim Hoorman, Ohio State cover crops and water quality specialist. “They loosen up the soil, add organic matter and can contribute 130 to 150 pounds of nitrogen per acre.”

Hoorman notes he’s seen 7 years of Ohio State University trials where corn grown after cowpeas yielded the same with no additional nitrogen inputs as corn that had 150 pounds of nitrogen applied.

“The corn in these trials grew extremely tall and the leaves were dark green, indicating adequate nitrogen,” Hoorman says.

He notes he’s seen these results for 140-to-150-bushel corn. For high-yielding corn, it will likely be necessary to front-load about 40 pounds of nitrogen per acre and determine additional nitrogen needs in-field with a pre-sidedress nitrogen test.

“The nitrogen from cowpeas will usually become available after June 1,

so you will need some early nitrogen for high-yielding corn,” Hoorman says.

Cowpeas are too large for broadcasting, so Hoorman recommends drilling them at ½ to 1 inch deep at a rate of 40 to 50 pounds per acre. He notes that cowpeas typically cost around 80 cents per pound.

While there are 60 or more varieties available, Hoorman has had good results with the Iron Clay variety and warns no-tillers to be careful in their selection.

Most cowpeas will grow about waisthigh by fall and will die at the first hint of frost, Hoorman says. For this reason, cowpeas are not typically paired with other crops. Most of the nitrogen is in the leaves, which form a thick carpet when the plant dies. This residue usually breaks down easily and causes little or no problems for no-till planting.

Of the crops listed here, Hoorman says cowpea is the best for surface soil compaction and attracts beneficial insects.

## Austrian Winter Peas

Often confused and interchanged, Austrian winter peas and Canadian field peas are closely related, but they are different varieties and each behaves uniquely in a cover-crop situation.

“Ninety percent of the time, Austrian winter peas will not survive winter, whereas Canadian field peas will with adequate snowfall,” Hoorman explains.

Unlike cowpeas, Austrian winter peas prefer cooler temperatures and more moisture. They can be used during a cool, wet summer or in the fall. They are more viney than cowpeas and get as long as 4 or 5 feet. For this reason, winter peas are often paired with a secondary cover crop, such as a small grain or oilseed radishes.

“With a split-row planter, you can plant winter peas on 30-inch centers and split them with oilseed radishes,” Hoorman says. “The radishes grow faster and the pea can wrap around the plant to get off the ground.”

He says both plants will winterkill. No-tillers should try to plant corn ½ to 1 inch away from the holes left by the radishes.

“The soil temperature can be 4 to 5 degrees warmer where radishes have pushed the soil up, and then the nitrogen from the winter peas is between the rows for easy access,” Hoorman says.

### Canadian Field Peas

Canadian field peas differ from Austrian field peas in that they can survive the winter. Hoorman has worked with the Windham and Scepter varieties with good results. If they bloom before fall, they will not survive the winter.

“They will survive the winter only if they get 3 to 4 inches tall in the fall and then get some snow cover,” he says. “Then they should survive and grow in the spring.”

Canadian field peas make an excellent partner for oilseed radishes, Hoorman says. The additional benefit is the potential for spring growth.

“When radishes winterkill, the spring growing field pea will recycle the

nitrogen from the decomposing radish and help hold more nitrogen in the system,” he says. “Let them grow as long as possible in the spring to get the most nitrogen production.”

Hoorman has experimented with planting corn into a living Canadian field pea crop, but says most no-tillers prefer to spray peas prior to planting corn. The lush plants are easy to control and give back about 80 to 90 pounds of nitrogen if allowed to grow.

For the best success with this combination, Hoorman says peas and radishes must be drilled between Aug. 1 and Sept. 1. They can follow wheat or short-season soybeans. When planting with radishes, pea seeding rates can be cut back to 30 pounds per acre.

### Nitrogen Recyclers

People don’t typically think of legumes as nitrogen recyclers, but Hoorman says they can be used to scavenge nitrogen from manure.

“The plant will use 25% of its carbohydrates to produce nitrogen, so if it can get it for free, it will grow better,” he explains. “It will take up what nitrogen it needs and then make its own additional nitrogen.”

If applying a large amount of manure, Hoorman recommends going with a grass or oilseed radish cover to hold the nitrogen. But for small amounts, peas can benefit from manure and, when the manure doesn’t meet all their needs, produce more nitrogen.

# Sorghum- Sudangrass

Description: Fast-growing, warm-season annual can grow 5 to 12 feet tall. When stimulated by mowing, roots can grow 10 to 16 inches deep.

Uses: Increasing organic matter, weed nematode and disease suppression, compaction alleviation, improving soil quality and scavenging residual nitrogen.

Planted With: Buckwheat, forage soybeans or cowpeas.

**M**ORE COMMON IN VEGETABLE rotations, this large biomass producer may have a place in more traditional corn-soybean-small grain rotations. Capable of producing 4,000 to 5,000 pounds of biomass per acre as a cover, sorghum-sudangrass builds organic matter.

Quick root growth stimulated further by mowing has proven sorghum-sudangrass to be an excellent option for breaking compaction. In fact, a Cornell University study found summer-planted sudangrass to be the best single-season cover crop for alleviating soil compaction in vegetable fields.

The warm-season annual needs to be planted in mid-July for best results, making it a potential fit following small grains.

"It likes 70-degree temperatures or hotter," says Thomas Bjorkman, Cornell horticulturalist. "It can reach 2 feet in height in about 6 weeks."

While the surface biomass is impressive, Bjorkman says much of the biomass is in the roots.

"No-tillers should let it grow a couple of feet, mow it and then let it grow again," he says. "Mowing will stimulate tillering."

Dale Mutch, Michigan State University cover crop and IPM extension specialist, sees a fit for sorghum-sudangrass in no-till as a summer cover crop.

"A lot of no-tillers had too much moisture this spring and it was July

before they could get in the field," he says. "An option for them would be to plant sorghum-sudangrass as a summer cover and as a forage crop."

Great care should be taken in using sorghum-sudangrass as forage due to the possible risk of prussic-acid poisoning to livestock. The risk is greatest when plants are less than 24 inches tall or have been drought-stressed or killed by frost.

It can also work following a crop or cover crop that failed. However, Mutch notes, if no-tillers are planting in August or later, they should look to oats because sorghum-sudangrass is very sensitive to cold.

Sorghum-sudangrass can suppress weeds and reduce nematode and disease pressure. All parts of the plant secrete sorgoleone, a chemical that suppresses weeds at very low concentrations.

"It mostly works to suppress weeds that are seedlings at the same time, with most of the allelopathy occurring early in its life," Bjorkman says.

Research indicates it successfully suppresses velvetleaf, large crabgrass, barnyardgrass, green foxtail, smooth pigweed, common ragweed, redroot pigweed and purslane. If planted densely, sorghum-sudangrass also serves to smother weeds.

Bjorkman says no-tillers struggling with nematodes — especially root-knot nematodes — may find sorghum-sudangrass appealing. While it can

suppress nematodes, it works best when the sorghum-sudangrass is incorporated in the fall, not really a viable option for most Corn Belt no-tillers.

### Establishment

Sorghum-sudangrass can be broadcast or drilled.

"I prefer drilling because, with cover crops, it's crucial to get them off to a fast start and have no gaps in the stand," Bjorkman says. "It's easier to do that with drilling for most growers."

Washington State University recommends a broadcast seeding rate of 40 to 50 pounds per acre when sorghum-sudangrass is grown for cover. They recommend that no-tillers harrow to cover the seed.

For drilling, Bjorkman recommends 30 pounds of seed per acre, but notes that seed sizes vary a lot between varieties. He says no-tillers should get a variety-specific recommendation from their seed dealer.

When drilling, Washington State recommends placing seed at a 1-inch depth or as deep as 2 inches if planting into excess moisture. They also recommend applying 75 to 100 pounds of nitrogen per acre.

### Management

Mowing is a critical part of managing sorghum-sudangrass. It stimulates tillering and root growth to maximize soil benefits and makes it easier to manage in the fall.

"If allowed to get tall and then freeze

in the fall, it may be hard for no-tillers to manage in the spring because it will have large crowns and stems that don't want to break up," Bjorkman says. "You really don't want to let it go in the fall."

Sorghum-sudangrass may need to be mowed twice or more to ensure that large, tough crowns do not develop.

Washington State reports 3 to 4 feet of growth is the optimal height to use sorghum-sudangrass as a latesummer green manure.

"Mowing while it's still tender makes sure you don't get a lot of long-lasting residue on the surface," Bjorkman says. "The more it matures, the longer it will take to break down. I'm not sure how well no-till planters will slice through tough crowns."

Control of the cover crop is simple. It is very frost tender, and will quickly winterkill in most climates.

Nitrogen tie-up in sorghum-sudangrass residue can be an issue. SARE recommends interplanting a legume cover crop with it to offset the effect. They also note that no-tilling sorghum-sudangrass before a later-planted crop can give the residue more time in the spring to decompose.

Bjorkman does note that, while not as productive, straight sudangrass produces an easier-to-manage stem and may be a better fit for no-till systems.

**"It mostly works to suppress weeds that are seedlings at the same time..."**

# Buckwheat

Description: Summer annual broadleaf grain achieving 3 feet of growth and a fibrous root system.

Uses: Weed suppression, soil conditioning, phosphorus recycling and attracting beneficial insects.

Planted With: Sorghum-sudangrass or as part of a cover-crop cocktail mix.

WITH A HISTORY OF BEING USED FOR weed suppression in the Northeast for several-hundred years, buckwheat is possibly one of the most historic cover crops.

It has long been successful for summer weed suppression due to the fact that it grows extremely quickly, reaching maturity in just 10 to 13 weeks while producing 2 to 3 tons of dry matter.

“It’s one of the fastest-growing summer annual crops, achieving cover in just 30 days and maturity in about 90 days,” says Robert Myers, Jefferson Institute director of programs at Columbia, Mo. “It can be planted in midsummer for quick cover without much fertility and its quick growth will smother weeds.”

Often used following wheat or as an emergency cover following crop failure, buckwheat will grow approximately 3 feet tall with 1-to-2- inch-wide leaves, providing a thick ground cover.

It does well in low fertility soils and, according to the Sustainable Agriculture Research and Education Web page, is often used to rejuvenate overfarmed fields.

The broadleaf grain is very tender, which makes for easy decomposition and quick return of nutrients to the next crop.

“It’s kind of a fragile crop,” Myers says. “Driving through it will smash it down and it won’t bounce back.”

He says many no-tillers report the fibrous root helps improve soil tilth, but does not do well in severely compacted soils. The roots usually stay in the top 10 inches of the soil profile.

Buckwheat has been reported to extract more phosphorus from the soil than other grain crops used as covers.

While an excellent weed suppressor, buckwheat and its soil-conditioning benefits can be short-lived and it can leave the soil bare for winter.

For that reason, Cornell University recommends following it up with a secondary cover crop, such as annual ryegrass, to maximize the soil-conditioning benefits and protect against erosion throughout the winter.

Jay and Rodney Arentz of Arentz Hay & Grain in Littlestown, Pa., have used buckwheat as part of a seven-way, cover-crop cocktail, including sunflowers. They’ve noticed that buckwheat attracts numerous honeybees, which they find encouraging among recent reports that honeybee populations have been crashing.

“When the buckwheat was in full flower, the field was loaded with honeybees,” Jay Arentz says. “Then the sunflowers came in after the buckwheat and gave the honeybees another food source for 2 months.”

## Establishment

Cornell University recommendations

say buckwheat can be seeded as a cover crop from June through early August.

Achieving a consistent cover is essential for weed control. Any gaps over 10 inches will allow for weed growth.

Seed can be broadcast or drilled. Myers recommends drilling 50 pounds of buckwheat per acre 1 inch deep or shallower in 6- to 7-inch rows.

The shallower the seeds are placed, the quicker they emerge, which is important when weed suppression is the goal.

Rates should be bumped to 80 to 90 pounds per acre for broadcast seeding.

Once again, when weed suppression is the goal, care should be taken to get even coverage.

Cornell recommends scouting for thin or bare patches after germination and filling them in with more seed.

“It’s not the cheapest cover crop,” Myers says. “It costs around \$6 to \$8 per acre and seed can be difficult to locate, so shipping can add to the cost.”

Buckwheat does well in marginal soils and does not typically require any additional nutrients.

“You could add some nitrogen to maximize growth following a high-nitrogen using crop,” Myers says. “But if you apply too much, it can get too tall and floppy.”

## Management

If planted late, no-tillers can rely on frost to terminate buckwheat. But because it grows and matures so quickly, actively controlling it in the fall is often

necessary.

The lush plant is considered easy to kill with herbicides or by mowing.

According to Cornell, buckwheat needs to be in full bloom for effective control with mowing. Mow too early and the buckwheat may resprout from lower nodes.

Full bloom occurs in about 35 days and mowing should occur no later than 10 days after bloom.

**“It’s one of the fastest-growing summer annual crops, achieving cover in just 30 days...”**

“It’s easily killed by mowing or by herbicides in the fall,” Myers says. “It also can be left for hay or grain production.”

“Many farmers grow it after wheat as a grain crop, not just for soil cover. A successful harvest will control growth.”

If allowed to grow for too long, no-tillers may see buckwheat volunteer in the following crop, Myers says, noting that it’s easily controlled by any broadleaf herbicide.

## Watch Outs

Herbicide carryover can inhibit a buckwheat cover crop.

According to Cornell, buckwheat should not be planted after use of atrazine, Pursuit (imazethapyr), Permit (halosulfuron) or Reflex (fomesafen).