COVER CROP GUIDE

CISCO SEEDS

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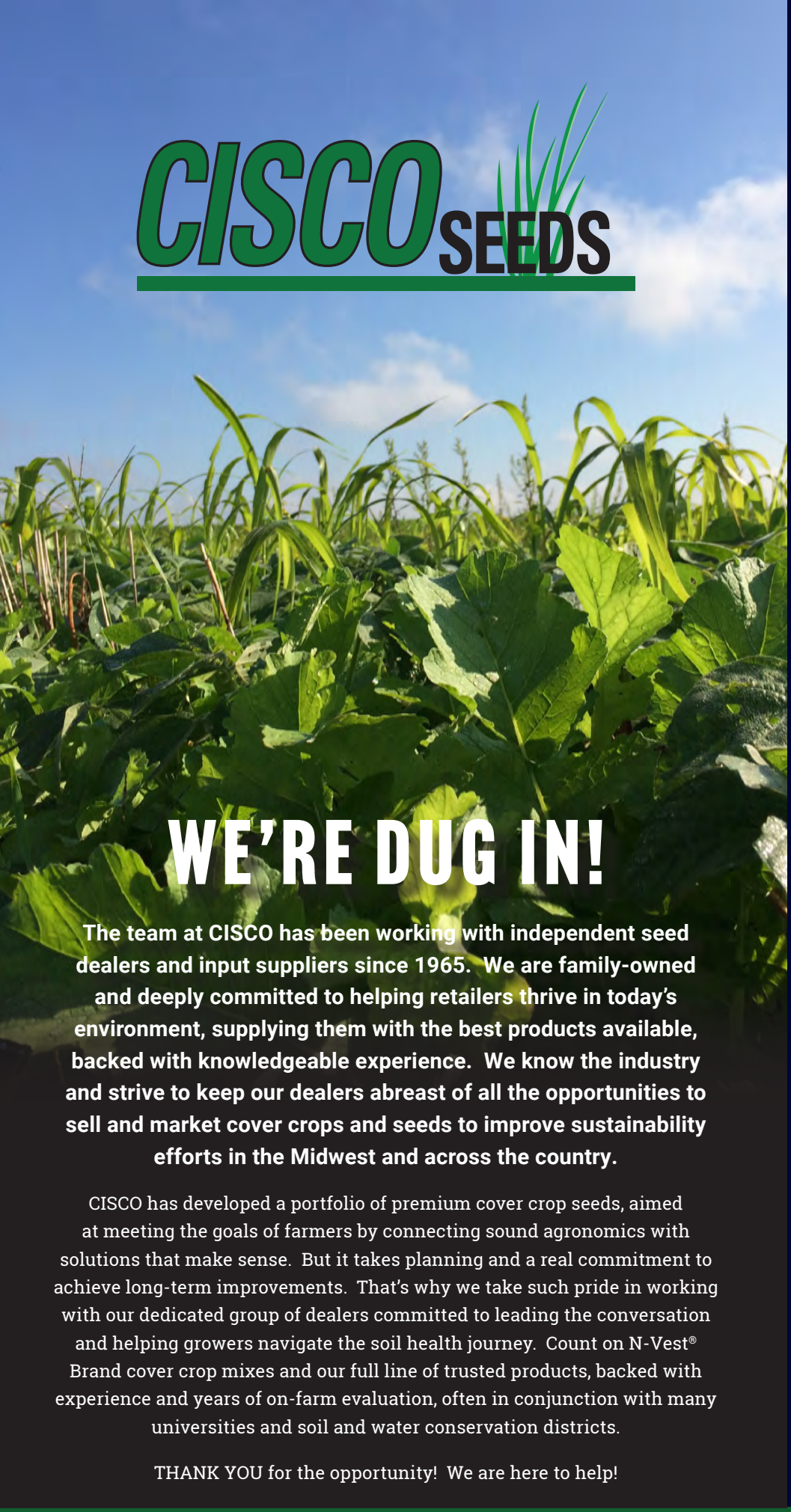


COVER CROP SEED GUIDE

WE'RE DUG IN!

The team at CISCO has been working with independent seed dealers and input suppliers since 1965. We are family-owned and deeply committed to helping retailers thrive in today's environment, supplying them with the best products available, backed with knowledgeable experience. We know the industry and strive to keep our dealers abreast of all the opportunities to sell and market cover crops and seeds to improve sustainability efforts in the Midwest and across the country.

CISCO has developed a portfolio of premium cover crop seeds, aimed at meeting the goals of farmers by connecting sound agronomics with solutions that make sense. But it takes planning and a real commitment to achieve long-term improvements. That's why we take such pride in working with our dedicated group of dealers committed to leading the conversation and helping growers navigate the soil health journey. Count on N-Vest® Brand cover crop mixes and our full line of trusted products, backed with experience and years of on-farm evaluation, often in conjunction with many universities and soil and water conservation districts.

THANK YOU for the opportunity! We are here to help!

HAVE A GOAL IN MIND & MAKE A PLAN

Houses are not built without a plan. Similarly, a sound conservation practice, like implementing cover crops, begins with an understanding of the goals and the expected benefits.

1 **With help from your partners at CISCO, select the right cover crops to help reach those benefits.** Different species have unique characteristics intended for distinct benefits and positive outcomes. The right species (and perhaps a distinct variety) will move the plan forward. Conversely, utilizing the wrong cover crop in a given geography, rotation, or cropping plan can bring unintended consequences.

2 **Plot out a cropping plan to give the cover crop the best opportunity for success and understand that a few changes may be needed to maximize the potential.** Growers new to cover crops may consider starting with smaller fields or acreage, as new management considerations will undoubtedly emerge. Planting windows are crucial, so modifying crop rotations and/or shifting harvest dates slightly can make a big difference. Don't forget how pesticides can negatively affect cover crop performance as well.

3 **As soon as possible, make certain that equipment and labor are prepared and ready to go, as timely seeding is critical.** Work with CISCO Seeds to ensure seed is where it's needed, understanding that most all cover crop seed originates outside of the Midwest, and it may take additional time.

4 **Be willing to make a few tweaks along the way.** Mother Nature often has other plans in mind, so balancing goals and management expectations will be needed. Even the best-looking stands of cover crops can cause problems when spring weather doesn't cooperate, or when other pests or challenges unexpectedly show up. Improving conservation and overall soil health takes time; growers would be wise to think long-term with their expectations, and practice patience along the way.

9 short and long-term goals that create financial value:

SOIL SURFACE PROTECTION

Covers planted in-between traditional row crops protect the topsoil from water and wind erosion. This canopy helps shield the soil surface from weather extremes, retaining valuable soil moisture and minimizing evaporation.

DECREASING UNDESIRABLES

Cover crops that produce noticeable biomass, or when planted at higher seeding rates, suppress weeds by direct competition and by shading the soil. Cereal rye releases allelopathic compounds that deter smaller seeded weeds from germinating. Others have shown the ability to reduce nematode populations by controlling the winter annual weeds that serve as a refuge, or by releasing chemicals that biologically fumigate vulnerable soil environments (in sugar beet and potato rotations).

ALLEVIATING COMPACTION

Many popular cover crops are known for their roots. These roots break through tough, compacted soil. These root channels improve aeration, water movement, and soil structure.

IMPROVE SOIL STRUCTURE

Over time, living cover crops, along with earthworms and other beneficials, will methodically improve soil structure. Cash crop roots will penetrate soil with greater ease, allowing oxygen and microbial populations to grow. As cover crops grow and die, soil aggregates are formed that catch organic matter and build soil structure. Improvements in soil structure ultimately allow for better utilization of nutrients and water.

NUTRIENT CYCLING

Scavenging leftover nutrients from preceding row crops (and reducing run-off) is a mainstay of today's covers. Depending on the species, phosphorus (P) and potassium (K) sequestered within the soil profile can be made available for successive cropping systems.

NITROGEN FIXING

Legume cover crops convert nitrogen (N) from the air into nitrogen that plants and our subsequent row crops can utilize, often reducing overall fertility (N) requirements.

POLLINATOR BENEFITS

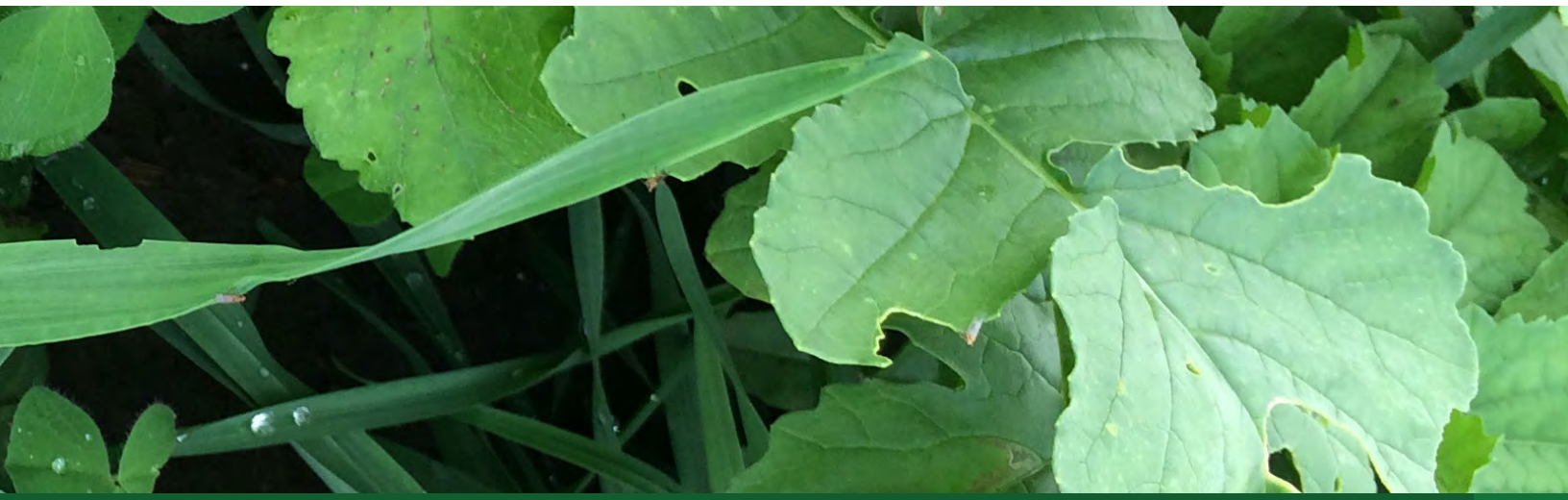
Many cover crops create the habitat, shelter, and overall biodiversity needed for pollinators and wildlife in general.

FORAGE CONTRIBUTION

There's no better way to make cover crops pay for themselves than by utilizing the growing biomass for livestock forage. More info can be found on page 11.

ORGANIC MATTER (OM) IMPROVEMENTS

Integrating cover crops adds carbon, which feeds the soil food web, and enhances soil tilth and water holding capacity. OM percentage within the soil expands as the cycle continues; more nutrients are securely stored as humus develops. Measuring OM increases is a long-term process, but not the life-long endeavor everyone once believed. The short-term soil structure improvements give us physical evidence of organic matter enhancement.



N-VEST COVER CROPS

The Benefits of COVER CROP MIXES

Implementing a mix of different cover crops makes sense for many reasons:

1. Planting a cover crop mix meets several goals at the same time.
2. Mixing distinct species together (that flourish in different weather environments) spreads out risk, insuring against the extreme weather we frequently face.
3. Mixes enhance biodiversity on the farm, increasing soil biology and paving a way for quicker soil health gains.
4. Mixes formulated with complementary species often bring advantages at contrasting times of the growing cycle. Example – mixing cereal rye and crimson clover together offers weed suppression, grazing, and erosion benefits in the fall. The clover delivers N in the spring. These returns only work when the appropriate balance is given when the mix is formulated. Not every species plays well with others.

Keep in mind, not every situation calls for a mix. A well-adapted single species often may be all that is needed to reach a single, desired goal – both from a productivity and economic standpoint. Moreover, not all plans call for blindly adding species that may not make agronomic sense. Selecting the right group of cover crops that supply the desired benefits is much more important than merely increasing the number of species in a cover crop mix or cocktail.

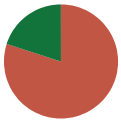
ICON KEY

Weed Suppression
Compaction Fighting Roots
Erosion Protection
Nitrogen Fixer
Biomass & Forage Producer
P & K Cycling
Pollinator Benefit

N-VEST® CRIMSON COVER-ALL MIX

SEEDING (LBS/ACRE)

DRILL: 15-17 LBS
BROADCAST: 17-20 LBS
FORAGE: 17-20 LBS



80% IMPROVED CRIMSON CLOVER
20% SCAV-N-GER® RADISH

Mix of crimson clover and radish; perfect for soil protection and alleviating compaction

Expect some level of winter annual weed suppression if crimson clover is not terminated prior to bud stage

Great for building soil tilth and structure

Best planted after wheat or corn silage; ideal mix in front of corn (with low C:N ratio)

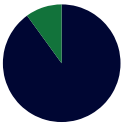
Earlier planting gives crimson clover the best chance of overwintering; radish will likely winterkill

Plant at least 6-8 weeks before a killing freeze

N-VEST® GROUNDBREAKER MIX

SEEDING (LBS/ACRE)

DRILL: 35 LBS
BROADCAST: 35-40 LBS
FORAGE: 35-40 LBS



90% AUSTRIAN WINTER PEAS
10% SCAV-N-GER® RADISH

Biomass production will suppress winter annual weeds and protects soil surfaces from fall through spring

Due to the size of peas, this mix works best when drilled

Fast nodulating peas are capable of quick N production (use an appropriate pea inoculant for maximum N fixation)

Expect winter peas to survive until temperatures reach 10°F; radish will likely winterkill sooner

Plant at least 6-8 weeks before a killing freeze

N-VEST® OAT-RADISH MIX

SEEDING (LBS/ACRE)

DRILL: 35 LBS
BROADCAST: 35-40 LBS
FORAGE: 35-40 LBS

90% OATS
10% SCAV-N-GER® RADISH

Simple and effective cover crop mix, perfect for scavenging leftover nutrients

Should completely winterkill in the northern parts of our territory; no lasting residue in late spring

Effective and straightforward cover crop option in front of corn

Heavy biomass producer; good for erosion control and forage production when given 70-80 days in the fall

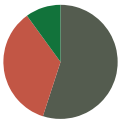
Plant at least 6-8 weeks before a killing freeze

N-VEST COVER CROPS

N-VEST® NUTRIBUILDER MIX

SEEDING (LBS/ACRE)

DRILL: 20-25 LBS
BROADCAST: 25-30 LBS
FORAGE: 25-30 LBS



55% ELITE DIPLOID ANNUAL RYEGRASS
35% IMPROVED CRIMSON CLOVER
10% SCAV-N-GER® RADISH

A popular 3-way mix adds diversity and builds soil structure

Perfect for breaking up compaction and sequestering any leftover nutrients

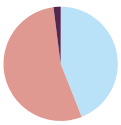
Crimson clover will likely overwinter if planted earlier in the fall; will need to be terminated along with the annual ryegrass – follow termination guidelines on page 30

Plant at least 6-8 weeks before a killing frost

N-VEST® FORAGER MIX

SEEDING (LBS/ACRE)

DRILL: 60-100 LBS
BROADCAST: 60-100 LBS
FORAGE: 100-120 LBS



44% OATS
54% CEREAL RYE
2% FORAGE TURNIPS

Grazers' choice for a dual-purpose cover crop – oats and turnips grazed in the fall; cereal rye utilized in the spring

Ready to be grazed in as little as 60 days

Works well in cropping systems alongside manure applications

Higher seeding rates for forage also help with fighting soil erosion and suppressing weeds

Plant 4-6 weeks prior to first killing frost

CUSTOM SEED BLENDING

When the desired goal doesn't match up with any of our stock mixes, CISCO offers custom seed mixing to meet any cover crop need.

We've invested in industry-leading seed mixing systems, capable of handling mixes both small and large, from small pack to bulk container and tote requirements. Our operations team continues to meet the many challenges that come with mixing and blending, vigilant of strict seed quality standards, while eliminating cross-contamination.

WHEN A CUSTOM MIX IS NEEDED, PLEASE PLAN AHEAD AS MUCH AS POSSIBLE.

- **Allow several more days to get seed blended and shipped.** Understand additional time is normally needed for our team to mix, bag, and properly tag – without sacrificing our quality standards.
- **Select mix components, recognizing that all species should be adapted to the environment they are planted** – soil type, drainage and topography, and winter climate – to name a few.
- **Think through the crop rotation;** not all cover crop species are beneficial to the following cash crop.
- **More species or ingredients are not necessarily better.** Yes, cocktails provide the opportunity for more benefits; however, simpler mixes with fewer ingredients often come with fewer surprises and more consistent results – easing management choices and cost.

PLANT SEED, NOT GRAIN

With CISCO, there are never any compromises when it comes to seed quality. Our seed is sourced knowing that our customers demand and deserve the highest quality seed, not grain. Our small grains originate in regions where proper agronomic and overall quality standards are in place.

- Seed fields are monitored from planting, throughout the growing season, and at harvest to make sure there are no issues with potential weed problems or varietal purity.
- Seed is professionally conditioned, cleaned, and packaged.
- Every lot of seed is tested at harvest, and after conditioning, by independent laboratories that adhere to the approved standards of the Association of Official Seed Analysts. We know what we have before it arrives at our warehouse.
- Any mixing is done in our facility, by our people, with our equipment, which is designed to gently handle seed.
- Once tagged, rest assured it has met our rigorous standards to ensure success.

Do not take the chance of introducing new and potentially invasive (and glyphosate resistant) weeds to your farm by buying "cheap" seed.

The tag says it all: ***Once it's in the bag, it's a true testament to our high standards.***

CEREAL (WINTER) RYE

CEREAL RYE is an upright, cool season, and high-yielding fall-seeded forage. It has a flexible planting window that extends long into fall, largely because it germinates in cool temperatures. It's extremely winterhardy, tolerant of poor soil conditions, and incredibly useful in multiple cropping systems. Cereal rye is the most widely utilized cover crop in the Midwest.

Huge root mass for improved soil conservation and erosion prevention

Suppresses winter annual weeds when planted at heavier seeding rates (& through allelopathy)

Builds soil tilth and cycles leftover nutrients from preceding cash crops with its immense root system

Early to mature in the spring; will need herbicide applications or another method for successful spring take-out

Forage = harvest in the boot stage for optimal quality; graze in vegetative stage for high-quality pasture, as forage quality declines rapidly with maturity

Consider adding Scav-N-Ger® Radish or other brassicas to further broaden soil-improving benefits

GRAZE KING 90

SELECTED FOR FORAGE YIELD

GRAZE KING 90 is a fall-planted cereal rye selected for improved forage yields and quality with increased tillering and leafiness. Throughout our footprint, dry matter yields have ranged from 3 to 5 tons/acre. Graze King 90 can be grazed in the fall as long as 4" of leaf area is left on the plant. Mixing Graze King 90 with oats and turnips/radish increases fall forage production.

Fertilize Graze King 90 like a highly productive wheat crop – 30-40 lbs. actual N at planting (from manure or commercial fertilizer), and another 60-70 lbs. actual N top-dressed in spring. Like wheat, excess N applications can cause lodging and increase runoff. Graze King 90 remains vegetative through fall and takes the overwintering process to promote vernalization, which then triggers its reproductive life cycle into the spring.

Harvest – ideal in the flag leaf stage – in the Midwest usually occurs in late April or early May. Graze King 90 matures quickly in the spring, so extra attention is needed to maximize tonnage and quality. Once heading occurs, forage quality begins to drop, with crude protein (CP) decreasing and NDF and ADF increasing. In general, cereal rye offers the greatest opportunity for hay or pasture because of its quick establishment in fall and growth in spring. Its best use is fall, winter, and spring pasture, however, it's flexible enough to be grazed, hayed, chopped, or wet wrapped.

MANAGING CEREAL RYE & OTHER SMALL GRAINS

Having a plan for spring take-out and residue management is critical for the success of the cash crops that follow. All things being equal (and depending on the goal) – we recommend terminating small grains earlier in the spring rather than later in the window[1]. Terminating early decreases nutrient immobilization and conserves valuable soil moisture. Voles, army worms, and other pests tend to be less challenging when more of the residue is dead and dying prior to planting.

Information about terminating small grains with herbicides is found on page 29.

Though equipment can be difficult to find, and cash crop planting may be delayed, the use of a roller-crimper is gaining interest in many parts of the Midwest. Rollers and crimpers used at milk or soft dough stage[2] (after rye has shed pollen and normally around 24-30" tall) flattens stems and prevents regrowth, while laying the cover in an even mat that reduces shading on the crop and improves weed control. Scout for pests after crimping, as insects and other challenges (slugs) thrive in residue.

Mowing is a method typically used in no-till and organic systems. Mowing normally allows residues to decompose quicker than crimping, which may or may not be part of the strategy. Wait until flowering for most small grains, barley at mid-bloom. Some growers mow or graze early, which suspends flowering and allows more flexibility for control.

Tillage can terminate a cover crop by burying the plant residue altogether, often cutting the roots to pieces and eliminating any chance of regrowth. However, tillage may require multiple passes to achieve satisfactory control. Note: strip-till farmers contend they use tillage as a tool to warm soils in the planting zone, breaking up residue and creating a better environment for cash crop planting.

[1] We do understand that many vegetable and orchard growers allow cereal grains to stand longer, lessening the risk of root rot by keeping bedding under the crop.

[2] When crimping or rolling barley, mid-bloom is recommended.

TIPS FOR PLANTING ROW CROPS INTO SMALL GRAIN & COVER CROP STANDS

Establishing corn and other cash crops effectively into rye stands and/or residue requires a few modifications to one's planting equipment. Here are a few things to consider:

1. Down force is critically important for **consistent seeding depth**, but too much down pressure can cause sidewall compaction. Keeping the planter parallel to the ground is key too. Bottom line = do everything possible to get seed to the bottom of the furrow possible.

2. Seed-to-soil contact is important no matter the seed. Where there's biomass, **row cleaners** move residue away from the disk openers, reducing stand losses from hair-pinning and increasing soil temperatures in the seeding zone. Today's corn hybrids and heavier populations amplify this need.

3. Diminish side wall compaction by using proper **gauge wheels**. In high residue environments, lighter gauge wheels tend to float over obstructions in the field that interfere with seeding depth and cause compaction in the root zone. Based on soil type, residue, and other factors, most growers have their preference of **closing wheels**, but the ultimate goal is closing the trench without worsening side wall compaction. Still other growers insist **front coulters** are needed as well to reduce sidewall compaction. Coulters – from round to notched to fluted – should not run deeper than the double disk opener.

4. Keep **disc openers** sharp, clean, and running true with the planter. Especially for growers not employing a front coulter, caring for disc openers could be the most crucial step to insure a consistent seed bed and germination.

Planting corn, soybeans, or other cash crops into any living cover crop is not for the beginner. "Planting green" demands watching the calendar and the weather forecast, as inopportune moisture that prevents timely planting and/or termination could worsen the effects excess residue might present.

UTILIZING SMALL GRAIN COVER CROPS FOR FORAGE

WINTER BARLEY

WINTER BARLEY is widely considered the most vulnerable fall-seeded small grain to winterkill, so seed earlier in the fall planting window and use extra caution when grazing winter barley later into the fall. Barley's value is silage, as many producers often compare its quality with that of whole plant corn silage.

- Excellent standability and straw production
- Forage = for silage, harvest in boot - dough stage; also, a good option for early fall pasture
- In our experience, Valor winter barley has been the most winterhardy variety in the Midwest

WINTER TRITICALE

WINTER TRITICALE is a hybrid of cereal rye and winter wheat, resulting in a small grain with improved forage quality compared to cereal rye, and higher yielding compared to wheat.

- Forage = fall and spring pasture; for silage and hay, harvest in boot - dough stage; also utilized for fall & spring pasture
- For an outstanding dual-purpose forage/cover crop, we recommend **TriCal Flex 719**
- *SPRING TRITICALE* mixed with peas and other legumes is a great forage option, often producing higher yields and forage quality than oats

SPRING OATS

SPRING OATS are a versatile cover crop grain. Though they are widely spring-planted, late-summer seeded oats serve as a perfect symbiotic complement to brassicas and legume cover crops. When planting in August-September, allow 60-80 days to maximize forage production.

- Spring oats winterkill in most Midwestern environments; however, over-wintering plants are simple to take out (see termination guidelines on page 29)
- Oats are great at sequestering leftover nutrients in the soil but require another mix partner – like Scav-N-Ger® Radish – to capitalize the return
- Excellent choice for erosion control and ease of use
- Forage = for silage, harvest in milk - dough stage; hay = boot - heading stage
- Consider Haywire, a high-yielding variety with proven standability and forage quality

WINTER WHEAT

WINTER WHEAT is a low-risk fall-seeded cover crop, typically with higher forage quality than rye, triticale, and oats. Wheat does not generate the root mass of cereal rye, but it undoubtedly provides other soil surface protection benefits like other small grains, with the highest winter survivability.

- Forage = fall & spring pasture; for silage, harvest in boot - dough stage; for hay = boot to dough to milk stage

CEREAL RYE

Keep in mind, **CEREAL RYE** combines two traits that make it a highly attractive option for winter forage – it is extremely easy to establish, even in poor soil environments AND because it is very cold tolerant, its planting window is a bit wider than other small grain options.

SILAGE HARVEST

SILAGE HARVEST should be focused around boot to late-boot stage for most all the cereal grains when moisture is at 65%. Expect higher quality forage at boot stage, with 30% more production coming at late-boot. Growers advise on 2 things:

- Set chop length a bit finer with small grains compared to corn or forage sorghum.
- Have a plan and be ready - small grains mature fast and quality declines rapidly if not prepared.

HAY PRODUCTION

HAY PRODUCTION is trickier than silage with small grains, largely because quality is so dependent on moisture. To achieve the best balance of yield and quality, we recommend targeting early-milk stage. Harvest would be maximized earlier at late-boot stage, when producers often tell us using a crimper speeds up drying. Management and fertility dependent, expect forage yields to average between 2-4 DM tons / acre.

GRAZING COVER CROPS

Combining cover crops and grazing livestock is like 1+1=3. Benefits come from the cover crop (and manure) for all the reasons that have been described. But nutrient cycling is now being elevated = approximately 66% of the phosphorus and 90% of the potassium in the plant when grazed are returned to the soil in the form of manure. Weight gain on the animals is realized without high quantities of stored feed. All this while acres get utilized during a period when historically they are not growing productive row crops.

CONSIDERING WARM SEASON ANNUAL COVERS FOR FORAGE

When the cropping rotation allows, warm season annuals can provide substantial amounts of quality forage suitable for all classes of livestock. Even though many livestock producers consider warm season annuals – like sorghum X sudangrass and millet – as "emergency forage," these species can just as easily be used in a planned program when extra feed is needed. But there are a few watchouts to consider when utilizing summer-seeded cover crops:

1 **NITRATE TOXICITY** is more common than many realize, occurring in most cover crops and forages, not just warm-season summer annuals. Any time fertility or manure applications are followed by drought or other stressors, elevated nitrate levels are probable. Plan to test forage for several weeks until toxic levels recede.

- Once plants are cut, nitrate levels do not decline.
- Raising the cutting height can lessen the risk, as nitrates are concentrated in the lower stalk.
- If drought conditions precede rainfall, delaying harvest or grazing by 2 weeks is suggested.
- Lastly, to lessen the concern of nitrate toxicity, split applications of N (especially for summer annuals given how inefficient they are) should be considered.

2 **PRUSSIC ACID** poisoning is another challenge, occurring when forage sorghums are fed (or allowed to be grazed) after periods of stress – including drought or frost. Unlike nitrates, prussic acid levels decrease in forage when stored (as hay or silage). Grazing is the largest concern.

- Because prussic acid is most concentrated in new growth, forage sorghums should be 18" tall before grazed.
- Storing hay or silage for 4 weeks normally lessens prussic acid levels.

3 **BLOAT** is common in livestock when legumes (and brassicas) are the predominate source of forage fed – either by hay or through grazing. Bloat can be reduced by integrating grasses into the forage ration. Many producers fill their livestock with dry hay (high in fiber) before turning out hungry animals onto legume-based pasture. Keeping grazing livestock away from paddocks that are wet from rain or dew also reduces the threat.

4 **BRASSICA CROPS** like turnips, kale, and rape can cause other disorders in livestock (from sunburn and diarrhea to anemia and bloat), though most all the concern can be diminished by including fiber-rich feedstuffs in the diet. Since brassicas are highly digestible carbohydrates with extremely low fiber levels, limiting the fraction of the diet to less than 2/3 is suggested. Livestock should be introduced slowly and methodically to pastures with higher brassica composition – usually limiting grazing to a few hours per day over a week to 10 days. Feeding brassicas with small grains (or other high fiber sources) ensures adequate fiber is consumed.

PEST CONSIDERATIONS

The addition of cover crop residues may increase the likelihood of pests in certain environments. Additional management may or may not be needed, but it's important to be prepared.

VOLES

Meadow or Prairie **VOLES** resemble mice, only with a shorter tail. In most Midwest regions, they reproduce from March through October, often producing a litter (from 4-8) every 3 weeks. Because young females mature in about 5 weeks, numbers expand quickly. They feed on seeds and vegetation both day and night, with most of the damage occurring between 2-4 weeks post row crop planting. Larger colonies of 30 voles or more can reach ¼ acre in size, so when multiple colonies are observed, rescue treatments are most likely warranted.

SCOUTING for VOLES – Check fields in late winter for active vole colonies (especially in areas with more residue and/or snow cover). Keep monitoring at least until 30 days before planting no-till corn or soybeans.

SLUGS

SLUGS can also cause challenges from feeding. Even though they normally mate to reproduce, slugs are hermaphrodites, and like voles, populations can increase rapidly. Gray garden slugs lay eggs in the fall, and hatch in spring. Juveniles begin feeding in spring only 1-2 weeks after hatching. These critters are only nocturnal, but they feed on everything from seeds and seedlings, to leaves, residues, and other invertebrates. Thresholds can be difficult to determine, so monitoring defoliation is crucial.

SCOUTING for SLUGS – Check fields in April/May (for eggs or adults) – eggs are about half the size of a BB

- Defoliation should alert one of damage
- Monitor at dusk or after dark, or any time after moisture events
- Cool and wet springs will obviously give slugs the perfect conditions to thrive

PEST CONTROL OPTIONS

With both slugs and voles, closing the seed slot will reduce the degree of feeding directly on the seed. In certain soil environments, this might justify a deeper seed placement.

Minimal tillage is always an option, but there are alternative paths to consider as well.

Vole Control

Terminate cover crops 3-4 weeks prior to planting. Managing residue at planting time is crucial.

Keep roadsides and ditches/waterways mowed in the spring, decreasing the protection that voles have.

Perch poles for predators have been effective in some states, but may not be as effective in larger fields.

Zinc-phosphide baits covered in-furrow have been effective to some degree. Treating field edges or areas adjacent to grass/waterways normally is the most cost effective. Integrating bait will take additional work to the planter.

Slug Control

Varying the crop rotation disrupts the life cycles and perennial timing issues we see with many pests. The more varied the cropping cycle, the less pests (like slugs) can adapt.

Planting cash crops early, as quicker establishment and larger plant size often results in less feeding from slugs. Think through planter set-up and hybrid/variety selection to maximize the likelihood of quick and strong emergence.

OTHER POSSIBILITIES GROWERS ARE USING:

- **Iron phosphate baits (like Sluggo)** – not cost-effective for larger applications. OMRI-listed for organic systems.
- **Applying liquid nitrogen at night** (when slugs are most active) has worked for some growers. It might take multiple applications to reach the desired level of control.

COVER CROP KEY ATTRIBUTES

		Seeding Rate (lbs/acre)				
	Cover Crop	Mono Drilled	Mono Broadcast	In Mix	Recommended Seeding Dates	Seeding Depth
N-Vest Mixes	Crimson Cover-All Mix	15-17	17-20	-	August -Sept	1/4” - 1/2”
	Forager Mix	60-100	60-100	-	August-Sept	1/2" - 3/4"
	Groundbreaker Mix	35	35-40	-	August-Sept	1/2" - 3/4"
	NutriBuilder Mix	20-25	25-30	-	August-Sept	1/2" - 3/4"
	Oats-Radish Mix	35	35-40	-	August-Sept	1/2" - 1"
Nitrogen Fixing Legumes	AberLasting Clover	3-5	4-6	.5-2	Feb-April, August-Sept	1/8" - 1/4"
	Alfalfa	18-20	20-25	2-5	March-April, August-Sept	1/8" - 1/4"
	Alsike Clover	6-8	8-10	1-2	January-April, August-Sept	1/8" - 1/4"
	Balansa Clover	8-15	12-20	3-6	April-October	1/4"
	Berseem Clover	8-15	12-20	3-6	April-August	1/4"
	Cowpeas	30-60	NR	3-10	May-August	1" - 1 1/2"
	Crimson Clover	12-20	15-20	5-10	August-Sept	1/8" - 1/4"
	Lentils	20-30	25-35	3-8	August-Sept	1" - 1 1/2"
	Mung Beans	20-30	NR	3-10	May-August	1" - 1 1/2"
	Peas, Spring	30-80	NR	10-25	March-April, August-Sept	3/4" - 1 1/4"
	Peas, Winter	30-50	NR	10-25	August-Sept	3/4" - 1 1/4"
	Persian Clover	5-8	8-10	3-4	April-August	1/8" - 1/4"
	Red Clover, Mammoth	10-12	10-15	2-5	January-April, August-Sept	1/8" - 1/4"
	Red Clover, Medium	10-12	10-15	2-5	January-April, August-Sept	1/8" - 1/4"
	Sweet Clover	10-15	15-20	2-5	January-April	1/8" - 1/4"
	Sunn Hemp	12-15	15-20	3-8	May-Sept	1/2" - 1"
	Vetch, Hairy	18-20	25-30	8-15	August-Sept	1/4" - 1/2"
Nitrogen Scavengers — Cool-Season Grasses	Annual Ryegrass	15-20	20-25	5-15	March-May, August-Oct	1/4" - 1/2"
	Barley, Winter	25-50	Increase rate 20-25%	25-50	August-Oct	1" - 1 1/2"
	Cereal Rye	30-60	Increase rate 20-25%	30-60	August-Oct	1" - 1 1/2"
	Oats, Spring	15-50	Increase rate 20-25%	15-50	March-May, August-Oct	3/4" - 1"
	Black Oats	15-50	Increase rate 20-25%	15-50	August-Oct	3/4" - 1
	Triticale, Fall	35-50	Increase rate 20-25%	35-50	August-Oct	1" - 1 1/2"
	Triticale, Spring	35-50	Increase rate 20-25%	35-50	March-May, August-Oct	1" - 1 1/2"
	Wheat, Winter	25-60	Increase rate 20-25%	25-60	August-Oct	1" - 1 1/2"
Nitrogen Scavengers — Warm-Season Grasses	Pearl Millet	16-20	20-25	2-8	May-August	1/2"-1"
	Sorghum, Forage	5-8	10-15	1-3	May-August	3/4"- 1 1/2"
	Sorghum Sudangrass	20-50	30-60	2-8	May-August	3/4" - 1 1/2"
	Teff Grass	10-12	NR	NR	May-July	1/8"-1/4"
Nitrogen Scavengers — Brassicas	Kale	3-4	5-6	1-2	April-June, August-Sept	1/4"
	Mustard, White	20	20-25	NR	April-May, August-Sept	1/4" - 1/2"
	Radish, Daikon	2-5	3-6	1-2	August-Sept	1/4"
	Radish, Nematode	2-5	3-6	1-2	August-Sept	1/4"
	Rapeseed	2-3	4-6	1-2	August-Sept	1/4"
	Turnips, Forage	2-4	3-5	1-2	August-Sept	1/4"
Nitrogen Scavengers — Forbs	Buckwheat	40-50	50-75	5-10	May-August	1/2" - 1"
	Flax	25-50	30-60	4-10	August-Sept	3/4" - 1 1/4"
	Phacelia	3-5	4-6	1-2	June-Sept	1/4" - 1/2"
	Sunflowers	5-8	NR	2-5	May-August	1"-2"

ICON KEY

Approx. Seeds/LB	Bulk Density (average)	Days to Germination	USDA Hardiness Zone	Winter Termination	C/N Ratio (whole plant average)	Cover Crop Attribute
	56	7-10	-	Overwinter	-	
-	43	7-10	-	Overwinter	-	
-	45	7-10	-	May overwinter	-	
-	40	7-10	-	Overwinter	-	
-	38	2-10	-	20-22° F	-	
800,000	54	7-10	3	Overwinter	15:1	
225,000	48	7-10	2	Overwinter	18:1	
725,000	54	7-10	3+	Overwinter	20:1	
500,000	55	7-10	5	Overwinter	15:1	
130,000	52	7-10	8	10-20° F	18:1	
4,000	48	7-10	FROST	32° F	20:1	
150,000	52	7-10	7	May overwinter	15:1	
15,000	48	10-14	5+	May overwinter	30:1	
7,000	54	3-7	FROST	32° F	20:1	
3,500	52	7-10	FROST	32° F	25:1	
3,500	52	7-10	6	May overwinter	25:1	
140,000	53	7-10	7	May overwinter	20:1	
270,000	48	7-10	3	Overwinter	15:1	
270,000	48	7-10	4	Overwinter	15:1	
250,000	54	7-10	2	Overwinter	25:1	
15,000	58	3-7	FROST	32° F	27:1	
16,000	52	7-10	4	Overwinter	15:1	
225,000	32	7	6	May overwinter	20:1 (vegetative)	
12,500	40	7	6	May overwinter	20:1 (veg); 80:1 (straw)	
18,000	48	7	3	Overwinter	20:1 (veg); 80:1 (straw)	
14,000	38	7-10	7	20-22° F	20:1 (vegetative)	
14,000	-	7-10	6	May overwinter	20:1 (vegetative)	
20,000	48	10	3	Overwinter	20:1 (veg); 80:1 (straw)	
20,000	48	10	-	20-22° F	20:1 (veg); 80:1 (straw)	
14,000	48	7-10	3	Overwinter	20:1 (veg); 80:1 (straw)	
60,000	42	3-7	FROST	32° F	25-30:1 (vegetative)	
16,000	45	3-7	FROST	32° F	25-30:1 (vegetative)	
19,000	45	3-7	FROST	32° F	25-30:1 (vegetative)	
1,250,000	NA	3-7	FROST	32° F	20-25:1 (vegetative)	
30,000	46	5-7	6-7	10° F	15:1	
100,000	46	7	7	May overwinter	20:1	
35,000	44	2-7	9	20-22° F	12:1	
35,000	44	2-7	9	20-22° F	12:1	
125,000	46	5-7	5	May overwinter	20:1	
240,000	45	5-7	6-7	10° F	12:1	
15,000	40	7-10	FROST	32° F	15:1	
80,000	45	10-14	5-6	May overwinter	19:1	
225,000	-	7-10	8	20-22° F	15:1	
8,000	28	10-Jul	FROST	32° F	30:1	

NITROGEN PRODUCERS

SPRING & SUMMER SEEDED

MEDIUM RED CLOVER

- Works well when spring frost seeded into winter small grain crops
- Capable of producing 60-100 lbs. N/acre
- Deep tap roots complement the roots of the companion grass crop for soil health improvement
- Many producers will take one or two harvests of red clover for forage

YELLOW BLOSSOM SWEET CLOVER

- Frost seed in the spring into winter small grain crop
- Large tap root with vigorous growth
- Great pollinator option, recognized for its ability to restore depleted mineralized soils
- "Green Manure" fits this clover; not recommended for forage

COWPEAS

- Warm-season legume capable of producing 50-75 lbs. N/acre
- Rapid summer growth with adequate moisture, but also drought tolerant; winterkills in fall
- Out competes and smothers weeds with substantial amounts of biomass
- Mixes well with sorghum sudangrass and other summer seeded forages

BERSEEM CLOVER (FROSTY®)

- Cool-season, non-bloating annual clover; hay or graze multiple times (prior to blooming)
- Known for its outstanding seedling vigor & rapid growth
- Good nitrogen producer – 100-180 lbs. of N/acre available in the plant's biomass
- Hollow stems allow for quicker hay drying
- Works best following wheat harvest
- Tolerates waterlogged soils & saline environments better than alfalfa or red clover (pH 4.8–7.8)
- Berseem clovers normally winterkill in northern climates, however Frosty® Berseem Clover offers improved winter tolerance (survives in the fall to 5°F)

SUNN HEMP

- Warm-season legume that can produce up to 100 lbs. of N/acre
- High seeding rates produce large amounts biomass, increased organic matter levels, and increased soil fungi populations
- Mixes well with other summer annuals for soil building
- Research has shown suppression to (root knot & burrowing) nematodes
- Can reach 6 feet tall in 60 days, with significant biomass

ICON KEY

Weed Suppression | Compaction Fighting Roots | Erosion Protection | Nitrogen Fixer | Biomass & Forage Producer | P & K Cycling | Pollinator Benefit

FALL SEEDED

BALANSA CLOVER (FIXATION®)

- Dense growing with extensive fall root growth and abundant (forage) growth in late spring
- Biomass can yield up to 200 lbs. of N/acre
- Beneficial for weed suppression and nutrient leaching
- Accepts later plantings in fall (vs. other clovers); mixes well with cereal rye and fall triticale
- Hollow stems improve palatability and hay drying; also allows for termination by roller crimper
- Drought tolerant and suitable for low pH environments (4.5–8.0)
- Great pollinator option shown to be a non-host to soybean cyst nematode (SBN)
- ***WATCH OUT – balansa can be a prolific re-seeder; terminate/graze prior to flowering lowers risk***

CRIMSON CLOVER

- Top nitrogen producer (75-100 lbs. N/acre) when planted early and allowed to reach bud stage
- Semi-upright legume needing 6 weeks of growth in the fall before a killing frost
- Performs well in mixes, especially with annual ryegrass and radishes
- Overwintering likelihood increases with snow cover in northern climates; easy to spring terminate
- Shade tolerance makes it suitable for inter-seeding
- Stands allowed to reach flower have proven to be attractive to pollinator and beneficial insects
- ***WATCH OUT – crimson is a good option for hay/grazing, but it can cause bloat when unmanaged***
- ***WATCH OUT – thick, dense stands have been known to attract voles and other unwanted pests***

HAIRY VETCH

- Strong N producer; excellent for phosphorus scavenging, weed suppression, & soil improvement
- Needs 5-6 weeks of growth in the fall to overwinter; snow cover improves winter tolerance
- Great cover crop option when mixed with small grains or annual ryegrass (which also helps spring control)
- Tolerates poor soil environments, low fertility, and low pH (5.5–7.5); keep off poorly drained soils
- Very low C:N ratio – quick decay and mineralization
- Villana™ variety produces almost no hard seed and brings increased winterhardiness
- ***WATCH OUT – possible association with increased soybean cyst nematode/root knot nematode***

AUSTRIAN WINTER PEAS

- Fall seeded low-growing field pea, capable of strong biomass and up to 90-150 lbs. N/acre
- Green manure option that decomposes quickly; works very well with Scav-N-Ger® radish
- Most effective with 6-8 weeks of growth in the fall to maximize N production
- Forage value increases when mixed alongside oats or small grain
- Expect winterkill when temperatures fall below 18° F, especially without snow cover
- Keep off water-logged soils
- Vail™ Winter Peas were selected for forage quality and cold tolerance
  - Low tannin (white flowers) forage type winter pea
  - Increased biomass vs. Austrian winter peas

FIGURING N CONTRIBUTIONS FROM LEGUMES

Predicting delivery and timing of nitrogen is complex. Estimates are broadly given on the levels of nitrogen a given cover crop legume can produce. However, due to many variables – like climate, nutrient availability, and cropping system, only a portion of that N will be utilized by the following crop.

Thanks to the work done by several universities, we have more confidence in understanding the value legumes provide. There are ways to evaluate and account for Plant Available Nitrogen or PAN. Typical N contributions from cover crops are listed below:

Cover Crop	% N in DM (early spring)
Annual Ryegrass	.5 – 1.0
Cereal Rye	.9 – 1.4
Winter Wheat	.9 – 1.4
Crimson Clover	1.5 – 2.4
Red Clover	1.9 – 2.8
Hairy Vetch	2.5 – 3.5
Winter Pea	2.5 – 3.5
Rapeseed	.8 – 1.5
Spring Oats	.7 – 1.2

For rough estimates, take the average N value multiplied by the DM yield. For example: crimson clover – take the average PAN contribution of 2.0% N/DM ton multiplied by a reasonable expectation of yield – let us say for this example the field below might yield about 1.5 tons DM/acre (or 3,000 lbs.). 3,000 x .02 = 60 lbs. of nitrogen the following crop can actually utilize. OR find the exact number by taking a representative sample:

STEP 1:

Take a DM (biomass) sample by collecting all the above ground growth (clipped to the ground) and send off for testing.

- Depending on the lab, they will offer their own instructions on packaging the sample correctly to reduce mold & ensure timely testing
- Verify the type of analysis desired (DM nutrient analysis) and the size of the area in which the sample was taken (ex: 1' x 1' square or 2' x 2' square, etc.)

STEP 2:

Review the analysis once completed by the testing lab.

- Analysis will include "% N in DM." This number multiplied by 2,000 equals the lbs. N/DM ton.
- As long as the sample area was indicated when submitted, the analysis will also include the estimated "DM lbs. or DM tons/acre"

STEP 3:

Do the math – the field below of crimson clover and cereal rye had an analysis of 1.8% N in DM, with an estimated DM yield of 1.7 tons DM/acre.

(1.8 x 2000 = 36 LBS N/DM ton)

36 x 1.7 tons DM/acre (estimated) = 61.2 lbs. of estimated PAN (or Plant Available Nitrogen)

CONSIDERATIONS:

1. The longer the stand grows into spring, the more biomass, and the increased amount of estimated PAN. Growers must evaluate the time it takes to allow PAN to build vs. ideal spring planting windows.
2. Depending on species, the added biomass (and subsequent above & below ground residue) may have to be offset with added N to compensate for the leftover carbon material/ residue.
3. Increased residue will limit how quickly PAN is made available to crops.

LEGUME INOCULANTS ARE CRUCIAL

When cover crop legumes are planted, a major expectation is N contribution for the following cropping cycle. Rhizobia bacteria inoculants are vital for allowing legumes to maximize N fixation. Inoculation is needed when the proper background population of rhizobia is absent in the soil, normally the case when most of the common cover crop legumes are seeded. The rhizobium strains that inoculate many common legumes – including winter peas, hairy vetch, and sunn hemp – do not survive on seed for more than 24 hours. These cover crops must be treated with an inoculant at time of seeding – meaning pre-inoculated seed will not be viable.

Today, CISCO offers OMRI approved inoculants, packaged as a pre-mixed, humus-based organic product. For a successful growing experience, match the proper seed inoculant strain with the legume seed being planted.

No special equipment is needed for application, and best results occur when mixed with a small amount of water to aid in seed adhesion and applied at the time of planting. Our inoculants may be applied in a slurry or directly onto the seed. Follow label instructions for slurry application rates. Applying the inoculant dry is recommended for seed that is pre-treated with fungicide; however, maximum seed adhesion will not be obtained through dry application methods. These inoculants can easily be applied at the planter box.

NITROGEN SCAVENGERS

SUMMER SEEDED SCAVENGERS

BUCKWHEAT

- Fast growing broadleaf with fibrous roots; great for improving soil tilth and mineralizing phosphorous
- Can flower within 35 days of emergence
- Terminates with first frost
- Perfect option for summer pollinator plots

SUNFLOWER

- Deep rooted broadleaf with rapid summer growth; significant rooting and biomass potential
- Performs well in cover crop mix
- Terminates with a freeze

PHACELIA

- Wonderful pollinator with a fine, fibrous root system
- Best used (and most economical) alongside other warm season summer seeded covers

WARM SEASON SUMMER ANNUALS
(LIKE SORGHUM SUDANGRASS, FORAGE SORGHUM, AND PEARL MILLET)

WARM SEASON SUMMER ANNUALS all share many of the same attributes – drought tolerance, water efficiency, large biomass production, and good root systems – needed to survive the harsh summers faced in the Midwest. All make for great forage, filling the "summer slump" caused by traditional cool-season forages. CISCO offers brown mid-rib varieties as well, which increases digestibility over traditional varieties. No matter the choice, summer annual grasses fit well after wheat harvest or when the calendar allows for earlier summer seedings.

ICON KEY

Weed Suppression | Compaction Fighting Roots | Erosion Protection | Nitrogen Fixer | Biomass & Forage Producer | P & K Cycling | Pollinator Benefit

FALL SEEDED SCAVENGERS

BLACK OATS

- Rapid growth in late fall. We've seen black oats survive longer into winter (vs. spring oats) by up to 2 months
- Much like cereal rye, black oats show terrific weed suppression, with allelopathic effects, too
- Highly palatable forage = perfect for grazing or baleage, but dry hay has been challenging
- Suppresses root-knot nematode

ANNUAL RYEGRASS

ANNUAL RYEGRASS is a quick establishing, cool season annual grass. Annual ryegrass can do it all – improve soil structure and alleviate compaction, control erosion, and sequester leftover nutrients. It produces quality forage with exceptional yield in a short period of time, often shining in poor soil conditions. Additionally, annual ryegrass has been proven to help reduce soybean cyst nematode populations.

But beware of annual ryegrass blends, or common and/or VNS lots of annual ryegrass – they may not have the winterhardiness needed nor have uniform maturity, which is so critical for successful spring management. CISCO has gone to great lengths to ensure we provide the best performing, winter tolerant varieties of annual ryegrass. We partner with leading suppliers to guarantee these elite varieties bring value for both cover cropping and forage:

- **WinterHawk** – very durable diploid annual ryegrass with industry leading winterhardiness
- **Centurion** – diploid variety selected for cover cropping, with deep roots and improved forage quality
- **Bruiser** – late maturing diploid selected for disease resistance and cold tolerance

NITROGEN SCAVENGERS

LATE-SUMMER SEEDED BRASSICAS

DAIKON RADISH

DAIKON-TYPE RADISH is an upright, cool season annual broadleaf. Widely adapted, daikon radish was bred for deep taproots, ideal for breaking up hardpans and scavenging leftover nutrients from the preceding crop. Pure radish stands have value, but when radish is mixed with grasses and/or small grains, they unlock their full potential of reducing erosion, suppressing weeds, and increasing soil structure and microbial function.

SCAV-N-GER® RADISH

- Our elite daikon-type radish, featuring a deep and penetrating taproot
- Great nutrient scavenger, able to reposition nutrients in the soil profile
- Easy to seed through various planting methods
- Mixes well with small grains, either for cover crops or forage
- Normally needs about 6-8 weeks (prior to freezing temps) to reach potential
- Generally winterkills, once temperatures reach the teens

NEMATODE RADISH

DOUBLEMAX is a late flowering, nematode reducing radish. It has class 1 resistance to sugar beet cyst nematodes (90% reduction), as well as Columbia root-knot nematodes (95% effective). Doublemax also can reduce stubby root nematode populations. When chopped and incorporated into the soil (while green), Doublemax and other nematode radishes work as a natural soil fumigant.

- Perfect in rotations with sugar beets, potatoes, carrots, and other vegetables
- Long slender taproot helps reduce soil compaction
- Green manure crop capable of producing large amounts of biomass quickly, aiding in weed suppression

CONTROL is a medium-maturing oilseed type radish that reduces both sugar beet cyst nematode (SBCN) up to 90% and Columbia root knot nematode populations (95% control). When worked into the soil, it acts like a bio-fumigant.

- Control stimulates SBCN cysts to develop but prevents them from completing their life cycle. This results in a dramatic decrease in the nematode population
- Fibrous root system captures and recycles nutrients, improving soil structure and aeration
- Effective control demands higher seeding rates (25 lbs./A) compared to daikon types

All radish respond favorably to N and other nutrients; bio-fumigant benefits show the greatest value.

As with all radishes, avoid integrating into cropping systems with other brassicas, as **disease bridges can occur**.

When radishes are left to decay, they produce a compound that releases an odor **similar to natural gas**.

DWARF ESSEX RAPESEED

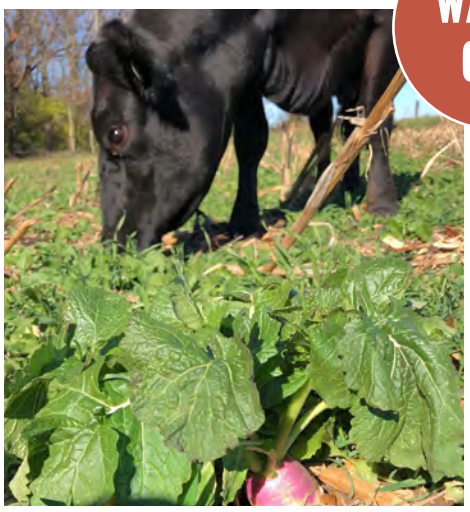
- Upright, cool season broadleaf with a deep and fibrous root system – good N and P scavenger
- Winterhardiness allows for multiple grazing cycles in fall and winter
- Routinely overwinters in most of our footprint
- Often more difficult to terminate in the spring if allowed to go to seed
- Adapted to drought and wide range of soil environments, including pH range of 5.8-8.0
- Rapeseed may attract some non-beneficial pests

TURNIPS – "EXTENDING THE GRAZING SEASON"

- Upright, cool season broadleaf - great forage for ruminant livestock
- Turnips tend to persist longer in the fall (compared to radish), improving nutrient cycling
- Overwintering is common, but terminates easy in the spring
- Works well alongside forage oats, breaking up compaction and shading out competition
- Grows best in pH 5.5 – 6.8
- Various types and varieties deliver different benefits, based on the shape of the tuber and leaf/bulb ratio. Purple top turnips are widely used, but the varieties listed below perform particularly well in grazing systems:
  - **Appin:** bred for grazing; expect excellent re-growth and multiple grazings when management and weather conditions allow; high leaf yield
  - **Barkant:** high sugar content improves palatability; reliable bulb yield and top growth
  - **Pasja:** hybrid brassica with high leaf/bulb ratio; bred for rapid growth (50-70 days)

KALE

- Highly palatable forage with a wide planting window – summer through fall
- Thick canopy protects the soil's surface from wind and water erosion
- Works well in mixtures with other brassicas and small grains



WATCH OUT

Always introduce livestock slowly to turnips and other brassicas and include high fiber feedstuffs to prevent **unfavorable livestock conditions**.

SEEDING METHODS

Growers today are utilizing many different approaches to timely seed cover crops - and as efficiently as possible.

The methods we describe are arguably the most widely employed, and normally work well in the Midwest given producers' cropping systems and availability of equipment.

DRILL OR SEEDER

- Using a drill or air seeder is the best approach to encourage adequate seed-to-soil contact and rapid germination.
- Calibrating drills takes time and attention to detail, especially when seeding cover crop mixes that include wide variances in seed size (see instructions on page 28).
- Simply put, using a drill or any pull type machinery only works post-harvest, therefore seeding windows are shortened.

BROADCASTING POST HARVEST (WITH LIGHT TILLAGE)

- There's a myriad of practices post-harvest to consider – like combining seed with fall fertilizer applications or placing seeders directly on tillage equipment.
- Increase seeding rates slightly (10-25%) to account for variable soil conditions and uneven seeding depth. Monitor tillage to make sure seeds are not being placed too deep.
- Depending on the broadcasting width and the system in place, double spreading may be needed to produce a uniform stand.
- **FROST-SEEDING** uses no tillage but rather leverages freeze-thaw cycles to pull seed into the soil. These applications in winter and early spring work best with small-seeded legumes like clovers, and dense seeds in general. But it's common for producers to frost seed spring grains as well.

SURFACE / AERIAL SEEDING

- Surface seeding using airplanes or drones enables earlier planting. Rainfall events and/or irrigation are critical to the success of aerial seedings.
- Timing recommendation into standing corn = > 50% sunlight penetration to the soil surface.
- Soybeans are tougher to pinpoint, but generally the best opportunity for success is at leaf senescence. Applications need to occur prior to leaf drop to maximize seed-to-soil contact.
- Moisture is key. It's always encouraged to apply seed sooner than later (in that ideal planting window) if/when moisture events are forecasted (or when irrigation can be arranged).

INTERSEEDING APPLICATIONS

- A popular practice 100 years ago, interseeding is being considered again to get covers established earlier in standing corn. Applications should be considered at V3 - V6, and although cover crop seeding toolbars are becoming more widespread, broadcast applications are more common.
- Probably a better fit further north in CISCO's footprint, where shorter seeding windows limit cover crop opportunities.
- Herbicide applications prior to seeding have a huge impact on establishment success. Non-residual options make the most sense.

DON'T MAKE A MISTAKE...

CALIBRATE!

DRILL CALIBRATION (USED WITH PERMISSION FROM UNIVERSITY OF KENTUCKY)

Items Needed to Calibrate Drill:
1. Tape measure (150 feet)
2. Flags to mark stopping & starting points
3. Gram scale with 0.1 gram accuracy
4. Plastic sandwich bags
5. Rubber bands

College of Agriculture, Food and Environment
Cooperative Extension Service

KADF KENTUCKY AGRICULTURAL DEVELOPMENT FUND

KBN KENTUCKY BEEF NETWORK

1. Read your drill's operators manual to learn where the adjustments for leveling, seed depth, and seeding rate are located.
2. Ensure that seed tubes are not blocked by spraying them out with an air hose and running a wire through them. DO NOT SKIP THIS STEP!!!
3. Use the "Seeding Rate Chart" on the drill to determine the initial drill setting and set the drill accordingly.
4. Select the proper gear box setting or drive gear for the desired target seeding rate based on the manual.
5. Place a small amount of seed above each opening in the drill box.
6. Lower the drill to engage the seeding mechanism.
7. Turn the seeding mechanism until seed comes out. Make sure that seed is coming out of each disk opener.
8. Disconnect three to five seed tubes from the disk openers.
9. Place and secure a collection container on each seed tube. A sandwich bag secured with a rubber band works well.
10. Pull the drill 150 feet OR turn the drive wheel the number of revolutions it would take to travel 150 feet.
    a. Revolutions can be determined by using the following formula: Number of Revolutions = 150 / (3.14 x Diameter of the Drive Wheel in feet).
11. Carefully remove collection containers.
12. Tare the scale for an empty collection container and then weigh and record in grams each collection container with the seed in it.
13. Add the seed weight for each collection container together and divide by the number of seed drop tubes collected to get the AVERAGE weight per disk opener.
14. Compare the AVERAGE weight per disk opener to the grams of seed/disk opener found in Table 1 for the desired seeding rate and row spacing.
    a. If the collected weight is within 10% of the target weight found in Table 1, then you are finished.
    b. If the collected weight is more than 10% different than the target weight found in Table 1, repeat steps 7 to 12 after adjusting seeding rate setting on drill.

TABLE 1. Grams of seed to catch per disk opener in 150 feet for given combinations of disk opener width (inches) and seeding rate (pounds/acre).

SEEDING RATE IN POUNDS/ACRE

Distance between disk openers	2	4	6	8	10	12	14	16	18	20	25	30	35	40	50	60	80	90	100	120	140	160	180
Inches	Grams of seed/disk opener to catch in 150 feet																						
6	1.6	3.1	4.7	6.3	7.8	9.4	10.9	12.5	14.1	15.6	19.5	23.5	27.4	31.3	39.1	46.9	62.5	70.4	78.2	93.8	109.4	125.1	140.7
7	1.8	3.6	5.5	7.3	9.1	10.9	12.8	14.6	16.4	18.2	22.8	27.3	31.9	36.5	45.6	54.7	72.9	82.0	91.1	109.4	127.6	145.8	164.1
7.5	2.0	3.9	5.9	7.8	9.8	11.7	13.7	15.6	17.6	19.5	24.4	29.3	34.2	39.1	48.9	58.6	78.2	87.9	97.7	117.3	136.8	156.3	175.9
8	2.1	4.2	6.3	8.3	10.4	12.5	14.6	16.7	18.8	20.9	26.1	31.3	36.5	41.7	52.1	62.6	83.4	93.8	104.3	125.1	146.0	166.8	187.7

*A YouTube video on grain drill calibration can be viewed on the KYForages YouTube channel at **https://www.youtube.com/c/KYForages**.*

TERMINATING COVER CROPS THAT OVERWINTER

COVER CROP TERMINATION IS A BALANCING ACT.

More growth can equal greater cover crop benefits, but additional residues become harder to effectively kill. GROWERS NEED TO PLAN, understanding that the best management practice is to terminate cover crops at least 10-14 days ahead of corn planting. Timing is not as crucial in soybeans; however, establishment (and yield) can suffer if cover crops are not controlled prior to crop emergence.

		CHEMICAL CONTROL[1]		MECHANICAL CONTROL		
		Best Options	Critical Timing	**ROLLER-CRIMPER** Best for monocultures, but may harbor pests	**MOWING[2]** Not ideal, but may make sense on small acreage	**TILLAGE[3][4]** Not endorsed, as other benefits are wasted
GRASSES	Cereal Rye	Glyphosate .75 lb. ae/A = < 18" tall 1.0 lb. ae/A = >18" Paraquat (& atrazine/28%) (full rates & 20gal/A volume)	Prior to boot stage (less than 18")	YES after flowering (milk to dough stage)	YES at Flowering	YES, but multiple passes will be needed depending on height and extent of biomass
	Winter Barley					
	Winter Triticale					
	Winter Wheat	Glyphosate 1.5 lb. ae/A = < 18"				
	Annual Ryegrass	Full rate of glyphosate, PLUS helpful tips below	less than 6-9" (prior to 1st node)	NR	NR	NR
LEGUMES[5]	Hairy Vetch	Glyphosate + 2,4-D/ dicamba (glyphosate at least .75 lbs. ae/A) Paraquat + 2,4-D or atrazine	Before flowering to support chemical movement in plants	YES at Mid-Full Bloom	YES at Mid-Full Bloom	YES
	Winter Peas			YES at Maturity		YES
	Crimson Clover	Glyphosate + 2,4-D/ dicamba (glyphosate at least 1.0 lbs. ae/A)		YES at Mid-Bloom		YES
BRASSICAS	Radish/turnips	Paraquat/Glyphosate/ Glyphosate + 2,4-D	Control escape plants before flowering	YES at Early-Bloom	YES at Early-Bloom (Flail mower is best)	YES
	Canola/rapeseed	Glyphosate at least 1 lb ae/A (may need multiple apps)	Best when plants are small & vegetative	NR	NR	NR

Tips for Annual Ryegrass Burndown

1. Pre-treat water with AMS to reduce hard water, and ensure correct pH levels.
2. Follow herbicide label directions (for adjuvants too).
3. Use standard or flat fan nozzles, keeping glyphosate spray volumes to a max of 12gal/A.
4. Confirm soil temps are 45° F and climbing, and air temps are 60° F (3 nights no lower than 40° F).
5. Target applications for midday (after dew has dried, but 3-4 hours prior to sunset).
6. If a 2nd pass is needed, wait at least 2 weeks (BUT DO NOT LET IT GET AWAY).

[1]There are other herbicides that growers have used and that have been quite effective, other than what is included here. It is important to always read and follow herbicide labels and understand herbicide rotational restrictions for following crops.

[2]Mowing only works to terminate when crops are cut very short, below the growing point. Sickle bars cut closer to the ground, increasing effectiveness. Rotary and flail mowers leave residues that normally decompose quicker.

[3]Tillage may work if crop residues are altogether buried. However, some forms of tillage will require multiple passes to achieve satisfactory control. Moldboard and chisel plows are effective for dense stands. Vertical tillage tools are not effective.

[4]Tillage quickly destroys other advances achieved by cover crops. It takes added time post tillage for residues to decompose.

[5]The best time to kill legumes to maximize plant available nitrogen (PAN) is at the budding growth stage. When spraying legume/grass mixes, terminate before grasses reach boot stage so newly fixated N is not immobilized.

TAKEN FROM OREGON RYEGRASS GROWERS COMMISSION

COVER CROP ROTATIONS

FITTING COVER CROPS INTO ROW CROP ROTATIONS

CISCO has developed these additional mixes to cover the majority of custom mix requests. These simple formulas will meet many of the goals that dealers and growers are focused on. These mixes will be available on an as ordered basis with a minimum of 500 lbs.

N-VEST RYE/RADISH MIX

Cereal Rye	96%
Scav-N-Ger® Radish	4%

COVER-ALL RYE MIX

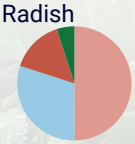
Cereal Rye	75%
Improved Crimson Clover	20%
Scav-N-Ger® Radish	5%

COVER-ALL OATS MIX

Oats	82%
Improved Crimson Clover	13%
Scav-N-Ger® Radish	5%

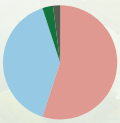
3-SEASON COVER MIX

Cereal Rye	50%
Oats	30%
Improved Crimson Clover	15%
Scav-N-Ger® Radish	5%



4-WAY CORR MIX

Cereal Rye	55%
Oats	40%
Scav-N-Ger® Radish	3%
Rapeseed	2%



NOTES

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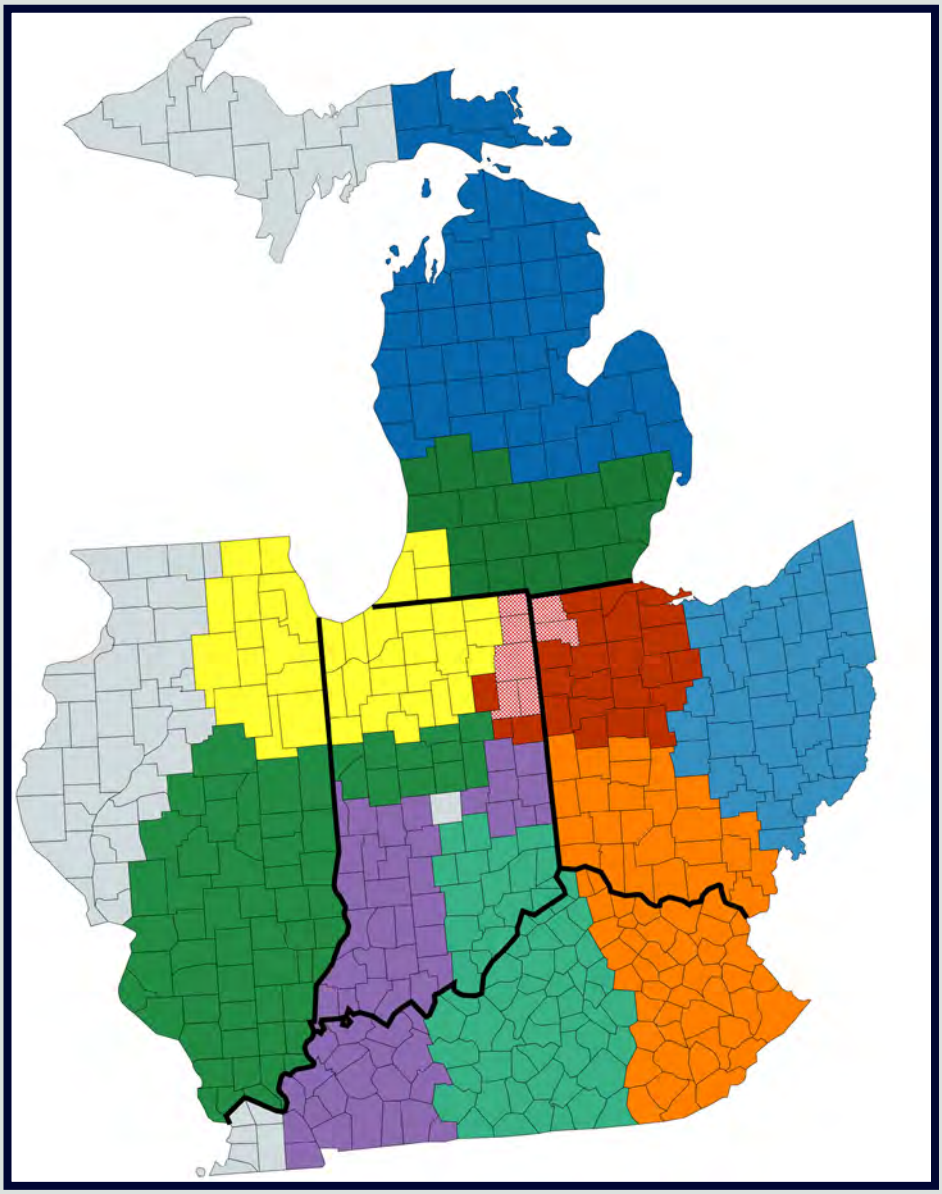

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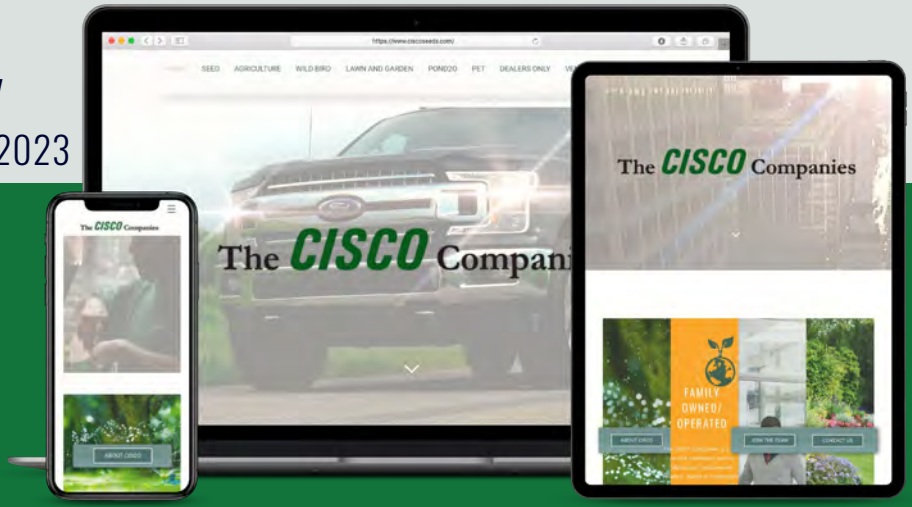

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