SOIL FIRST®

BY DLF

MANAGEMENT GUIDE 2027

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DLF

SOIL FIRST®
BY DLF

DLF + SOIL FIRST®: SEEDS & SCIENCE, DELIVERED

Since 2018, Soil First® has been a brand within DLF, the global leader in research, development, production and distribution of forage, turfgrass and cover crop seed.

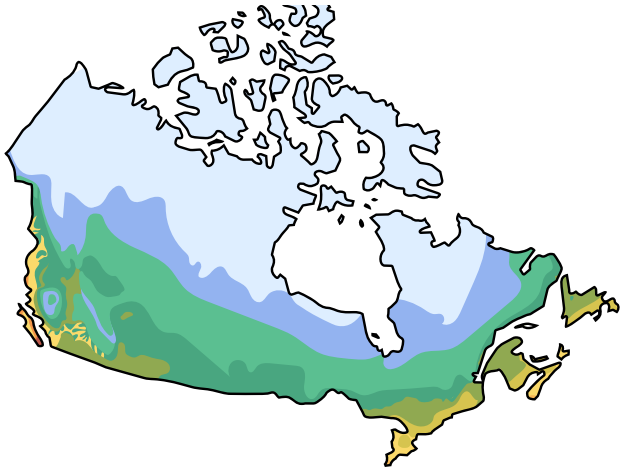
Still the Soil First® you know and love, we are now part of a worldwide organization with a tremendous passion for innovation and a commitment to helping us deliver the absolute best forage products.

Soil First® has been reliably supplying its customers with quality seed, expert advice and prompt service for many years. Our mission is simple, to be your preferred seed partner. We know you have options and it's our job to prove to you that doing business with DLF is your best choice.

The team at DLF has carefully researched and selected a family of products that we believe link sound agronomics to practical solutions. Combining solid advice on what to plant and how to manage it - from establishment practices to removal strategies - you can count on the team at DLF and the Soil First® family to help you reach your productivity and conservation goals. Soil First® products were designed to meet the needs of farmers and landowners looking to increase productivity by preserving and bettering their soils. We believe integrating soil conservation practices like cover crops takes planning, commitment and long-term dedication. We take pride in working with a group of dealers dedicated to delivering the cover crop message to the field. We invite you to think "SOIL FIRST®" when making your cover crop planting decisions. The goal of this manual is to provide insights on soil health concepts, cover crop species, management strategies and practical solutions.

CANADIAN PLANT HARDINESS ZONES

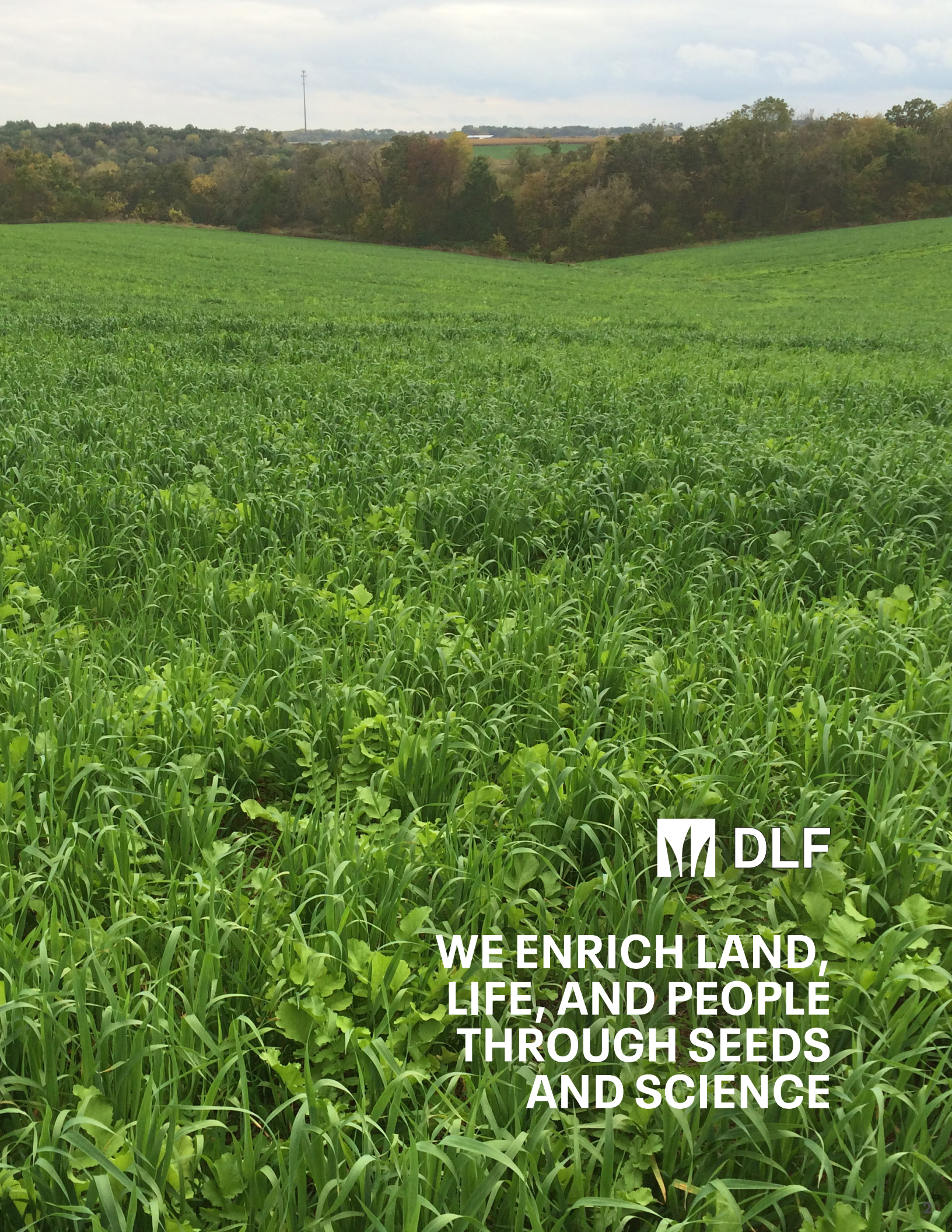
Look for hardiness zone recommendations for plant species featured throughout this guide



-51 to -45 °C	1
-45 to -40 °C	2
-40 to -34 °C	3
-34 to -28 °C	4
-28 to -23 °C	5
-23 to -17 °C	6
-17 to -12 °C	7

PRODUCT BENEFIT KEY
Look for these helpful icons throughout this guide as an easy starting point for choosing the best product for you.

EASY ESTABLISH · P & K CYCLING · POLLINATOR BENEFIT · COMPACTION ALLEVIATION · WEED SUPPRESSION · BIOMASS PRODUCTION · EROSION CONTROL · NITROGEN FIXER


DLF
WE ENRICH LAND, LIFE, AND PEOPLE THROUGH SEEDS AND SCIENCE

GROWING WITH DLF

Our customers demand a lot from their seed: yield, forage quality, winterhardiness and disease resistance. That is why we invest heavily in global R&D and Product Management. For more than 30 years, DLF R&D and Product Management have optimized forage grass and legume varieties ideal to local climatic and environmental conditions to seed the green future. We aim to deliver sustainable solutions with the potential to increase productivity of land and livestock, sequester carbon and reduce emissions in the supply chain.

Berry, Kentucky USA

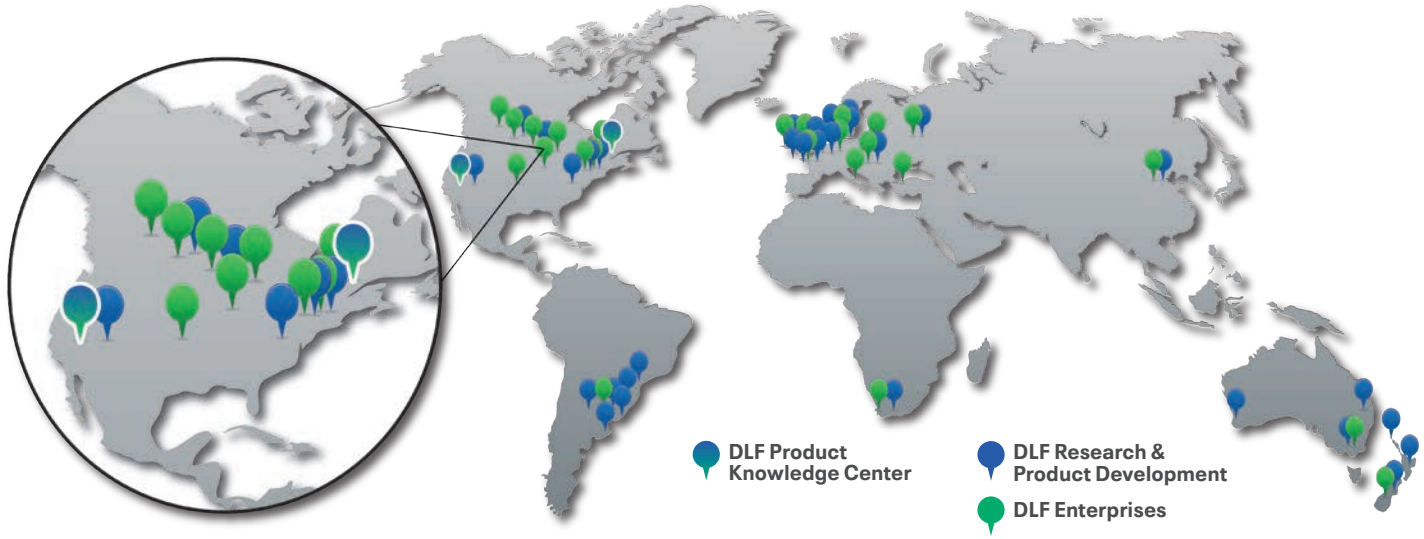
Philomath, Oregon USA

Port Hope, Ontario Canada

Touchet, Washington USA

West Salem, Wisconsin USA

THE WORLD OF DLF



WE ENRICH LAND, LIFE, AND PEOPLE THROUGH SEEDS AND SCIENCE

EMBRACING CHANGE AND LOOKING TO THE FUTURE

At DLF, we believe in the transformative power of seeds and science to create a better future. As a farmer-owned cooperative with deep roots, expert know-how, and global presence, we are uniquely positioned to lead the change in addressing the challenges of climate change and biodiversity loss through our product solutions and their productivity.

Our purpose *"We enrich land, life and people through seeds and science"* captures the heart of who we are and what we aim to achieve.

A LEGACY OF COLLABORATION AND INNOVATION

Founded on the democratic traditions of cooperation, DLF has grown from a local Danish seed producer to a global leader in forage and turf seed. Guided by the collective dedication of our farmer-owners and suppliers, we bring locally adapted seed solutions to over 100 countries. Our heritage ensures business resilience, and our forward-looking mindset drives innovation.

We see the world's challenges not as obstacles, but as opportunities to make a difference. By blending science with sustainability, we aim to create products and solutions that go beyond profitability, contributing to ecosystems, economies, and communities.

SEEDS AS CATALYSTS FOR A GREEN TRANSITION

Seeds are a catalyst of the green transition. They are simple, essential, scalable, and regenerative. Through plant breeding and scientific research, our seeds work both above and below the ground to deliver dual-purpose solutions that address critical issues.

Above the ground innovative seeds enable biomass production and quality of leaves, enhance biodiversity and tolerance to disease, and stabilize landscapes through erosion control.

Below the ground our seeds enable carbon capture, improve soil health, reduce nutrient loss, and foster stable, resilient ecosystems. As global market leaders, we invest in future growth levers to build seeds for a changing climate and use our expertise to unfold future opportunities for businesses and people.

ENRICHING LAND, LIFE, AND PEOPLE

DLF's commitment to innovation enriches ecosystems and enhances quality of life for all living organisms. By leveraging our local knowledge and global presence, we bring green surroundings and climate-resilient solutions to people and communities.

THE POWER OF COLLABORATION

Our purpose is grounded in DLF's cooperative model and a deep-rooted belief that collaboration is the path forward. By uniting farmers, scientists, and businesses, we unlock the full potential of seeds to drive positive change. Together, we are more than a seed supplier – we are partners in transformation, empowering our sector and communities to thrive.

A FUTURE GROUNDED IN PURPOSE

DLF's long-term purpose strengthens us as a company with a significant societal and environmental impact. The phrase *"We enrich land, life and people through seeds and science"* reflects our commitment to creating a better future. It is a story of passion, potential, and positivity.

As we continue to lead the seed sector, we remain dedicated to bridge the past and the future, tradition and innovation, local presence, and global impact.

WE WORK WITH NATURE AND SCIENCE TO BRING RESILIENT SEED SOLUTIONS FOR LAND, LIFE AND PEOPLE.

OVER THE PAST 10 YEARS WE HAVE HARVESTED A TOTAL OF

106,030 PLOTS ACROSS CANADA!

TRIAL DESIGN

- DLF is home to the only proprietary, replicated forage trials across Canada
- Each plot in a trial is 3 feet wide by 17 feet long
- Each trial has randomized replications of all varieties
- Each trial runs for three production years

Trial showing comparisons of orchardgrass winterhardiness - Port Hope ON

TESTING

DLF's Canadian trialing provides the ability to select varieties that have improved disease resistance, superior yield, improved winterhardiness, faster regrowth and high forage quality based on true head-to-head comparisons!

Trial showing comparisons of alfalfa regrowth - Lindsay ON

HARVESTING

- Using DLF's custom RCI Engineering 36A forage harvester, legume trials are harvested 3-4 times and grass trials are harvested 2-3 times per season

DLF'S CUSTOM RCI ENGINEERING 36A FORAGE HARVESTER IN PORT HOPE, ON

HAVE A GOAL & A PLAN WHEN DECIDING TO TRY COVER CROPS

Research to date proves cover crops are making strides in bettering our soils in the short term and encouraging soil structure and soil health improvements for decades to come. Initiatives across the country support the agronomics behind keeping soil and their nutrients in place and keeping our natural resources protected for the next generation.

Yet, without the proper commitment and planning, making cover crops function in today's complex cropping systems will simply not work as well and achieving gains in soil quality can certainly be delayed.

1. **Have a goal when planting a cover crop.** Ask yourself: "What do I want to accomplish by planting a cover crop and what benefits am I working toward?"

2. **Select the right cover crops to help you reach your goals.** There are many species on the market and each species has a distinct set of characteristics aimed toward achieving different outcomes. Wrong choices can be a pathway to potential problems.

3. **Have a plan!** Think about the changes that may be needed to your current farming system to allow for correct establishment (and management):
   - » Modifying your crop rotation (perhaps the addition of another crop to your rotation allows for a wider window in the fall)
   - » Altering the previous crop's harvest slightly, allowing for more timing flexibility
   - » Adjusting your herbicide program to allow for timely cover crop seeding
   - » Integrating an additional pass in fall and/or spring for planting and spring termination

4. **Select a field** or area(s) of your farm that would benefit the most from a cover crop.

5. **Think small acres starting out.** Consider any new management concepts needed when trying cover crops or green manures for the first time.

6. **Order seed sooner than later.** It may take longer than you think for less-traditional seeds to make their way to you. Good, clean seed will be the most demanded (seed, not grain, is professionally grown and maintained to ensure good quality and germination).

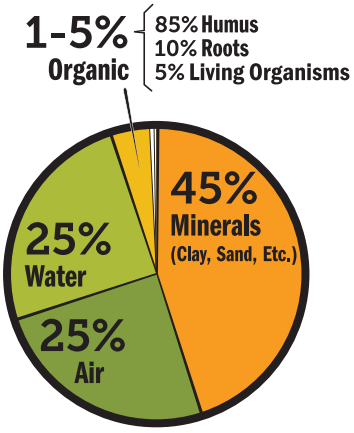
7. **Allocate labor and equipment.** Depending on your seeding plan, it may be imperative to have extra help in late summer/fall to allow for the quickest seeding after cash crop harvest. If plans include using custom seeding, communicate your plans early to ensure the most timely application.

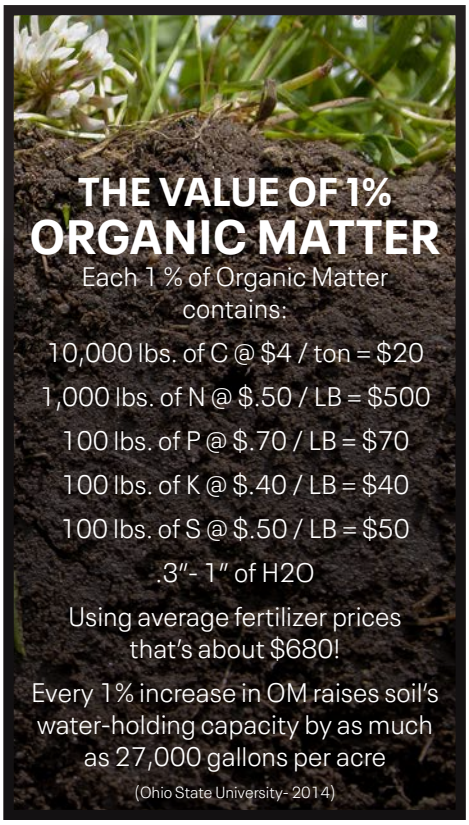
8. **Consider leaving a check strip for comparison.** How better to determine the progress than by seeing uncovered ground side-by-side?

9. **Balance your goals and spring management wisely.** A perfectly established cover crop not managed or terminated correctly in the spring can create huge challenges for your subsequent cash crop.

10. **Make a commitment. Some goals are easily noticed and well defined, but improving soil health is a journey, not a destination. It takes time to regenerate soils and it requires that producers consider long term expectations, and having patience with initial goals or objectives.**

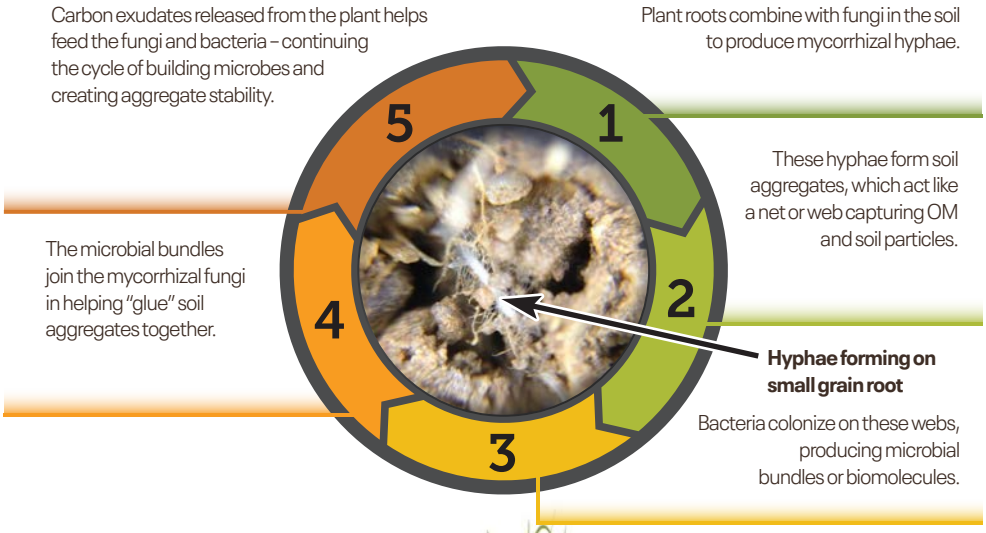
Our soils are a dynamic system composed of living and dead organisms, decomposing and residual organic matter, minerals, water and oxygen. A large portion of our soils cannot be changed or altered. No matter the soil type or condition, that fraction has some level of minerals, air, and water that together comprise 95 to 99% of the soil makeup. The balance is the segment that can be affected by conservation practices. This organic section is how we can impact nutrient cycling, water quality and overall soil structure and condition.





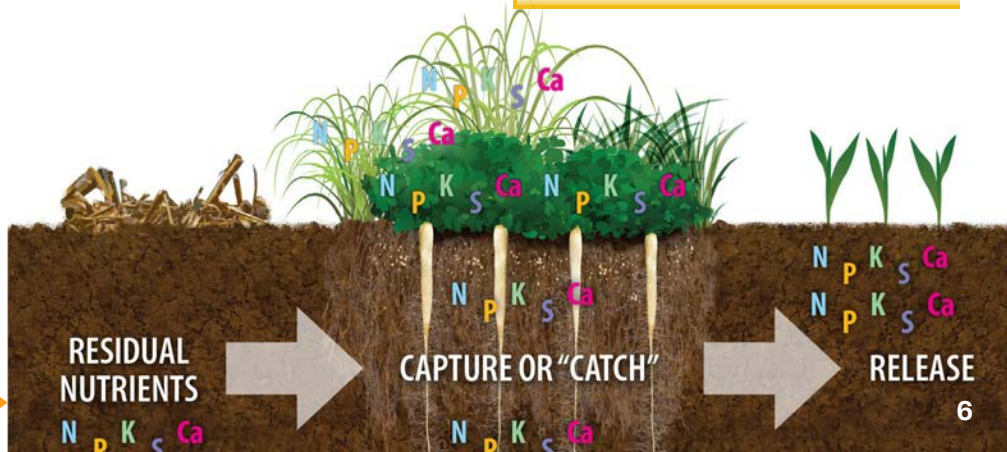
It may take time to create major advances in soil quality, however progress can be discovered by following four basic principles:

1. **Minimize Disturbance.** Unlike soil texture, the soil's structure can be greatly impacted by tillage. Disturbing the soil destroys pore space, ultimately decreasing infiltration of water and the movement of oxygen. Whereas minimum-tillage systems have had a huge impact in improving soil organic matter (a leading indicator of soil quality), however no-till by itself isn't enough.
2. **Maximize Biodiversity.** As soil is less disturbed and plant diversity is improved, nutrients become more available for cash crops while restricting unwanted plants and organisms.
3. **Maximize Soil Cover.** Bare soils introduce the probability of wind and water erosion, during which nutrients and organic matter can be carried away and the opportunity for carbon capture is lost.
4. **Provide Continuous Living Roots.** Living organic matter (OM) and dead plant residues in the soil improves soil structure and stores nutrients, making them available later for cash crops. Adding continuous roots speeds up organic matter gains and at the very least maintains organic matter levels. Building OM levels offsets the "mining" action of cash crops.



Cover crops and green manures stimulate microbial activity because they supply food (carbon) for the microorganisms to feed on. Microorganisms in our soils use carbon to build organic matter and in turn store nutrients. Carbon reserves allow nutrients to be scavenged, supplying food for the soil ecosystem, instead of robbing the microbes' reserves left from the organic matter.

Aggregate stability leads to increased soil structure, which ultimately leads to better nutrient cycling, and better movement of water and oxygen. Cover crops and green manures prevent captured nutrients from being lost through soil erosion, leaching and volatilization.



MATCHING COVER CROPS TO YOUR GOAL

1 SEQUESTER & CYCLE NUTRIENTS:

Cover crops can aggressively scavenge and cycle nutrients from deep within the soil profile making them available in the root zone of subsequent crops, improving yields and reducing runoff into sensitive watersheds.

2 REDUCE SOIL EROSION:

Extensive root systems cling to the top layer of soil creating an interior shield from erosion while top growth minimizes wind and water erosion.

3 CREATE A NITROGEN SOURCE:

Legumes produce additional nitrogen (N) by converting atmospheric nitrogen into nutrients plants can use.

4 BREAK UP SOIL COMPACTION:

Deep burrowing roots break through compacted soil to create pore space improving aeration, water movement and helping soil organisms flourish.

5 PROVIDE WEED CONTROL:

Cover crops create competition for winter annuals and other weeds by shading them out, and preventing them from robbing valuable moisture and nutrients from subsequent cash crops (with the potential of lowering herbicide requirements per acre).

6 SUPPORT PEST CONTROL:

Most cover crops that suppress weeds during the winter months can consequently reduce nematode populations. Some cover crops deplete nematode populations by causing premature egg hatching. Other species provide control by eliminating winter annuals that historically provide a refuge for nematode populations. Still other cover crops contain chemicals that naturally fumigate at-risk soil environments.

7 GENERATE EXTRA FORAGE:

Most cover crop species have the added benefit of being "dual-purpose", meaning they provide both the benefit of a soil cover while providing a valuable forage source for livestock.

8 ADD HABITAT FOR WILDLIFE & SHELTER POLLINATORS:

Fall, winter and spring cover crops create environments crucial for wildlife protection and nesting. Additionally, the biodiversity created by many cover crop systems have positive effects on native pollinators.

9 BUILD ORGANIC MATTER:

As cover crops grow, die and break-down, they add carbon to soil, feeding the soil food web, improving soil tilth, soil quality and water holding capacity.

10 INCREASE SOIL STRUCTURE:

Actively growing plant roots increase mycorrhizal hyphae creating soil aggregates that act like a net capturing organic matter and soil particles. Aggregate stability builds soil structure that leads to better movement of nutrients, water and oxygen.

11 CONSERVE SOIL MOISTURE:

By converting the sun's energy into growing biomass and the opportunity for organic matter, soil moisture is increased while reducing runoff, evaporation and overall variability from weather extremes.

12 CREATE FINANCIAL VALUE:

The above benefits create the opportunity for better yield potential in cash crops, lower input costs and ultimately higher land values. In addition many states and counties offer cost-sharing initiatives for this important practice.

CUSTOM SEED MIXING

DLF offers custom mixing capabilities to meet any cover crop or conservation needs. Contact us at info@dlf.com or visit our website to learn more.

Cover crops are one of many conservation tools on the farm to better protect our soil and water. There are many choices when it comes to conservation and environmental farming practices, and we provide a diverse selection of conservation seed solutions.

SEED OPTIONS

DLF offers a vast portfolio of seed designed for many conservation applications. A partial list available through DLF includes seed for:

- Conservation cover – including CRP and pollinator habitat seeds
- Contour buffer strips
- Filter strips
- Field borders
- Forage and biomass plantings
- Grassed waterways
- Stream bank protection

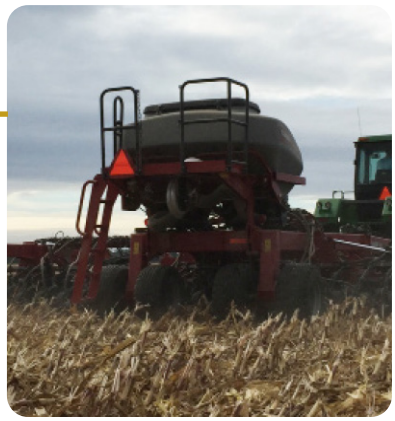
CONSIDERATIONS WHEN CREATING CUSTOM SEED MIXES:

- Think about seed sizes – will the different size and shape of certain seeds prohibit specific application methods?
  - » Aerial: too large of seed might struggle to get adequate seed-to-soil contact
  - » Drilling or Ground Seeding: seed size usually affects seeding depth. Different seeding depths become a real challenge with numerous species all in the same bag
- Different cover crops often perform best when planted at different times
- Not all crops are beneficial to the next crop in the rotation
- Select species carefully, making sure all species are adapted to the field's soil, drainage and crop rotation

WATERWAYS & BUFFER STRIPS

NATIVE GRASSES WILDFLOWERS

DRILL OR TRADITIONAL/AIR SEEDER



Using a drill or seeder to plant cover crops and green manures ensures the best seed-to-soil contact and an ideal environment for the quickest germination. Clearly, this is not an option until the standing crop has been removed or harvested. The best methods for seeding cover crops require sufficient planning to ensure its success.

CONSIDERATIONS:

- Keep in mind changing field conditions that may alter seeding depth and seed spacing
- Make sure your drill is calibrated correctly, knowing the various sizes of cover crop seeds
- As a rule of thumb, use the largest seed in your blend as the indicator for calibration - see drill chart on page 28.

AERIAL/SURFACE SEEDING

When aerial seeding, consider the ideal planting window for the cover crop being planted. For example, radishes typically need 800-900 Growing Degree Days (GDD), or at least 4 - 6 weeks and preferably 8 - 10 weeks of growth prior to winter termination. That planting period needs to be taken into account so it coincides with the proper maturity stage of the crop in the field. Moisture or irrigation is crucial when surface seeding to make up for the lack of seed-to-soil contact. When time could be a hurdle, aerial and "over-the-top" seedings offer a worthy alternative.

CONSIDERATIONS:

Assuming seeding intervals match, the ideal time to aerial seed into traditional cash crops are as follows:

CORN	When at least 50% of sunlight can penetrate to the soil surface
SOYBEANS	At leaf senescence typically, but that depends to some degree on row width and soybean architecture. Delaying seedings into soybeans decreases seed-to-soil contact and increases the risk of poor moisture retention needed for maximizing germination.
SUNFLOWERS	When the back of the seed head turns yellow

When crop stage and the seeding calendar do not align, always tend towards earlier seedings, especially when a moisture event is forecasted or irrigation can be planned. It's better to have the cover crop seed in the field to begin the germination process rather than planting later where the seed may have to compete with excess cash crop residue.

BROADCAST APPLICATIONS

- Most broadcast seedings occur after cash crop harvest and are followed with a culti-packer or light tillage pass to encourage better germination. A common practice is combining cover crop seed and fall fertilizer to increase efficiency when time may be an obstacle in the fall. It's not uncommon for growers to attach seeders directly to their tillage equipment, eliminating a trip through the field. Even though moisture isn't as critical for establishment versus an aerial application, any tillage will decrease soil moisture, lessen soil microbe activity and slow gains in soil structure.

CONSIDERATIONS:

- A common mistake is planting the seed too deep. Take extra caution to keep tillage depth shallow. Most cover crop seeds only need to be placed between ¼" - ½" deep.
- Due to the width and variance of some broadcasters, a double-spread pattern may be needed to ensure even spreader distribution
- Rule of thumb: increase seeding rates by 20 - 25% or more to guard against imperfect seed bed environments

INTERSEEDING

Interseeding cover crops into cash crops (like V3 - V6 corn) lengthens the growing season for the cover crop seeding. Besides the benefit of earlier establishment, improved nutrient cycling and greater biomass for grazing are further advantages of getting covers seeded roughly 60 - 90 days ahead of typical plantings. Interseeding implements are becoming more widely available, however most interseeded acres we've witnessed have been seeded using broadcast equipment, many along with a fertilizer application. Interseeding continues to gain traction, especially in northern areas where the post-harvest seeding window is reduced by colder temperatures and unpredictable weather.

PRECISION/ROW-CROP PLANTERS

Precision planters allow for the precise seeding of cover crops, while making it an option to plant subsequent cash crops exactly in the same location using today's technology. Row-crop planters guarantee consistent seeding depth and seed spacing (assuming seed plates and other planting equipment is used properly).

FROST SEEDING

Frost seeding works well during the late winter months (usually February - March) taking advantage of the upcoming freeze-thaw cycles. Legumes like red clover are commonly frost seeded into small grain or perennial fields, but many cereal cover crops can be frost seeded as well to get a jump start on early spring growth.

OTHER SEEDING METHODS

Many methods work across the country. Don't be afraid to try something that makes sense. For example, growers affix seed boxes to combines (on the rear of the machine to spread within the residue, or on the combine head). Others put smaller seed through irrigation equipment. Mixing cover crop seed and slurry manure is another effective method assuming proper equipment is used – specifically a tank and delivery system with the proper tines and/or coulters. It's important to inject the seed into the soil rather than simply leaving on the surface as not all seeds tolerate the high salinity and/or ammonia of the manure slurry. Ultimately, whatever method is chosen, the goal should be getting cover crops seeded in a timely, agronomic manner that increases the likelihood for success.

COVER CROP TERMINATION CHART

		WINTER KILL	ROLLING / CRIMPING	MOWING	TILLAGE	HERBICIDE	COVER CROP GROWTH STAGE	HERBICIDES FOR TERMINATION
Brassicas	Radish / Turnips	*	No	No	Yes	Yes	°	Glyphosate
	Canola / Rapeseed							
	Mustard							
Legumes	Crimson Clover	*	No	No	*	Yes	°	Glyphosate; 2,4-D + Dicamba
	Winter Pea	*	No	Yes	*	Yes	°	Glyphosate + 2,4-D
	Hairy Vetch	No	Yes (Full Bloom)	No	Yes, but 2 passes may be needed	Yes	Yes (Pre or Mid- Bloom)	Glyphosate + 2,4-D or Dicamba
Grasses	Annual Ryegrass	*	No	No		Yes	< 6 - 8"	See Page 14
	Winter Barley	No	Yes, at Milk or Dough Stage	Yes		Yes	Prior to Boot Stage (<18")	Glyphosate 4.5 lb ae Per Gal; 22 fl. oz Per Acre
	Winter Triticale							
	Winter Wheat							
	Winter Rye							

WINTER RYE

- Fast growing and very hardy (hardiest of all the cereal grains)
- Tolerant of poor soil conditions
- Fights soil erosion and helps suppress weeds when planted at heavier seeding rates
- Captures excess nutrients from cash crops
- Works well as a nurse crop with legumes
- Several methods exist for successful spring management (refer to pgs. 7 & 8)
- Spring and fall forage option (best use – spring, fall, winter pasture)

WINTER RYE HARDINESS ZONE

Winter rye is an upright, cool season annual grass that germinates in cool conditions. Also known as "fall" or "cereal" rye, very few species offer the many benefits as winter rye while allowing extended planting flexibility long into the fall.

CONSIDERATIONS:

- Ideal pH = 5.0 – 7.0
- Quick spring growth can easily get away from many producers – have a plan to manage effectively

SPRING OATS

- Fights erosion and helps suppress weeds planted at heavier seeding rates
- Very good Biomass Production
- Fast growing and tolerant of poor soil conditions
- Spring and fall forage option

SPRING OATS HARDINESS ZONE

Seeding Rate: Varies with use, see chart on pgs. 21 & 22

CONSIDERATIONS:

- Ideal soil temperature 3 degrees celcius - Highly sensitive to cold.

SPRING TRITICALE

- Performs well on marginal land and/or poor soil environments; tolerates poorly drained soils as well
- Fights soil erosion and helps suppress weeds planted at heavier seeding rates
- Captures excess nutrients left from cash crops
- Growth patterns favor use with legumes and brassicas
- Higher levels of digestible energy and crude protein compared to barley
- Spring and fall forage option (best use – fall and spring pasture, silage and hay)
- Spring triticale is an upright, cool season annual grass bred from crossing wheat and rye. This brings together the cover crop benefits (and tonnage potential) of winter rye with the increased feed value of wheat.

SPRING TRITICALE HARDINESS ZONE

CONSIDERATIONS:

- Ideal pH = 5.2 – 7.0
- Spring growth can be a management concern; terminate early when preceding a grass crop

WINTER TRITICALE

- Performs well on marginal land and/or poor soil environments; tolerates poorly drained soils as well
- Fights soil erosion and helps suppress weeds planted at heavier seeding rates
- Captures excess nutrients left from cash crops
- Growth patterns favor use with legumes and brassicas
- Triticale can be seeded earlier in fall than other small grains (less susceptible to Hessian Fly)
- Higher levels of digestible energy and crude protein compared to barley
- Spring and fall forage option (best use – fall and spring pasture, silage and hay)

WINTER TRITICALE HARDINESS ZONE

Winter triticale is an upright, cool season annual grass bred from crossing wheat and rye. This brings together the cover crop benefits (and tonnage potential) of winter rye with the increased feed value of wheat.

CONSIDERATIONS:

- Ideal pH = 5.2 – 7.0
- Spring growth can be a management concern; terminate early when preceding a grass crop

NITROUS BRAND

WINTER TRITICALE

- New selection = improvement in winter hardiness
- Outstanding forage yield
- Reduced awns for greater palatability
- Increased ergot resistance
- Strong Fusarium resistance
- Characterized by bluish hue
- Seeding Rate: Varies with use, see chart on pgs. 21 & 22
- Nitrous is our new winter triticale variety, showing increased winter hardiness over Hy Octane. Nitrous delivers outstanding forage yield with a greater leaf:stem ratio. Nitrous makes a great option for fall or winter grazing, extending the season beyond that of brassicas and cool season grasses.

WINTER TRITICALE HARDINESS ZONE

MANAGEMENT TIPS FOR WINTER CEREAL GRAINS

TERMINATING SMALL GRAINS

Assuming the predetermined goal allows, it's always recommended to terminate small grains early. Terminating with herbicides, glyphosate and/or grass herbicides have been effective in late spring prior to boot stage. This lessens nitrogen immobilization, conserves soil moisture and reduces exposure of voles, armyworms and other pests. It's common for vegetable and orchard growers to let small grains stand as long as possible between plant rows. This practice also allows for proper bedding under many fruit and vegetable crops, reducing the risk of root rot while keeping them clean and dry.

OTHER TERMINATION METHODS

Tillage – usually eliminates regrowth, but should be done when rye and triticale are at least 10 - 12" tall. Once crop grows taller than 18 - 24", tillage becomes less effective and will likely take at least two passes. Tillage can be effective on barley at mid-late bloom stage (before seed set).

Mowing – wait until the stand has begun flowering (rye usually flowers with 14 hours of continuous sunlight and temps above 40°F). The use of sickle mowers usually works better than flail mowers. Mowing barley at mid-bloom has been effective.

Rollers, stalk choppers and crimpers used at milk or soft dough stage (usually around 20-24" tall) can flatten stems and potentially eliminate a burndown pass. For barley, rolling needs to take place earlier (mid-bloom).

Triticale and wheat grow more slowly in spring than rye and barley, offering more flexibility in wet conditions.

All winter cereal grains require vernalization to produce seed/grain. Spring grazing or mowing can postpone and prolong cereal grain flowering if that fits into the goal.

SEEDING CASH CROPS INTO CEREAL GRAIN STANDS

Adequate seed-to-soil contact is crucial to proper cash crop establishment, but it's a challenge where residues remain on the soil surface, especially small grain residue. Equipment that removes this residue from the immediate seeding area can help reduce stand losses, increase soil temperature in the seed zone and decrease the amount of residue that comes in contact with the seed. Equipment manufacturers have developed several tools to help manage these challenges that cover crops potentially pose to the soil surface in spring. Row cleaners are designed to clear away residue from the opening disks of the planter units, reducing the chance of hair-pinning residue into the seed furrow (common with small grains). Row cleaners should be adjusted to move only residue and not soil (soil movement results in soil drying out and potentially introducing weed competition). Spoked closing wheels improve establishment in poorly drained soils, where traditional smooth rubber closing wheels can result in soil crusting. Any planting equipment should be properly maintained with adequate weight and down pressure for ideal penetration into the soil.

Note: "Planting green", or planting cash crops into living cover crops, is not for the cover crop beginner. If dry weather is forecasted or a dry spring is expected, it is always recommended to kill the cover crop early, saving valuable soil moisture.

PLANTING CORN AND SOYBEAN CROPS AFTER SMALL GRAINS

Many people attribute the inhibition in corn growth by rye to allelopathy, the release of chemicals by one plant that inhibits the growth of adjacent plants. While rye does produce chemicals that can inhibit plant growth, under most situations the rye biomass on the soil surface is responsible for suppression of weeds rather than the release of phytotoxic chemicals. The chemicals produced by rye likely have little influence on corn growth. Research has shown that susceptibility to allelochemicals is indirectly related to seed size — the smaller the seed the more susceptible the plant. The large seed of corn and its relatively deep planting depth minimize the impact of any chemicals released by the cover crop. Small grains' negative effect on corn are concentrated on these factors:

1. The presence of rye mulch on the soil surface alters the soil environment in a way that inhibits corn growth. The mulch may delay soil warming and drying, creating a less favorable environment for corn.
2. The decaying rye biomass immobilizes soil nitrogen.
3. Rye may act as a 'green bridge' for plant pathogens. The dying rye could serve as a host for pathogens that move to corn seedlings after the rye dies.

Proper management reduces the risk rye poses to corn production. Terminating rye 10 to 14 days prior to planting corn greatly minimizes the chance of a negative impact. Burndown herbicides are more consistent at killing rye when applied to small plants; however, much of the benefit in suppressing weeds will be lost when treating the rye while it is small. Soybeans can tolerate heavy amounts of rye residue, thus early termination is not as critical when planting soybeans following cereal rye.

(Hartzler, Iowa State, 2011)

MANAGING SMALL GRAINS FOR FORAGE

With a greater need for quality feed sources, cereal grain options are becoming increasingly popular as forage supplements to existing perennial hay and summer annual acres. Many forage benefits are consistent across all these cereal grain options but differences do exist in quality and tonnage based on proper management.

WINTER TRITICALE

Winter triticale is a cross between wheat and rye. This makes for a crop with higher yields than wheat, but lower quality. Triticale is best suited for grazing pasture. Because of its large stems, hay wilting and silage packing can be difficult.

- Best Use: Fall & Spring Pasture; Silage & Hay (boot to dough stage)

WINTER RYE

Winter rye offers the advantage of being the easiest cereal grain to establish in poor soils and having the greatest cold tolerance. Rye offers the greatest production for hay or pasture ground because of its quick growth both in the fall and spring.

- Best Use: Fall, Winter & Spring Pasture

SPRING OATS

Oats can be planted in the fall, as long as it's early enough to justify 60 - 90 day production.

- Best Use: Silage (milk to dough stage); Hay (boot to heading stage)

WINTER WHEAT

Wheat has good potential for forage and is usually higher in quality than rye, triticale and oats but not barley. However, wheat usually produces more dry matter than barley.

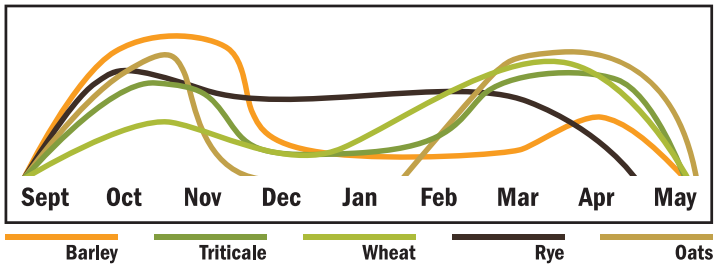
- Best Use: Fall & Spring Pasture; Silage (boot to dough stage); Hay (boot to milk stage)

WINTER BARLEY

Winter barley is the most susceptible to winterkill of the cereal grains. Consideration should be made when grazing late into the fall. Barley's value
as a silage crop is the most comparable to whole-plant corn (90-100%).

- Best Use: Fall Pasture; Silage & Hay (boot to dough stage)

Relative Production of Small Grain Cereals



(Kansas State University)

FERTILITY

When utilizing cover crops as forage, it's critical to consider the nutrients being removed along with the biomass. These fertilizer levels will need to be added to ensure maximum nutrient availability for the following cash crop.

REMOVAL RATES	
Wheat/Rye as Silage • Equivalent 60 bushel yield crop	80-100# N 40# P 60-70# K
OATS • Equivalent 80 bushel yield crop	70-90# N 30# P 100# K

HAY PRODUCTION

Hay yields often average between 2 and 4 tons/acre. Moisture content should be between 15 - 20% moisture. Hay quality is more maturity-dependent at harvest than is silage.

The most efficient time to harvest small grain cereals for hay is at early-milk stage. This allows for the greatest compromise between forage yield and quality (quality would be greatest at the late-boot stage). To help speed up drying, a crimper is recommended when harvesting in the late-boot stage.

SILAGE PRODUCTION

Wheat, barley, oat and triticale silage yields are similar, 4 - 7 tons/acre of 35% dry matter forage in the boot stage and closer to 6 - 10 tons/acre when harvested in the late-boot stage. Small grains should be ensiled at between 62 – 68% moisture. Chop length should be set finer than when harvesting corn or forage sorghum.

(Kansas State University)

When fields are open during late spring /summer, whether part of a planned system or created by unfortunate weather, it's critical to keep soils covered, taking advantage of the longer seeding window to maintain soil health benefits.

1 **Do Something.** Leaving the ground fallow greatly increases the threat of soil erosion and improves likelihood of leaching nitrates, sulfates and other nutrients utilized by a following crop. Bare ground also encourages Fallow Syndrome, which can occur when there is no plant growth in an area for an extended period of time, reducing active mycorrhizae (which rely upon actively growing roots to survive). Corn and small grains tend to be more affected by fallow syndrome, although it has been a reported issue in soybean stands. Planting an annual crop on prevented planting acres or drowned-out spots can help maintain levels of mycorrhizae in the soil. Annual plantings provide multiple benefits to the soil versus allowing weed populations to thrive and causing future management issues.

2 **Determine Your Goals.** Crop rotation goals can help steer the decision on cover crop use. Often, crop harvest limits time available to plant cover crops, but with an early planting window, almost anything can be used.

3 **Review and Understand Local Guidelines.**

4 **Think About Herbicide Restrictions.** Consider herbicides already applied on the acres not yet planted. In many cases, cover crops and other non-traditional crops are not listed on the herbicide label. Land grant universities are helping to determine what options farmers have in the case of "prevent plant" or other cropping systems with quick seeding windows. If a cover crop is being planted for a non-forage goal (with no harvest), the grower assumes the risk if the cover crop is not listed on the label. However, if that cover crop will be harvested as forage, either mechanically or by livestock, then rotational restrictions on the label must be followed. For more information, visit lacrosseseed.com/resources

5 **Use Mixes.** Using cover crop mixes allows for diversity and the opportunity to spread risk. Mixes also allow for reduced weather risks, help break pest cycles and prevent erosion that some monoculture species are vulnerable to. Added benefits include nitrogen fixing and improved soil health as well.

CONSIDERATIONS – When seeding certain species in late spring/early summer, expect a few more management challenges such as stand establishment, plants setting seed, biomass control, pest control, maintaining forage quality, etc.

	COMPACTION BUSTER	EROSION PREVENTER	NITROGEN FIXER	NUTRIENT SCAVENGER	WEED SUPPRESSOR	FORAGE PROVIDER
GRASSES						
Annual Ryegrass	+++	++	◦	+++	++	++
Winter Rye	++	+++	◦	+++	+++	+++
Winter Triticale	+	+++	◦	+++	++	+++
Spring Oats	+	++	◦	++	++	+++
Millets	+	++	◦	+	++	++
Sorghum x Sudangrass	+	++	◦	++	+++	+++
Sudangrass	+	++	◦	++	+++	+++
BROADLEAVES						
Buckwheat	◦	+	◦	++	++	◦
Sunflower	+	+	◦	++	++	+
LEGUMES						
Balansa Clover	+	++	+++	++	+++	+++
Crimson Clover	◦	++	+++	++	++	++
Red Clover	+	++	+++	++	+++	+++
White Clover	◦	++	++	++	++	++
Berseem Clover	+	++	+++	++	++	++
Cowpeas	◦	+	+++	+	+	++
Sunn Hemp	+	++	+++	+	++	+
Spring Peas	◦	+	+++	+	+	++
Winter Hairy Vetch	◦	+++	+++	++	++	++
BRASSICAS						
Winter Camelina	+	++	◦	+++	++	+
Daikon Radish	+++	+	◦	+++	++	+
Turnip	+	+	◦	+++	++	++
Rapeseed	++	+	◦	+++	++	+
SOIL FIRST® COVER CROP MIXES						
SF COVER STARTER +	+++	+++	+	+++	+++	+++
SF MULTI-PURPOSE	++	+++	++	+++	+++	+++
SF CLASSIC	++	++	++	++	++	++
SF FIELD FIT	++	++	◦	++	++	+++
SF SOIL BUILDER	+++	+++	++	+++	+++	++

◦ No Benefit | + Some Benefit | ++ More Benefit | +++ Best Benefit

COLDSNAP™ ANNUAL RYEGRASS

ANNUAL RYEGRASS

COMPACTION ALLEVIATION | WEED SUPPRESSION | EROSION CONTROL | EASY ESTABLISH

- Establishes quickly - excellent at controlling erosion and suppressing weed development
- Ability to break up hard pans and alleviate compaction with its deep root system
- Fibrous root system is excellent at scavenging residual nitrogen
- Tolerant to poor soil conditions & tolerant to flooding once established
- Good for fields where manure applications are likely
- Proven to help reduce soybean cyst nematode populations
- Beware of annual ryegrass blends - harder to manage because they exhibit different maturity stages when herbicide control is needed in the spring

ANNUAL RYE HARDINESS ZONE

Annual ryegrass is a quick growing, cool season annual grass. Annual ryegrass has come under scrutiny recently as a cover crop, however the species still provides many benefits across the Midwest: nutrient sequestration, erosion control and compaction alleviation. It also adds biomass and organic matter while improving soil structure. With proper management in areas where it over winters, annual ryegrass should be considered as a viable option - both for cover cropping and/or forage needs.

CONSIDERATIONS:

- Prefers pH between 6.0 – 7.0
- Intolerant of heat and dry weather
- Hundreds of annual ryegrass varieties are on the market – choose the best to meet your goals

9 KEY DETAILS WHEN USING GLYPHOSATE FOR ANNUAL RYEGRASS BURNDOWN

1. Use full glyphosate rates and include ammonium sulfate (AMS)
2. Check your water to ensure the correct pH levels
3. Standard or XR flat fan nozzles are the best for most applications (medium droplet size)
4. Keep spray application volume to 10 gallons/acre
5. Top growth should be taller than 4 - 8″
6. Soil temperatures need to be at least 7°C and climbing
7. Ambient air temperatures need to be above 12-15°C – delay applications when night-time temperatures drop below 3°C (ideally need 3 nights above 4°C)
8. Spray in the middle of the day (after dew has dried but 4 hours prior to sunset to allow for adequate translocation)
9. If a 2nd application is needed, wait at least 2 weeks after the 1st pass, annual ryegrass becomes harder to control after it joints (begins stem elongation)

Oregon Ryegrass Growers - 2014 (RyegrassCovercrop.com)

Tillage Radish®

- Tillage Radish® offers similar benefits to SF Select Radish®.
- Reduces compaction and improves drainage and air/water movement (through rapid spring decay)
- Soaks up and releases nitrogen and other nutrients in spring when cash crops need it most
- Dense seed makes for easy planting, typically reaching full growth in 6 - 8 weeks (about 900 GDD)
- Shades out winter annuals and suppresses spring annual weeds
- Winterkills with temperatures in the teens

Tillage Radish® was selected based on performance in the field. This daikon type radish was evaluated across many different soil types and environments from the Northwest to across the upper Midwest and Transition Zone. A superior, deep, penetrating taproot is one characteristic that separates Tillage Radish® from other radish varieties - growing to a level of 3 - 6', based on soil type, region and planting date. The upper portion of the taproot (or tuber) can grow to a length of 12 - 24". Tillage Radish® germinates in just 2 to 3 days when moisture is present.

Radish is an upright, cool season annual broadleaf. After winter rye, perhaps no cover crop species has been planted on more acres than radish. Radish tubers and taproots reduce compaction and scavenge excess nutrients left in the soil from cash crops. Radish stands suppress weed growth, reduce soil and wind erosion, and increase soil microbial activity, especially when mixed with a grass or small grain cover crop. Tolerant of many kinds of manure, radishes work especially well after late summer applications.

CONSIDERATIONS:

- Benefits from nitrogen applications (30 - 60# N). Depending on goal, adding nitrogen and other nutrients may or may not be needed.
- Grows best in pH 6.0 – 7.5
- Avoid radish in cropping systems with other brassicas (disease bridge – club root)
- Radishes produce a compound when decaying that omits an odor similar to natural gas

DAIKON-TYPE RADISH ON THE LEFT, OILSEED-TYPE RADISH ON THE RIGHT

HYBRID BRASSICA

- Known for its quick regrowth, even under close grazing
- As opposed to turnips, most of the energy of the plant is contained in the leaves
- High digestibility – suitable for dairy, beef and sheep
- When fed, brassicas need to be combined with other forages (no more than 1/3 of the total animal diet) to prevent potential livestock disorders

Hybrid Brassica is a quick-growing brassica (upright and spreading cool season annual) with very little bulb development. This brassica is best suited for multiple grazing cycle situations because of its excellent regrowth. It can be used to extend the grazing season in the fall or planted alongside warm season annuals for multiple grazings during the summer. With proper management (first grazing in 40 - 45 days AND subsequent grazing cycles every 25 - 30 days when grazed no less than 4"), it has the potential to yield over 5 tons of dry matter per acre.

RAPESEED

- Deep, fibrous root system, scavenging both nitrogen and soluble phosphorus
- Offers the most brassica family grazing cycles if planted in late summer/early fall
- Can be difficult to control with only glyphosate
- Likely to overwinter in Transition Zone and South

Rapeseed is an upright, cool season and/or winter annual broadleaf. Rapeseed is versatile enough to be planted in spring or summer cover, or may be utilized in the fall for a winter cover crop. Rapeseed works great as a dual-purpose crop, adapting to a wide range of soil types and conditions. Rapeseed tends to be extremely drought-tolerant and resists frost better than many brassicas. Because of its winter hardiness, it's common for growers to get multiple grazing cycles when feeding rapeseed.

- Prefers soils with a pH 5.8 – 8.0
- Rapeseed may attract some non-beneficial pests

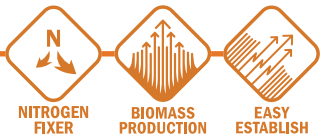
TURNIPS

- Various types and varieties deliver different benefits, based on leaf/bulb ratio
- Good tolerance to dry weather
- Longer stay-green improves sequestration of excess nutrients from crops

Turnips are an upright, cool season broadleaf which make the perfect dual-purpose cover crop. Their tubers and roots penetrate the soil and cycle nutrients. Early fall planted turnips provide a massive amount of dry matter, and help control erosion and weeds. They work great for forage, especially with small grains. Popular options like purple top turnips have large bulbs or tubers, but some varieties are bred for lesser bulb size and larger tops. These options work well for grazing. Some varieties allow for multiple grazing cycles into fall and winter months.

- Grows best in pH 5.5 – 6.8
- Avoid radish in systems with other brassicas (disease bridge – club root)
- Combined with other forages: lesser digestible grass or dry hay in ruminant animals (to prevent livestock disorders)
- Introduce livestock to turnips slowly

CRIMSON CLOVER



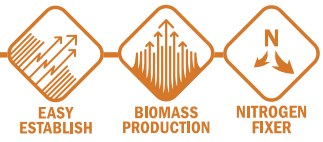
- Strong nitrogen fixing and high biomass potential – N production will be greatest when termination occurs at or after bud stage
- Really good shade tolerance – suitable for inter-seeding plantings in grass cash crops
- Good option for hay or grazing
- Increases water-holding ability and flowering stands attract many beneficial insects and pollinators
- Suitable for many cropping systems across the country, from potatoes to corn, to wheat to cotton
- Crimson clover is a semi-upright winter annual legume that germinates quickly and prefers well drained soil.

Crimson tends to remain actively growing in cooler temperatures when warmer season clovers go dormant. Crimson can be successfully established in both fall and spring. To maximize success in late summer plantings, seed at least 6 - 8 weeks before frost. Spring plantings should occur after all danger of frost has passed.

CONSIDERATIONS:

- Heavy stands may attract voles and other pests
- Crimson clover can cause bloat
- Ideal pH of 5.5 – 7.0

RED CLOVER

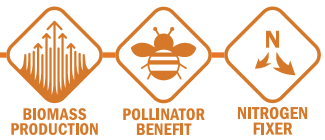


- Strong nitrogen fixing and high biomass potential – N production will be greatest when termination occurs at or after bud stage
- Really good shade tolerance – suitable for inter-seeding plantings in grass cash crops
- Good option for hay or grazing, excellent biomass potential
- Increases water-holding ability and flowering stands attract many beneficial insects and pollinators
- Suitable for many cropping systems across the country, from potatoes to corn and wheat
- Red Clover germinates quickly and can tolerate different soil types

CONSIDERATIONS:

- Red Clover can cause bloat
- Single cut Red Clover is slower to establish and only provides a single cutting
- Double cut Red Clover is quick to establish and provides multiple harvests

HAIRY VETCH



- Strong nitrogen fixing and high biomass potential
- Reduces runoff and recharges soils during winter (water enters soil through pores created by the vetch root residue)
- Heavy mulch provides excellent weed suppression/erosion prevention
- Excellent to plant with cereal grain (helps spring control)
- Phosphorus scavenger

Winter hairy vetch is a vigorous annual legume crop used for fixing nitrogen, biomass production and enhancing organic matter. It is slow to establish but an excellent choice for green manure. Its low carbon to nitrogen ratio (C:N) allows for quick plant decay and even quicker capture of nutrients in the soil profile. Hairy vetch tends to be tolerant of variable soil conditions, including low fertility environments, and prefers soil pH 5.5 – 7.5. Hairy vetch will overwinter in many areas of the country (USDA Zone 3 - 4) withstanding temperatures down to -25 to -30°F, especially where snow is likely.

CONSIDERATIONS:

- Little forage value (seeds/vegetation may harm livestock)
- Glyphosate alone may not be sufficient; close mowing or light disc for spring control
- Most varieties have high hard seed % requires proper spring management
- Keep off poorly drained sites
- Potential correlation of increased soybean cyst nematode/root knot nematode

WINTER PEAS

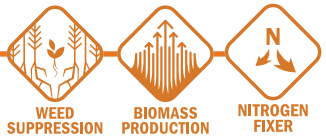
- Dwarf growth habit with upright stance
- Improved winter hardiness over Austrian-type winter peas
- Uniquely white-flowered and tannin-free (increasing palatability)
- Strong nitrogen fixer and very high biomass potential
- Hardy to USDA Zone 6 (-5 to -10° F)
- Spring peas planted in fall (as in SF 125) need 60 - 90 days to maximize growth

Winter peas are a rapid, low growing annual legume used across the country as a nitrogen fixing cover crop and/or a quickly decomposing green manure crop. The forage value of winter peas along with their overall management are benefited when planted alongside a cereal grain.

CONSIDERATIONS:

- Ideal soil pH 6.0 – 7.0
- Not the best option to sequester nutrients and/or break up compaction
- Large seed size makes broadcast applications more difficult
- Mowing or forage harvest in spring will terminate

SUNN HEMP



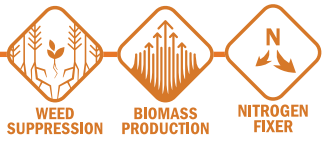
- Produces significant amounts of nitrogen in 60 days depending on conditions
- Tolerant of dry conditions and low fertility
- Can add up to 5,000+ lbs. of biomass per acre in 7 - 8 weeks

Sunn hemp is a warm season legume, upright and quick in its growth habit. Sunn hemp requires 60° F soil temps before it can be planted and will kill at the first signs of frost. Higher seeding rates of sunn hemp will help with summer annual weed suppression.

CONSIDERATIONS:

- Prefers soil pH above 6.0 (6.0 – 7.0)
- Kills at first frost, or controlled by mowing or herbicide at first flower for maximum benefit
- Residue (green manure) should be incorporated while still green

WINNER BERSEEM CLOVER



- Good weed suppression - very large amount of biomass
- Highly nutritious (18-28% protein)
- Non-bloating legume - great for livestock forage
- More saline tolerant than alfalfa or red clover (pH 4.8 – 7.8)
- Initially slow to establish, but then grows quickly - expect forage to be ready in about 8 weeks
- Tolerates waterlogged soil
- Less hard seed resulting in faster germination

Berseem clover is a summer/winter annual legume known for its ability to tolerate waterlogged soils and soil salinity while providing higher protein levels than many other legumes. Most berseems winterkill in northern climates.

ANNUAL COVER CROP FORAGE CHART

		PLANTING SEASON				SEEDING INFORMATION										
		SPRING	SUMMER	LATE SUMMER	FALL	CARBON/ NITROGEN RATIO (C:N)	SEEDING RATE (DRILL) LBS/ACRE	SEEDING RATE (MIX) LBS/ACRE	SEEDING RATE (FOR FORAGE) LBS/ACRE	SEEDING DEPTH (WITH DRILL)	SEEDS/LB	SEEDING TIME	BULK DENSITY* LBS/FT^3	AERIAL SEEDING RATE*	GERMINATION SOIL TEMPERATRURE (DEGREES FAHRENHEIT)
BRASSICA/MUSTARD	Camelina (Winter)				✓	20:1 - 30:1	4 - 6	1 - 2	∘	¼″	400,000	Oct-Nov	∘	8-10	36°
	Daikon Radish			✓		Tops - 9:1	3 - 8	1 - 3	5 - 8	¼″	30 - 40,000	Aug-Sep	44	3-8	45°
	Oilseed Radish			✓		Tops - 9:1	8 - 12	3 - 8	8 - 12	¼″	30 - 40,000	Aug-Sep	44	6-12	45°
	Turnips (Top)			✓		Tops - 9:1	2 - 6	2 - 4	3 - 8	¼″	220,000	Aug-Sep	45	2-6	45°
	Vivant Brassica		✓	✓		10:1 - 15:1	4 - 6	2 - 3	5 - 6	¼″	165,000	July-Sep	44	5-6	45°
	Forage Collards	✓	✓	✓		15:1 - 25:1	5 - 12	1 - 4	10 - 12	¼″ - ½″	175,000	Mar-Apr; Aug-Oct	44	8-12	40°
	Rapeseed	✓		✓		20:1 - 22:1	4 - 6	2 - 4	6 - 8	¼″ - ½″	145,000	Apr-May; Aug-Sep	45	5-8	41°
	Yellow/White Mustard	✓		✓		20:1 - 30:1	6 - 15	2 - 5	∘	¼″ - ¾″	100,000	Apr-May; Aug-Sep	46	10-15	40°
LEGUMES	Crimson Clover	✓		✓		15:1 - 20:1	10 - 15	4 - 8	6 - 15	¼″	150,000	Feb-Mar; Aug-Sep	52	6-15	42°
	Berseem Clover	✓		✓		15:1 - 20:1	8 - 20	5 - 10	15 - 20	¼″	150,000	Mar-Apr; Aug-Sep	52	6-15	40°
	Balansa Clover	✓		✓		15:1 - 20:1	3 - 6	1 - 4	3 - 6	¼″	500,000	Feb-Mar; Aug-Sep	56	3-6	40°
	Winter Hairy Vetch			✓	✓	10:1 - 15:1	15 - 30	10 - 20	30 - 40	1″	16,000	Aug-Sep	52	NR	60°
	Sunn Hemp		✓	✓		18:1 - 29:1	15	5 - 8	5 - 15	½″ - 1″	15,000	July-Sep	∘	NR	65°
	Austrian Winter Peas			✓	✓	15:1 - 20:1	30 - 80	10 - 30	40 - 60	1″	2,000	Aug-Sep	52	NR	41°
	Peas (Hay)	✓		✓		20:1 - 25:1	75 - 120	10 - 50	75 - 120	1″	3,000	Mar-Apr; Aug-Sep	50	NR	41°
	Peas (Silage)	✓		✓		Pea Straw - 29:1	75 - 120	10 - 50	75 - 120	1″	3,000	Mar-Apr; Aug-Sep	∘	NR	41°
	Peas and Oat Mix	✓	✓	✓	✓	∘	75 - 120	∘	75 - 120	¾″ - 1″	Varies	Mar-Apr; Aug-Sep	∘	NR	41°
	Medium Red Clover	✓		✓	✓	12:1 - 16:1	8 - 12	6 - 8	8 - 12	¼″	270,000	Feb-May; Aug-Oct	48	4-10	41°
GRASSES	Annual Ryegrass	✓		✓	✓	Vegetative - 20:1	15 - 30	10 - 15	25 - 35	¼″	215,000	Mar-Apr; Aug-Oct	32	15-35	40°
	Spring Oats (Hay)	✓		✓		Vegetative - 20:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	15 - 18,000	Mar-Apr; Aug-Sep	38	20-60	38°
	Spring Oats (Silage)	✓		✓		Straw - 80:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	15 - 18,000	Mar-Apr; Aug-Sep	∘	20-60	38°
	Winter Rye (Hay)			✓	✓	Vegetative - 20:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	16 - 18,000	Aug-Oct	50	20-60	34°
	Winter Rye (Silage)			✓	✓	Straw - 70:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	16 - 18,000	Aug-Oct	∘	20-60	34°
	Triticale (Winter)			✓	✓	Vegetative - 20:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	14 - 16,000	Aug-Oct	48	20-60	38°
	Triticale (Spring)	✓		✓		Straw - 80:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	14 - 16,000	Mar-Apr; Aug-Sep	□	NR	38°
	Barley (Winter)			✓	✓	Vegetative - 20:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	14 - 16,000	Aug-Oct	40	20-60	38°
	Barley (Spring)	✓		✓		Straw - 80:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	14 - 16,000	Mar-Apr; Aug-Sep	□	NR	38°
	Wheat (Hay)			✓	✓	Vegetative - 20:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	11 - 12,000	Aug-Oct	48	20-60	38°
	Wheat (Silage)			✓	✓	Straw - 80:1	30 - 50	20 - 40	80 - 120	¾″ - 1″	11 - 12,000	Aug-Oct	□	20-60	38°
	Forage Sorghum		✓			Vegetative-20:1	6 - 20	∘	6 - 20	¾″ - 1 ½″	17,000	May-July	45	NR	65°
	Sorghum x Sudan		✓			Leftover Stalks-80:1	25 - 70	5 - 20	25 - 70	¾″ - 1 ½″	21,000	May-July	45	NR	65°
	Sudangrass		✓			∘	20 - 45	∘	20 - 45	½″ - 1″	43,000	May-July	40	NR	65°
	Pearl Millet		✓	✓		12:1 - 20:1	20 - 30	5 - 20	20 - 30	½″ - 1″	60,000	May-Aug	42	NR	65°
SOIL FIRST MIXES	SF Cover Starter+			✓	✓	∘	30 - 35	∘	40 - 50	¼″ - 1″	∘	Aug-Sep	54	30-40	45°
	SF Multi-Purpose		✓	✓	✓	∘	35 - 40	∘	40 - 50	¼″ - 1″	∘	July-Sep	50	NR	45°
	SF Classic		✓	✓		∘	12 - 15	∘	15 - 20	¼″ - ½″	∘	Aug-Sep	52	20-25	45°
	SF Field Fit		✓	✓		∘	30 - 35	∘	40 - 50	¼″ - 1″	∘	Aug-Sep	36	30-40	45°
	SF Soil Builder			✓	✓	∘	20 - 25	∘	25 - 30	¼″ - ½″	∘	Aug-Sep	35	25-30	45°
OTHER	Phacelia		✓	✓		12:1 - 18:1	8	1 - 2	8	¼″	230,000	Jun-Sep	∘	8-10	37°
	Sunflower		✓	✓		Leaves 20:1, Stalks 40:1	3 - 5	1 - 2	3 - 5	¾″ - 1″	8,000	May-Aug	28	NR	50°
	Buckwheat	✓	✓			10:1 - 18:1	40 - 55	5 - 20	40 - 55	½″ - 1″	15,000	May-Aug	40	NR	65°
	Sugar Beet		✓	✓		Tops - 19:1	2 - 5	1 - 3	2 - 5	¼″	10,000	May-July	24	NR	50°

Days to Harvest = Estimations based on average growing season to reach optimum quality

* +/- 5%. Bulk Density averages are only a guide. Moisture, humidity and seed quality all affect bulk density.

REFERENCES: Texas Tech University, Oklahoma State University, Iowa State University, Mississippi State University, North Dakota State University, Colorado State University, University of Florida, Michigan State University, University of Wisconsin, Kansas State University, NRCS/USDA

NON-FORAGE BENEFITS

NUTRITIONAL VALUE INFORMATION (VALUES VARY GREATLY DEPENDING ON MATURITY)

USDA HARDINESS ZONE	DAYS TO EMERGENCE	NITROGEN FIXES OR SCAVENGES	NON-FORAGE BENEFITS (5 = EXCELLENT, 1 = POOR)								CRUDE PROTEIN	NEL † MCAL/LB	ADF% ‡	NDF% ◊	TDN	DM TONS PER ACRE	DAYS TO 1ST HARVEST	DAYS TO NEXT HARVEST	GRAZE	BALEAGE	CHOP
			COMPACTION ALLEVIATION	WEED SUPPRESSION	BIOMASS PRODUCTION	EROSION CONTROL	DISEASE/PEST CONTROL	POLLINATOR/ BENEFICIALS	P & K CYCLING	EASE OF ESTABLISHMENT											
† - Net Energy for Lactation = Energy available after subtracting digestive and metabolic losses | ‡ - Acid Detergent Fiber = Low values mean more digestible | ◊ - Neutral Detergent Fiber = Low values mean cows can eat more																					
3	7 - 10	Scavenger	4	5	3	4	3	5	5	5	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘
9	3 - 5	Scavenger	5	5	4	4	3	2	4	5	18	0.73	26	21	70	2-4	45	∘	+++	∘	+
9	3 - 5	Scavenger	4	5	4	4	4	3	4	5	18	0.73	26	21	70	2-4	45	∘	+++	∘	+
6 - 7	4 - 10	Scavenger	3	5	4	3	3	3	3	5	16	0.70	23	20	69	2-5	60-80	∘	+++	∘	+
7	4 - 6	Scavenger	3	4	4	3	3	3	3	5	14	∘	23	22	78	2-5	35-40	25-30	+++	++	+
5	4 - 10	Scavenger	3	4	4	4	3	3	3	5	20	0.74	25	21	70	2-4	35-40	25-30	+++	∘	+
5	4 - 10	Scavenger	5	3	4	4	4	4	4	5	14	TBD	28	41	57	1.5-4	60-80	∘	+	++	+++
7	5 - 7	Scavenger	4	3	4	3	4	5	3	5	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘	-
7	7 - 10	Fixer	2	4	3	3	3	3	3	4	17	0.56	31	42	59	.5-2	60	∘	++	+++	+
8	5 - 8	Fixer	2	4	3	4	1	3	4	4	18	0.73	23	36	69	1-2.5	60	∘	+	+++	++
5	14	Fixer	3	4	4	4	3	5	3	4	16	TBD	31	45	65	1-4	40-50	∘	++	+	+++
3 - 4	14	Fixer	3	4	4	3	3	5	4	3	26	0.58	33	48	64	1-3	Spring	∘	+++	∘	+
Frost	3 - 7	Fixer	2	4	5	3	3	4	3	3	25	---------- Varies Greatly ----------				1-5	40-45	∘	+++	+	++
6+	9	Fixer	2	4	3	3	3	4	2	4	28	0.60	38	54	70	0.5-2	Spring	∘	++	+	+++
Frost	9	Fixer	2	4	3	3	3	4	2	4	10	0.60	52	62	60	1.5-3	60-80	∘	++	+	+++
Frost	9	Fixer	2	4	3	3	3	4	2	4	16	0.58	44	55	58	1.5-3	60-80	∘	∘	+	+++
Frost	5 - 9	Both	2	4	4	4	3	3	3	4	17	0.57	30	57	59	3-5	60	∘	++	+	+++
4	7 - 10	Fixer	4	4	4	3	2	4	4	3	16	0.56	36	46	55	2-5	Spring	40	++	+++	+
6	7	Scavenger	5	5	3	5	3	2	3	5	9	0.58	38	65	58	.5-2	90	∘	++	+	+++
7	5 - 8	Scavenger	2	4	5	4	3	1	3	4	10	0.54	39	63	54	3-6	60-70	∘	++	+	+++
7	5 - 8	Scavenger	2	4	4	4	3	1	3	4	12	0.60	39	59	60	1.5-3.5	80	∘	∘	+	+++
3	5 - 8	Scavenger	4	5	4	5	3	1	4	4	10	0.58	38	65	58	3-5	Spring	∘	+	++	+++
3	5 - 8	Scavenger	4	5	4	5	3	1	4	4	14	0.59	37	59	59	2.5-4	Spring	∘	∘	+	+++
3	6 - 8	Scavenger	2	4	5	4	3	1	4	4	12	0.58	41	69	56	2.5-4	Spring	∘	+	++	+++
3	6 - 8	Scavenger	2	4	5	4	3	1	4	4	12	0.58	39	56	58	3-4	50-60	∘	++	+	+++
6	6 - 8	Scavenger	1	4	5	4	3	2	3	4	9	0.57	37	65	57	3-4	Spring	∘	++	+	+++
6	6 - 8	Scavenger	1	4	5	4	3	2	3	4	12	0.58	37	58	59	2-4	50	∘	++	+	+++
3	6 - 10	Scavenger	3	4	4	5	3	1	4	4	9	0.57	38	66	59	2-3	Spring	∘	++	+++	+
3	6 - 10	Scavenger	3	4	4	5	3	1	4	4	12	0.59	37	62	59	2-3	Spring	∘	∘	+	+++
Frost	10	Scavenger	4	5	5	4	4	3	3	4	9	0.59	38	59	59	6-9	80-105	∘	++	+	+++
Frost	10	Scavenger	4	5	5	4	4	3	3	4	16	0.70	29	55	55	5-8	45-70	30	+	++	+++
Frost	3 - 5	Scavenger	4	5	5	4	4	3	3	4	9	0.57	43	67	57	2-6	50	30	+	++	+++
Frost	3 - 5	Scavenger	3	5	5	4	4	3	3	5	16	0.66	39	48	52	3-6	45	35	++	+	+++
∘	Varies	Both	5	5	4	5	3	2	4	4	12-15	Nutrition values vary due to differences in the forage quality of the mix components and differences in how and when each component is harvested (grazed versus baleage)				2-5	45-50	Spring	+++	+	++
∘	Varies	Both	4	5	5	3	3	2	3	5	11-14					3-5	45-50	25	+++	+	++
∘	Varies	Both	4	3	3	3	3	3	4	4	16-18					2-4	45-60	Spring	+++	+	++
∘	Varies	Scavenger	5	5	4	3	3	2	3	5	13-17					2-4	45-50	∘	+++	∘	+
∘	Varies	Both	5	4	4	4	4	3	4	4	10-16					2-5	45-50	Spring	+++	+	++
8	10 - 14	Scavenger	2	5	3	3	4	5	2	4	∘	∘	∘	∘	∘	∘	∘	∘	∘	∘	+
Frost	4 - 10	Scavenger	4	3	3	4	3	5	4	3	11	TBD	36	42	63	2-3	Varies	∘	+++	∘	++
Frost	3 - 5	Scavenger	3	5	4	2	1	5	5	5	12	0.68	33	44	65	1.5-4	60	∘	++	∘	+
8	7 - 14	Scavenger	4	4	4	3	3	2	3	4	14	0.58	14	25	58	2-4	60-80	∘	+++	∘	+
											18	0.55	37	49	55	3-8	∘	30	∘	∘	+++
											19	0.59	35	45	59	3-8	∘	30	+	++	+++
											8	0.74	27	46	72	7-10	120	∘	∘	∘	+++

Some Benefit = +
More Benefit = ++
Best Benefit = +++

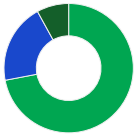
Not Recommended = ⊘
Not Applicable = ∘

Alfalfa (Silage)
Alfalfa (Hay)
Corn (Silage)

SF COVER STARTER +

- Crimson clover allows entire mix to decompose quicker, conserve water & decrease nitrogen immobilization
- Crimson clover is fairly quick to establish, adding biomass & additional root structure
- Nitrogen is maximized at clover flowering, however spring management will need to be considered

72% WINTER (CEREAL) RYE
20% CRIMSON CLOVER
8% SF SELECT RADISH®*



Mix formulations subject to change without notice depending on availability and new product.

SEEDING INFORMATION

	LBS/ACRE*		LBS/ACRE*
MONO*	30 - 35	AERIAL APPLICATION*	30 - 40
BROADCAST*	35 - 40	FORAGE	40 - 50
		SEEDING DEPTH (IN)	1/4 - 1/2

TERMINATION

Rye can be controlled with traditional glyphosate rates prior to 12-18" growth. 2' tall rye should be controlled with roller or crimper. If mowing, wait until rye begins to flower. Radish will terminate with multiple nights in the teens. If radishes survive, glyphosate and 2,4-D offer an effective control method. If crimson clover overwinters, control with glyphosate and 2,4-D.

CONSIDERATIONS

When seeded early in summer, additional grains or grass will need to be added to compete against radish growth. Rye can tie up nitrogen and other nutrients. Controlling rye early results in less nutrient tie-up and conserves more water. Crimson clover may attract voles and may need to be terminated even earlier to decrease the residue.

SF MULTI-PURPOSE

- Fits into several systems – after silage or small grain harvest
- Good option to seed on acres where leftover nutrients exist
- Formulated ideally for maximizing forage through multiple grazing cycles
- Great option after silage or small grain harvest (or acres where leftover nutrients exist)

50% NITROUS® WINTER TRIT
38% WINTER PEAS
6% SF SELECT RADISH®*
6% FORAGE BRASSICA

Mix formulations subject to change without notice depending on availability and new product.

SEEDING INFORMATION

	LBS/ACRE*		LBS/ACRE*
MONO*	30 - 35	AERIAL APPLICATION*	NR
BROADCAST*	35 - 40	FORAGE	40 - 50
		SEEDING DEPTH (IN)	1/4 - 1/2

TERMINATION

Triticale can be controlled with traditional glyphosate rates prior to 12 - 18" growth. 2' tall triticale should be controlled with roller or crimper. If mowing, wait until triticale begins to flower. Radish will terminate with multiple nights in the teens. If radishes survive, glyphosate and 2,4-D offer an effective control method. Forage brassicas will typically winterkill with temperatures below 25o F and collards are winter-hardy to Zone 5 (-15o F). Forage brassica can be controlled with glyphosate and 2,4-D.

CONSIDERATIONS

Designed for maximizing biomass on open opportunity ground late summer and/or early fall; can be utilized prior to any cash crop when taken off as forage.

SF CLASSIC

- Ideal for acres going to corn or other grass crops; research shows positive results in V3 - V6 corn interseeding
- Simple mix to use on acres where excess moisture can be an issue, or prevent plant acres, etc.
- Low seeding rates work well in aerial seedings & where application options are limited

85% CRIMSON CLOVER
15% SF SELECT RADISH®*

Mix formulations subject to change without notice depending on availability and new product.

SEEDING INFORMATION

	LBS/ACRE*		LBS/ACRE*
MONO*	12 - 15	AERIAL APPLICATION*	20 - 25
BROADCAST*	15 - 20	FORAGE	15 - 20
		SEEDING DEPTH (IN)	1/4 - 1/2

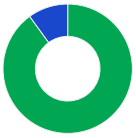
TERMINATION
Radish will terminate with multiple nights in the teens. If radishes survive, glyphosate and 2,4-D offer an effective control method. If crimson clover overwinters, control with glyphosate and 2,4-D.

CONSIDERATIONS
When seeded early in summer/fall, consider additional grasses to help compete with the quick radish growth. Heavy crimson clover may invite voles.

SF FIELD FIT

- Very simple cover crop mix; will completely winterkill in many northern climates
- If sequestering leftover nutrients is the goal, this is the mix to use

90% SPRING OATS
10% SF SELECT RADISH®*



Mix formulations subject to change without notice depending on availability and new product.

SEEDING INFORMATION

	LBS/ACRE*		LBS/ACRE*
MONO*	30 - 35	AERIAL APPLICATION*	30 - 40
BROADCAST*	35 - 40	FORAGE	40 - 50
		SEEDING DEPTH (IN)	1/4 - 1/2

TERMINATION
Radish will terminate with multiple nights in the teens. If radish overwinters, glyphosate and 2,4-D provide effective control.

CONSIDERATIONS
Because of its large percentage of oats, there is minimal lasting residue with SF 150. If grazing, introduce SF 150 slowly and don't allow brassicas to ever make up more than 1/3 of livestock's diet.

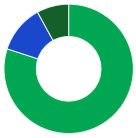
*** SF Select Radish® offers similar benefits to Tillage Radish®. For more information see Tillage Radish® details on page16.**

SF SOIL BUILDER

- Traditional "three-way" combination of species for breaking up compaction, sequestering leftover nutrients & building soil structure
- Flexible mix to use in front of corn, soybeans & many other cash crops
- Annual ryegrass requires spring management planning in areas where it's known to overwinter

80% COLDSNAP ANNUAL RYEGRASS†
12% CRIMSON CLOVER†
8% SF SELECT RADISH®*

†COATED



Mix formulations subject to change without notice depending on availability and new product.

SEEDING INFORMATION

	LBS/ACRE*		LBS/ACRE*
MONO*	20 - 25	AERIAL APPLICATION*	25 - 30
BROADCAST*	25 - 30	FORAGE	25 - 30
		SEEDING DEPTH (IN)	1/4 - 1/2

TERMINATION

Radish will terminate with multiple nights in the teens. If radish overwinters, glyphosate and 2,4-D provide effective control. Crimson clover should winterkill north of Zone 7; if crimson overwinters, control with glyphosate and 2,4-D. For annual ryegrass termination, glyphosate by itself or with other grass killers can be used, but several key management criteria must be met to ensure success. For more information, see page 14.

CONSIDERATIONS

Any time annual ryegrass is used, spring management has to be a main priority. Care should be taken to prevent ryegrass from going to seed. Annual ryegrass not terminated can have adverse effects on any subsequent grass crops. Use of blends have given ryegrass a bad reputation – make sure it is a single, respected variety. Multiple maturities make control more complex. Crimson clover may attract voles and may need to be terminated even earlier to decrease the residue.

SF CORN INTERSEED

- Into corn at 6-8 Leaf stage

80% COLDNSAP ANNUAL RYEGRASS
20% CRIMSON CLOVER

Mix formulations subject to change without notice depending on availability and new product.

SEEDING INFORMATION

	LBS/ACRE*
BROADCAST*	30 - 35

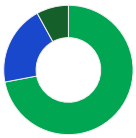
SOIL FIRST® COVER STARTER +

Building nitrogen & root mass while improving soil tilth & biomass potential

- Perfect before both corn or soybeans
- Ideal for Southern Corn Belt & beyond

SEEDING RATE (LBS/ACRE) Drill: 30 - 35 Broadcast: 35 - 40 Aerial: 30 - 40 Forage: 40 - 50

72% WINTER (CEREAL) RYE
20% CRIMSON CLOVER
8% SF SELECT RADISH®*



SOIL FIRST® MULTI-PURPOSE

For livestock grazers providing soil protection & biomass from fall through spring

- Early seeding/late fall silage opportunity
- Ideal forage for beef/non-lactating dairy

SEEDING RATE (LBS/ACRE) Drill: 35 - 40 Broadcast: 40 - 50 Aerial: NR Forage: 40 - 50

50% NITROUS® WINTER TRIT
38% WINTER PEAS
6% SF SELECT RADISH®*
6% FORAGE BRASSICA

SOIL FIRST® CLASSIC

For early planting windows – double-crop, prevent plant, interseeding

- Ideal for acres going to corn or other grass crops
- Plant early to maximize production

SEEDING RATE (LBS/ACRE) Drill: 12 - 15 Broadcast: 15 - 20 Aerial: 20 - 25 Forage: 15 - 20

85% CRIMSON CLOVER
15% SF SELECT RADISH®*

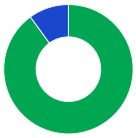
SOIL FIRST® FIELD FIT

Straightforward & flexible mix with very minimal spring management

- Winterkills in most northern climates
- Great for sequestering leftover nutrients

SEEDING RATE (LBS/ACRE) Drill: 30 - 35 Broadcast: 35 - 40 Aerial: 30 - 40 Forage: 40 - 50

90% SPRING OATS
10% SF SELECT RADISH®*



SOIL FIRST® SOIL BUILDER

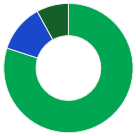
Coated clover & ryegrass creates spread patterns & broadcast germination

- Great compaction alleviation & nutrient scavenging
- Facilitates more accurate broadcast seeding patterns

SEEDING RATE (LBS/ACRE) Drill: 20 - 25 Broadcast: 25 - 30 Aerial: 25 - 30 Forage: 25 - 30

80% COLDSNAP ANNUAL RYEGRASS†
12% CRIMSON CLOVER†
8% SF SELECT RADISH®*

*COATED



SOIL FIRST® CORN INTERSEEDER

Plant into corn at 6-8 leaf stage

- Weed suppression
- Species diversity helps soil aggregate stability

SEEDING RATE (LBS/ACRE) Broadcast: 30 - 35

80% COLDSNAP ANNUAL RYEGRASS
20% CRIMSON CLOVER

*** SF Select Radish® offers similar benefits to Tillage Radish®. For more information see Tillage Radish® details on page16.**

When the opportunity exists to plant early, warm season annuals provide large amounts of biomass while improving soil tilth and absorbing excess nutrients left behind from cash crops. Summer Annuals provide quality forage suitable for all classes of ruminants (usually during periods where traditional perennial crops are less effective). Although sometimes referred to as "emergency forage", summer annuals can be part of a planned cover crop program where the dual benefit of forage is the goal.

TIPS FOR MANAGING SUMMER ANNUALS AND OTHER COVER CROPS FOR FORAGE

Nitrate toxicity is common when fertility or manure applications are followed by a period of drought or stress. Cut plants do not lessen in their nitrate levels as they cure. If high levels are suspected, forage should be tested for a period of a few weeks until levels subside. Though often linked to summer annual grasses, increased nitrate levels can show up in most cover crops and forages.

1. Nitrates are concentrated more in the lower stalk – raising cutting height can reduce the risk
2. When a stressful drought precedes a moisture event, it is recommended to delay harvest by 1 - 2 weeks
3. Consider split applications of nitrogen (especially useful on summer annuals) to decrease nitrate accumulations

Prussic acid poisoning can occur when feeding forage sorghums after periods of drought or other stress, including frost. Toxic levels dissipate usually after 2 - 3 weeks and will further decrease when ensiled. Prussic acid is most concentrated in new growth, so sorghum forages should not be grazed until they are at least 18" tall. Storing hay or silage for at least 30 days generally dissipates the concern.

Brassica crops can cause animal health disorders if not grazed properly. Introduce grazing animals to brassica pastures slowly (usually over 3 - 5 days). With extremely high forage values, brassicas can cause problems if hungry animals are turned out into predominate brassica pastures. Even though traditional recommendations allow for 2/3, we actually recommend keeping brassicas to under 1/3 of the grazing animal's diet - always supplement brassicas with dry hay or other grasses (higher in fiber).

Bloat can be an issue with most legume species. Reduce bloat by:

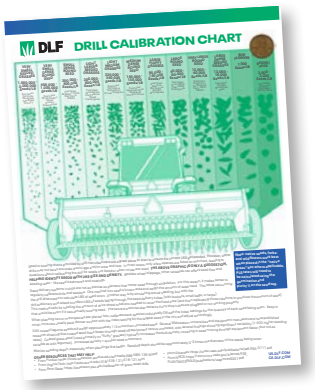
1. Utilizing grasses alongside the legumes
2. Pre-fill livestock with coarse hay prior to turning onto pasture, ensuring animals are not turned out to fresh pasture when hungry
3. Do not start grazing when the pastures are wet from dew or rain

Grass tetany can occur when grazing lush cereal grain crops in the spring or fall. Tetany risk can be lessened by adding legumes (which offset low magnesium levels that induce tetany) and by keeping livestock out of fields recently fertilized or manured.

DRILL & SEEDING CHART

	PLANTING WINDOW (WEEKS BEFORE FROST)	SEEDING DEPTH (INCHES)	DRILLED (7.5" ROWS SEEDING RATE LBS/ACRE)	COMPARABLE SEED ON DRILL CHART	CAN USE SMALL SEED BED BOX?	PRECISION PLANTING (PP) 4" IN-ROW SPACING. REFER TO BAG LABEL FOR SEEDS/LB.	(PP) 15" ROWS 4" IN-ROW LBS/ACRE	SEED SPACING	VACUUM PRESSURE (PSI)	PLATE
SF Cover Starter +	3 - 10	¼"-1"	30 to 35	Wheat	No	Kinze Brush Meter w/ Backing Plate (60 Cell Soybean Plate)	60 (5" in-row)	◦	◦	◦
SF Multi-Purpose	3 - 10	¼"-1"	35 to 40	Wheat	No	Kinze Brush Meter w/ Backing Plate (60 Cell Soybean Plate)	60 (5" in-row)	◦	◦	◦
SF Classic	3 - 10	¼"-½"	12 to 15	Alfalfa	Yes	Kinze Brush Meter w/ Backing Plate (60 Cell Milo Plate)	8 (1.5" in-row)	1.5" in-row	18	Large Sugar Beet (720220)
SF Field Fit	3 - 10	¼"-1"	40 to 50	Oats	No	Kinze Brush Meter w/ Backing Plate (60 Cell Soybean Plate)	20 (5" in-row)	◦	◦	◦
SF Soil Builder	3 - 10	¼"-½"	20 to 25	Tall Fescue (reduce by 25%), Crested Wheat Grass (reduce by 15%), or Annual Ryegrass	No	Kinze Brush Meter w/ Backing Plate (60 Cell Milo Plate)	12 (2" in-row)	◦	◦	◦
SF Corn Interseed	6-8 leaf stage	◦	30 - 35	Broadcast	No	◦	◦	◦	◦	◦
Guardian® Winter Rye	4 weeks prior to first killing frost to 6 weeks after	¾"-1"	30 to 50	Wheat	No	Kinze Brush Meter - 60 cell Soybean Plate (2" in-row) White - Wheat Plate	50	◦	◦	◦
Nitrous Winter Triticale		¾"-1"	30 to 50	Wheat	No		50	◦	◦	◦
ColdSnap™ Annual Ryegrass	3 - 10	¼"	15 to 30	Tall Fescue (reduce by 20%), Crested Wheat Grass (reduce by 10%) or Annual Ryegrass	Yes	Kinze Brush Meter w/ Backing Plate (60 Cell Milo Plate)	10 (1.5" in-row)	◦	◦	◦
Tillage Radish®	3 - 10	¼"	8 to 12	Alfalfa (reduce by 10%)	Yes	Small Sugar Beet Plate	◦	◦	◦	◦
Crimson Clover	3 - 10	¼"	10 to 15	Crimson Clover	Yes	Not Rec.	Not Rec.	1.5" in-row	18	Small Sugar Beet (720220)
Winter Peas	3 - 10	1"	30 to 80	Soybean	No	Soybean Plate	9	4" n-row	20	60 Cell Soybean (720265)
Hairy Vetch	2 - 10	1"	15 to 30	Vetch or Sorghum	No	Small Sugar Beet Plate	9	4" in-row	16	Large Sugar Beet (720220)

PURITY & GERMINATION AFFECT SEEDING RATES



Find more information on calibrating drills and seeders, taking into account seed size, density and PLS % with our **Drill Calibration Suggestion Sheet.**

Always plant cover crop seed with a current analysis tag. For more resources, visit ***ca.dlf.com/conservation/resources***

ONLINE RESOURCES

PLS (PURE LIVE SEED) EXAMPLES			
Seed Purity %	**90% Germ**	**85% Germ**	**80% Germ**
99.50	89.55	84.58	79.60
99.00	89.10	84.15	79.20
98.00	88.20	83.30	78.40
97.00	87.30	82.45	77.60
95.00	85.50	80.75	76.00
90.00	81.00	76.50	72.00
85.00	76.50	72.25	68.00
80.00	72.00	68.00	64.00
65.00	58.50	55.25	52.00

Example:
Guardian® Winter Rye has
≥ 90% germ &
≥ 98% purity, so:

$$\frac{(98 \times 90)}{100} = 88.2\ \%\ \text{PLS}$$

MATCHING THE GOAL TO THE CROPPING SYSTEM

INTENDED CROP

GOAL/BENEFIT

	Corn/Sorghum	Cole/Brassica Crops	Potatoes
EROSION REDUCTION	**SF COVER STARTER +, SF CORN** Interseed Grasses work well at reducing erosion. Small grains are an obvious choice, but consider spring management if planting anything other than oats.	Any grass will help control wind and water erosion. Winter rye, Nitrous winter triticale, ColdSnap™ annual ryegrass are the best options. Spring oats help, but ineffective in spring/late spring.	**SF CLASSIC, SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT** The addition of small grains is a possibility, but consider green bridge with other cereals in the rotation. Legumes (including winter peas, hairy vetch and others should be considered).
SEQUESTERING NUTRIENTS	**SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Annual ryegrass and brassicas work well. Small grains do really well also, but will need a spring management plan if anything other than oats. Other Options: SF 140, SF 102	Grasses are the recommendation. Winter rye, Nitrous winter triticale, ColdSnap™ annual ryegrass will all work well.	**SF CLASSIC, SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Brassicas work well at scavenging all important nitrogen. If considering small grains (spring grains or otherwise), control early to minimize nitrogen tie-up.
COMPACTION ALLEVIATION	**SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Two options best equipped for deeper rooting are annual ryegrass and brassicas. Balansa clover's taproot works well too.	Plant ColdSnap™ annual ryegrass when conditions allow for earlier seedings. Small grains will help break up hard pans, but to a lesser degree.	**SF CLASSIC, SF COVER STARTER +, SF FIELD FIT, SF SOIL BUILDER** Brassicas should be the selection and ryegrass can help too. The addition of brown mustard will help break up hard pans as well.
FORAGE PRODUCTION	**SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Several options depending on timing in the fall. When considering small grains, harvest or graze early in spring to minimize fertility concerns.	Small grains (winter rye, Nitrous winter triticale) deliver forage in cole crop rotations. Legumes enhance the protein content while supplying nitrogen for the growing grasses.	**SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Brassicas, legumes will provide biomass and protein for grazing animals. If considering small grains (spring grains or otherwise), control early to minimize N immobilization.
WEED SUPPRESSION	**SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Early plantings, use heavy biomass covers (brassicas, legumes, annual ryegrass). Limited fall timing, plant small grains (but only with a spring management plan).	Small grains (winter rye, Nitrous winter triticale) deliver heavy biomass in cole crop rotations. Legumes help supply nitrogen for the growing grasses, while aiding in weed competition.	**SF COVER STARTER +, SF MULTI-PURPOSE, SF FIELD FIT, SF SOIL BUILDER** Both brassicas and legumes can provide enough competition by themselves. Adding a grass or grain will help.
NEMATODE SUPPRESSION	Legumes and brassicas have shown some effectiveness to nematodes that negatively impact corn. If nematode control is an objective, avoid grasses as most are host to nematodes affecting corn.	Sudangrass and sorghum x sudan offer some biofumigant properties. To maximize effectiveness, they need to be incorporated into the soil. Soil temps need to be above 65° and enough time for 6 weeks growth.	Brown mustards have higher glucosinolate levels and have proven to be effective at reducing potato cyst and root knot nematode levels. Need to be chopped and incorporated quickly to achieve max control.
INCREASED SOIL MOISTURE	Many parts of Canada demand cover crops provide additional moisture for cash crops during a portion of the growing season. Deciding on the right cover crops to help minimize moisture loss can be complex depending on climate, region, and soil type. Consider how long cover crops will persist before termination and when and how the cash crop will be planted into leftover residue. ›››		
KEY POINTS	Main objectives should be adding legumes whenever possible and managing any cover crop that includes a small grain (see page 7). Don't forget about using annual ryegrass.	There are many cover crop options for cole crops, but other brassicas should not be included. Brassica cover crops allow disease and pest cycles in cole crops to persist and worsen.	Managing nitrogen is a major objective. Consider options that include legumes and brassicas for additional fumigation opportunities.

FOLLOWING THE COVER CROP

Soybeans	Sugar Beets	Vegetable/Fruit	Wheat/Small Grains
SF COVER STARTER + Several options based on time in the fall. Small grains will work great, but consider adding other species to accomplish multiple objectives.	Any grass will help control wind and water erosion. Winter rye, Nitrous winter triticale, ColdSnap™ annual ryegrass are the best options. Spring oats help, but ineffective in spring/late spring.	Use small grains (winter rye, Nitrous winter triticale, barley) before long season vegetable crops (90 - 120 days).	**WINTER GRAINS:** Fallow alternative - spring cereals and legumes (crimson, berseem clover). Continuous winter grains - options are limitless based on other benefits desired. **SPRING GRAINS:** Using species that terminate quickly will not impede on spring grain planting while still providing soil coverage for as long as desirable.
SF COVER STARTER +, SF CLASSIC, SF MULTI-PURPOSE, SF FIELD FIT Depending on time in the fall, utilize a brassica if possible. Consider adding other species to small grains to accomplish multiple objectives.	Winter rye, Nitrous winter triticale, ColdSnap™ annual ryegrass will all work well. Legumes impact nutrient scavenging very little, but adding N in sugar beet crops could be an added bonus.	Use small grains prior to long season vegetable crops (90 - 120 days); utilize summer annual grasses prior to short season vegetables (60 - 90 days).	**WINTER GRAINS:** Fallow acres - spring cereals and summer brassica mixes. Continuous grain - plant legumes and brassicas as time will allow for many options. **SPRING GRAINS:** Depending on how much time exists in fall, there may be limited time to plant non-cereal grain options to scavenge excess nutrients.
SF COVER STARTER +, SF CLASSIC, SF FIELD FIT Two options best equipped for deeper rooting are annual ryegrass and brassicas (if time allows). Winter rye is better than nothing, but not the best option.	Plant ColdSnap™ annual ryegrass when conditions allow for earlier seedings. Small grains will help break up hard pans, but to a lesser degree.	Plant ColdSnap™ annual ryegrass and brassicas, but only if the following cash crop is a different family of the cover crop to break up pest and disease cycles.	**WINTER GRAINS:** Fallow ground - use grasses that will be easier to manage (ryegrass, summer annuals). Continuous grain - brassicas planted in summer will reach max growth quickly. **SPRING GRAINS:** When time allows, choose a brassica crop (radish and turnips).
SF MULTI-PURPOSE, SF FIELD FIT Biomass is the goal and small grains will be needed for maximum growth. Including legumes will add protein and brassicas increase digestibility.	Small grains (winter rye, Nitrous winter triticale) deliver forage in beet rotations. Legumes enhance the protein content while supplying nitrogen for the growing grasses.	Several options exist for forage production in front of vegetable or fruit plantings. Be cognizant of any adverse effects the biomass/residue could have on the following crop.	**WINTER GRAINS:** Fallow acres - plant grasses like ryegrass and summer annuals; as well as legumes and brassicas. Continuous grain - brassicas and summer annuals will grow quickly in short summer windows. **SPRING GRAINS:** Utilizing grasses like summer annuals can generate good tonnage; adding brassicas or overwintering legumes can boost biomass and forage quality.
SF COVER STARTER +, SF CLASSIC, SF MULTI-PURPOSE, SF FIELD FIT Small grains are the key ingredient for reducing competition. Plant higher rates if that's the main objective.	Small grains (winter rye, Nitrous winter triticale) offer the biomass needed for competition against weeds. Legumes can help as well, however N will need to be managed prior to beet planting.	Grasses and small grains (winter rye, Nitrous winter triticale, barley, ColdSnap™ annual ryegrass) will provide suitable weed suppression. Consider nutrient available following grasses to next crop.	**WINTER GRAINS:** Fallow acres - grasses like ryegrass and summer annuals; as well as legumes and brassicas. Continuous grain - brassicas and summer annuals will grow quickly in short summer windows. **SPRING GRAINS:** To maximize weed suppression, plant heavy biomass cover crops early. Brassicas and legumes will help without compromising spring cereal grain planting.
SF SOIL BUILDER For SCN control, the best defense is controlling winter annuals. Annual ryegrass has shown very positive results.	Control Radish works well to control beet cyst nematode. Image is not only a non-host, but this radish encourages early cyst egg hatch that results in lack of food and eventual control.	Depending on the cash crop, any number of cover crops may provide some level of nematode control and/or suppression.	The use of summer annual grasses has shown the ability to limit nematodes in small grains (root lesion and cereal cyst).

For example, residue left from small grain cover crops in Canada may hold onto more moisture in early spring. These residues have the potential to help supply moisture to cash crops later in the summer too, as long as the residue doesn't impede cash crop establishment. Cover crops that use the least amount of moisture for establishment are millets, winter and spring barley, berseem and red clovers, cowpeas and field peas.

Sequestering nitrogen and capturing any nutrients is key. Select mixes that provide this and other benefits as well.	Concentrate on small grains as the base to eliminate any added concerns of increased pest pressure and N management. Other species (like nematode radish) are available depending on the objective.	Select the right cover crop to provide the residue/mulch desired. Consider how the cover crop will be successfully terminated and the vegetable will be paired into that residue.	It's all about time... With winter grains, one has a limited summer and fall for establishment. Spring planted small grains offer the flexibility of using overwintering species, but spring control/termination should be planned. Small grain cover crops may initiate a "green bridge" that could lead to added disease pressure.

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