

Cover Crop Basics

Second Edition

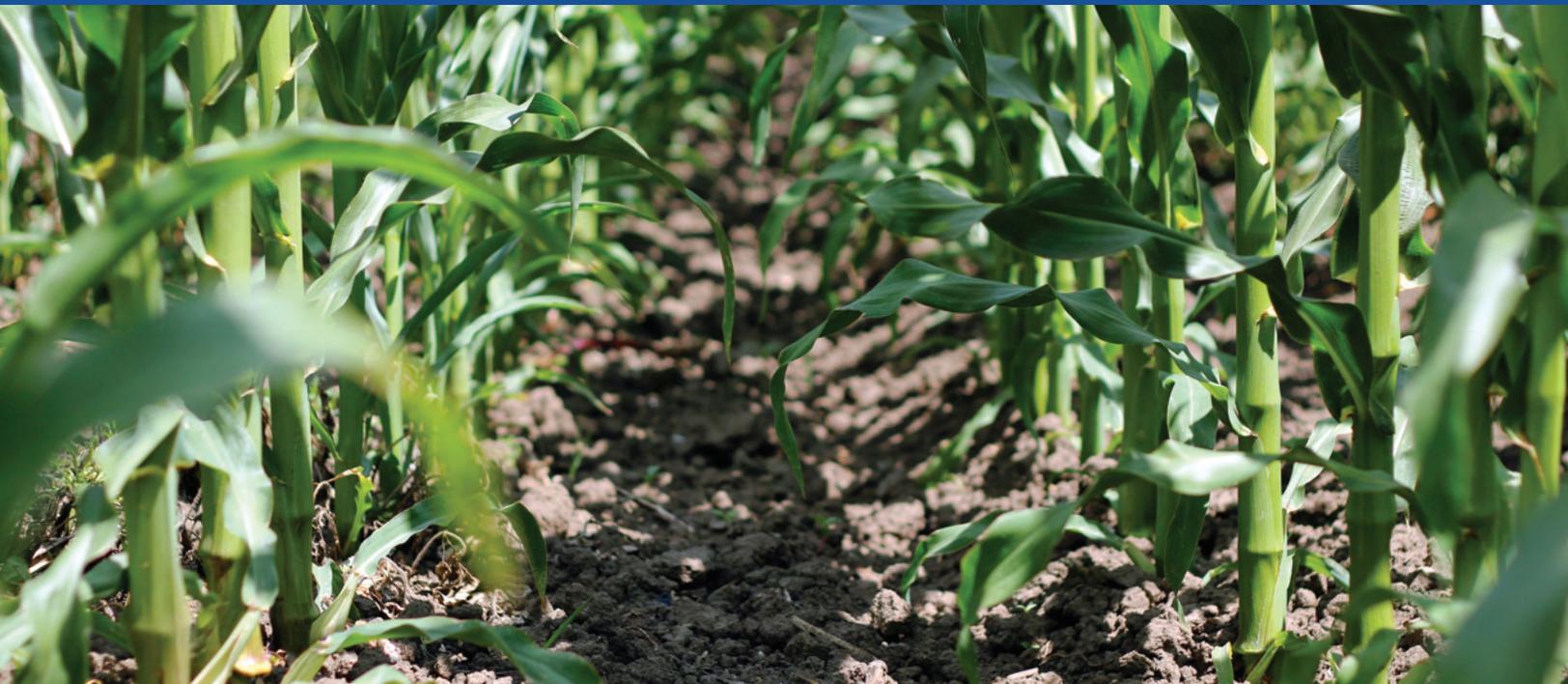


Corn Growing In FIXatioN Balansa Clover

WORKING WITH NATURE TO INCREASE PRODUCTIVITY AND BUILD SOIL HEALTH.



Cover crops are not a new idea; they have been used in farming for centuries. After the 1940's, when synthetic fertilizers and other inputs designed to make farming 'easier' took hold, the use of cover crops were left behind. While we can manage some of the missing pieces with synthetic inputs, we cannot replicate the synergy occurring in the soil between the microbes, bacteria, fungi and cover crops. When we quit utilizing cover crops in favor of sterile, fallow fields we lost these beneficial relationships; entering a spiral of soil degradation that continually relies on increased inputs. With synthetic inputs becoming more expensive and their potentially detrimental effects more evident, the use of cover crops as an effective and natural answer is regaining popularity. Cover crop knowledge from the past is being re-learned and transformed to incorporate modern ideas. Adopting a more holistic approach and nurturing the soil will not only improve your profitability, it will also protect your most valuable farm asset and benefit future generations with healthier soils.





The information in this booklet is designed to serve as a valuable reference for cover crop users. Included are species descriptions, recommended varieties, traits, benefits, usage charts, and more.

We know that there is no cookie-cutter plan that fits all situations. Every farm and field are as unique as the goals of each individual farmer.

The thought of utilizing cover crops can be overwhelming; whether you're a novice or have decades of experience. The information presented in this guide should provide you with enough knowledge to become more comfortable in using cover crops for your farming operation.

We would like to encourage you to submit your thoughts, suggestions, and especially your experiences.

Efforts to improve this resource are an ongoing process and your input is valuable.

Please send your comments to info@gocovercrops.com



KNOW WHAT YOU GROW

Saving a few bucks on seed with a few 'minor' issues can result in serious problems. If your seed germinates poorly, or you start seeing a lot of unwanted plants (weeds) coming up it's too late. Don't be tempted to buy seed your neighbor grew. Unless you've walked his fields thoroughly, you won't know what kind of problems you may be inheriting. A weed here and there in his field will be greatly amplified in the subsequent seed lot. Did you know that a single Palmer amaranth plant can produce up to 1,000,000 seeds?

Worse yet, trying to save by buying "bin-run" 'seed', which was never intended for planting. You will have no way of knowing what kind of nasty surprises may lurk inside (weeds, poor germination etc.). You'll be shooting in the dark on seeding rate, traits, and performance expectations.

BUYING SEED - \$/LB vs. \$/ACRE

It seems reasonable to look at the cost per pound.

Obvious and simple really – just a line item on a price sheet making it easy to comparison shop, right?

Not so fast - Consider the following example:

The local Ag Retailer's pricelist offers Dixie Crimson clover at \$1.80/lb. and FIXatioN Balansa Clover at \$2.60/lb. WOW! Seems like an easy decision if you only look at things from a cost-per-pound perspective.

But let's take a little deeper look:

Dixie Crimson

~ 135,000 seeds per pound (raw)
Plant rate = up to 20 lbs/A. (drilled)

The cost per acre = \$36

FIXatioN Balansa Clover

~500,000 seeds per pound (coated)
Plant rate = up to 8 lbs/A. (drilled)

The cost per acre = \$20⁸⁰

Cost per acre provides a clearer picture of your real cost.



HOW TO READ A SEED BAG TAG

Do either of these phrases sound familiar? “Garbage In, Garbage Out” or “Penny Wise and a Pound Foolish”. Both are important concepts when it comes to purchasing and planting cover crops. As a farm manager, it sometimes seems like there are more ways to spend money than to make money, and it takes hyper-vigilance to keep the black ink flowing. Here are a few ways that may seem counterintuitive, but can save you time (which is money), save you energy (which could be spent making money), stress (damaging to your health, which costs money), and additional herbicides

(which adds time, additional equipment, and costs money).

Inspect the Seed Tag & Test

Seed dealers are governed by the Federal Seed Act and required to label each lot as to purity and germination. To label accurately, dealers rely on seed tests conducted by registered seed analysts. These tests are used to create a tag for each container or bag of seed that is sold. At a minimum, you should know how to read and understand the information on the tag.

Many farmers are familiar with how to read these, but here’s a refresher - it’s that important!

	A				B	
		PERSIAN CLOVER				
		VARIETY: eNhance				
		LOT: M9-22-EPC-166				
C	●	PURE SEED:		99.83%		
		OTHER CROP SEED:		0.00%		
D	●	INERT MATTER:		0.17%		
		WEED SEED:		0.00%	E	●
F	●	NOXIOUS WEEDS:		NONE FOUND		
		GERMINATION:		81.00%	G	●
		HARD SEED:		9.00%		
		TOTAL GERMINATION:		90.00%		
		TEST DATE:		5/22		
H	●	ORIGIN:		OREGON		
		NET WEIGHT:		50LB/22.68KG		
		GREENER WORLD SEED COMPANY				
		123 MAIN STREET				
		HARTLAND USA				
		AMS 4804				

- A** VARIETY: Indicates the type of seed along with the name of the genetic variety. If the variety is not known, or it is open-source material, it will be listed as VNS (Variety Not Stated). It is difficult to understand performance and outcome when using VNS or variety unknown.
- B** LOT: Indicates the specific seed that was tested.
- C** PURE SEED: Indicates, by weight, the percentage of the ingredient listed
- D** INERT MATTER: Indicates content material that will not germinate. It is common to see 25-50% if the seed is coated.
- E** WEED SEED: Indicates by weight the amount of weed seeds present
- F** NOXIOUS WEEDS: Indicates by weight the number and kind of weeds that must be identified and listed by name (each state has its own unique list)
- G** GERMINATION: Indicates the amount of seed that will germinate for each ingredient (refer to the Test Date on the label to see how current this information is)
- H** ORIGIN: Indicates the region where the seed was produced

MORPHOLOGY

SPECIES/VARIETY	LIFESPAN	ROOT STRUCTURE	C:N RATIO
GRASSES			
Lonestar Annual Ryegrass	A	FIBROUS	25:1
Tetraploid Annual Ryegrass	A	FIBROUS	25:1
Pearl Millet	A	FIBROUS	30:1
Sorghum-Sudangrass	A	FIBROUS	30:1
Sudangrass	A	FIBROUS	30:1
GRAINS			
Barley	A	FIBROUS	80:1
Oats	A	FIBROUS	70:1
Rye	A	FIBROUS	80:1
Triticale	A	FIBROUS	80:1
Wheat	A	FIBROUS	80:1
LEGUMES			
AberLasting Kura x White Clover	P	RHIZOME	15:1
Common Vetch	A	TAP	15:1
Domino White Clover	P	TAP	15:1
Dynamite Red Clover	B/P	TAP	20:1
eNhanse Persian Clover	A	TAP	12:1
FIXatioN Balansa Clover	A	TAP	12:1
FROSTY Berseem Clover	A	TAP	20:1
Hairy Vetch	A	TAP	12:1
Kentucky Pride Crimson Clover	A	TAP	20:1
Sunn Hemp	A	TAP	44:1
Survivor Winter Peas	A	FIBROUS	20:1
BRASSICAS & FORBS			
Driller Radish	A	TAP	20:1
Carwoodii Radish	A	TAP	20:1
Image Radish	A	TAP	20:1
Purple Top Turnips	A	TAP	20:1
Bio-fumigation Mustard Mix	A	TAP	20:1
Dwarf Essex Rape	A	TAP	20:1
Buckwheat	A	FIBROUS	15:1
Phacelia	A	FIBROUS	20:1

Lifespan: A= Annual; B=Biennial; P=Perennial

USAGE

SPECIES/VARIETY	SEEDING DEPTH	DRILLED	BROADCAST	pH	SOIL TYPES
GRASSES					
Lonestar Annual Ryegrass	.25" - .50"	15-20	25-30	5.0-8.0	loam to heavy clay soils
Tetrastar Tetraploid Annual Ryegrass	.25" - .50"	15-20	25-30	5.0-8.0	loam to heavy clay soils
Pearl Millet	.50"-1"	20	30	5.5-7.5	loam to clay loam soils
Sorghum-Sudangrass	1"	35	50	6.0-8.5	fertile well-drained soils
Sudangrass	1"	35	50	6.0-8.5	fertile well-drained soils
GRAINS					
Barley	.75"-1"	40-55	60-75	6.0-8.5	well-drained loam/light clay soils
Oats	.75"-1"	40-55	60-75	4.5-8.0	loam to heavy soils
Rye	.75"-1"	40-55	60-75	5.0-7.0	well-drained loam/light clay soils
Triticale	.75"-1"	40-55	60-75	5.0-7.0	well-drained loam/light clay soils
Wheat	.75"-1"	40-55	60-75	5.0-7.0	well-drained loam/light clay soils
LEGUMES					
AberLasting Kura x White Clover	0" - .25"	2 - 3	3 - 4	4.5 - 8.0	loam to clay-loam soils
Common Vetch	1"-2"	55	65-75	4.5-8.2	sandy loam, loam, well drained soils
Domino White Clover	0" - .25"	2 - 3	3 - 4	4.5 - 8.0	loam to clay-loam soils
Dynamite Red Clover	.25" - .5"	8 - 10	12 - 15	6.0 - 7.5	loam to clay-loam soils
eNhance Persian Clover	0" - .25"	5 - 8	8 - 10	5.0 - 8.0	sandy to clay-loam soils
FIXatioN Balansa Clover	0" - .25"	5 - 8	8 - 10	4.5 - 8.5	loam to clay-loam soils
FROSTY Berseem Clover	.25" - .5"	15 - 20	20 - 25	5.0 - 7.8	loam to clay soils
Hairy Vetch	.5" - .75"	15 - 20	25 - 30	5.0 - 7.0	sandy to sandy loam
Kentucky Pride Crimson Clover	.25" - .5"	15 - 20	20 - 25	4.8 - 8.2	well drained soils, tolerates wet soils**
Sunn Hemp	0.75"	12 - 15	-	5.5 - 8.5	sandy to loam soils
Survivor Winter Peas	1" - 1.5"	40 - 60	20 - 25	5.5 - 7.0	well-drained loams/light clay soils
BRASSICAS & FORBS					
Driller Radish	.25" - .5"	5 - 8	10 - 12	6.0 - 7.5	loam to heavy soils
Carwoodii Radish	.25" - .5"	8 - 10	12 - 15	6.0 - 7.6	loam to heavy soils
Image Radish	.25" - .5"	8 - 10	12 - 15	6.0 - 7.7	loam to heavy soils
Purple Top Turnips	.25" - .5"	2 - 3	4 - 5	5.5 - 7.0	loam to heavy soils
Bio-fumigation Mustard Mix	.5"	5 - 8	10 - 12	5.5 - 8.0	loam to heavy soils
Dwarf Essex Rape	.5"	3 - 4	5 - 6	5.5 - 8.0	loam to heavy soils
Buckwheat	.5"	25 - 30	35 - 40	5.0 - 7.0	tolerant to poor soils
Phacelia	.25"	5 - 7	8 - 10	6.5 - 7.8	loam to heavy soils

* Denotes specific variety not tested but species is considered a poor host or non-host

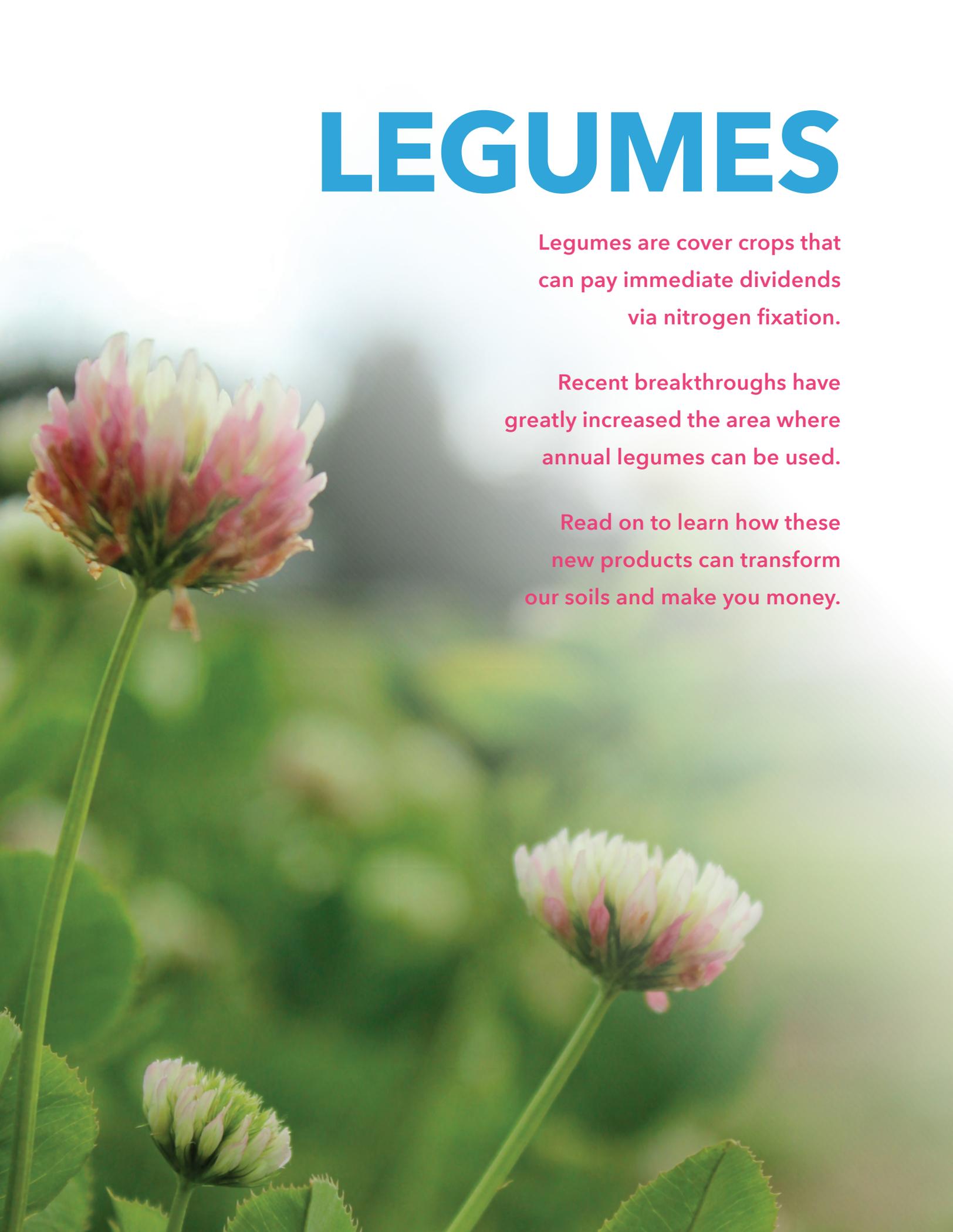
** Better than other crimsons

LEGUMES

Legumes are cover crops that can pay immediate dividends via nitrogen fixation.

Recent breakthroughs have greatly increased the area where annual legumes can be used.

Read on to learn how these new products can transform our soils and make you money.





BALANSA CLOVER (*Trifolium michelianum*)

BALANSA Clover is a reseeding annual originating from the northeastern Mediterranean region. It is the most versatile of the annual clovers, capable of high performance on:

- Heavy clay to sandy loam soils
- Soils with a pH of 4.5 to 8.5
- Waterlogged soils and capable of surviving short periods of flooding
- Mildly tolerant to saline soils

Balansa features a low C:N ratio which means organic material will break down quickly, rapidly providing nitrogen to the following crop.

There is only one commercially available variety bred in the USA and suitable for use in much of North America.

RECOMMENDED VARIETY

FIXatioN has the only patented cold tolerant genetics. It represents tremendous improvement over other Balansa Clover varieties that are susceptible to frost. FIXatioN is potentially the most cold-tolerant annual Clover in the world. This amazing Clover can survive at least -15 degrees F without snow cover and at least -25 with. Cold tolerance is just the tip of the iceberg.

FIXatioN thrives in water-logged soils making it more versatile than Crimson Clover.

FIXatioN features as much as 200% more biomass than competing Balansa clovers and has a higher percentage of nitrogen in its leaves, making it the #1 nitrogen fixing annual clover.

A C:N ratio of 12:1 allows for quick nutrient cycling which will benefit the following crop.

ADDITIONAL BENEFITS:

Soil conditioning Tap Roots - Reaching deep into the soil, FIXatioN is capable of breaking up hard pan soils. As one farmer

stated, "FIXatioN mellows out the soil like nothing else."

Cost Efficiency - FIXatioN seed is extremely small, so a little seed goes a long way! Capable of producing large quantities of nitrogen, FIXatioN delivers an immediate return on investment

It's BIO-Massive - At the University of Illinois Ewing Demonstration Center, FIXatioN produced more than 96,000 lbs. of biomass. This equates to more than 300 lbs. of N/Acre created to benefit future crops.

Nematode Non-Host - FIXatioN is not a host to Soybean Cyst nematodes.



IT'S BIO-MASSIVE!



BERSEEM CLOVER (*Trifolium alexandrinum*)

RECOMMENDED VARIETY

FROSTY Berseem Clover is capable of producing vast quantities of nitrogen.

FROSTY'S aggressive rooting system can pull up other nutrients from deep within the soil, making them available to the following crop.

Farmers in warm climates have long known the benefits of berseem clover.

Now, thanks to the patented cold tolerant genetics in FROSTY Berseem Clover, farmers across North America can benefit from this amazing, non-bloating Clover. FROSTY can survive temperatures to at least 5 degrees F without snow cover.



ADDITIONAL BENEFITS:

Moderate Salt Tolerance - Berseem Clover is moderately tolerant to salt. This means that with good management there will be little impact on its growth when using irrigation water with a salinity content of over 1,500 iS/cm (1,000 ppm). Some yield loss will occur when the salinity content approaches 3,000 iS/cm (2,000 ppm).

Tremendous Biomass - Capable of fixing over 150# of nitrogen and over 47,700 lbs. of highly nutritious, non-bloating forage per acre.

Late Maturity - Providing a longer window for termination without sacrificing nitrogen contribution.

Summer Cover Crop - The late maturity of FROSTY Berseem makes it the ideal variety for a nitrogen producing cool-season cover. Slow to flower and produce seed heads, it is one of the best choices for prevent plantings.

BERSEEM Clover is quick to germinate and establish making it a good tool for weed suppression. It tolerates a soil pH range of 5.2-7.8 and tolerates moderate periods of waterlogged soils. Originating in the Southeastern Mediterranean region; all Berseem varieties, with the exception of FROSTY, are susceptible to winter-kill when temperatures drop below 25 degrees Fahrenheit.

Berseem Clover has long been popular for its synergistic relationship with Alfalfa. Planting the two together results in bigger and higher quality forage yields.





CRIMSON CLOVER (*Trifolium incarnatum*)

Long known as THE cover crop clover, Crimson Clover is widely used for soil regeneration. It provides a shot of early spring nitrogen for full-season field crops and serves as a roadside cover or reseeding annual in pastures and hay ground. Gaining popularity in the north, Crimson Clover grows rapidly in the Fall, making it a winning pick for weed suppression and green manure purposes.

RECOMMENDED VARIETY

Kentucky Pride is unique amongst Crimson Clover varieties as it is very cold tolerant. Initially, Kentucky Pride's leaves and tillers are more prostrate, growing lower to the ground. It is far superior to the variety Dixie in both cold tolerance and the ability to survive waterlogged soils.

Kentucky Pride is capable of providing more than 4 times the biomass and 3.5 times the nitrogen when compared to Dixie.

Kentucky Pride's increased biomass production has been shown to provide 50% greater weed suppression when compared to Dixie.

ADDITIONAL BENEFITS:

Later maturity - Kentucky Pride provides a longer window for termination without sacrificing nitrogen production.

Nitrogen fixation - The amount of biomass is the key for nitrogen production. The more green growth, the better. When plants begin to flower, they quit producing green vegetation, at which point the nitrogen that is stored in the leaves and stems moves to the seed, diminishing the benefit to following crops

Deeper Root System - 25% longer roots than Dixie make Kentucky Pride more capable of breaking up hard-pan soils



KENTUCKYPRIDE
Crimson Clover





PERSIAN CLOVER (*Trifolium resupinatum* var. *maju*)

Persian Clover is possibly the most fragrant of all the clover species with a pleasantly sweet scent. It is an annual legume that originated in the eastern Mediterranean area. It has a semi-upright growth habit, and the leaves are oval with jagged edges.

Persian Clover works well in close grazing situations, but care should be taken as it can cause bloat.

Persian Clover features excellent regrowth after grazing or cutting.



- Suitable for sandy soils
- Soils with a pH of 5.0 to 8.0
- Moderately tolerant to soils higher in salinity
- Can tolerate standing water or short periods of flooding
- Seeding rate 6-8 pounds per acre

Persian Clover's low C:N ratio - 12:1 means the organic material will break down and release nitrogen quickly to the following crop.

There are two types of Persian Clover.

Trifolium resupinatum var. *resupinatum* has a prostrate growth habit with small leaves and less biomass. It is earlier flowering than *majus* types and can be high in hard seed.

Trifolium resupinatum var. *majus* has an erect growth habit, with thick hollow stems and large leaves. This type is usually low in hard seed.

Persian Clover is best adapted to areas receiving 17+ inches of precipitation.

Persian Clover cold tolerance varies by variety with most experiencing winterkill at 10 degrees F°, however one variety has shown ability to withstand temperatures as low as -15 F° with little to no snow cover.



PERSIAN CLOVER

RECOMMENDED VARIETY

eNhance (*Trifolium resupinatum* var. *majus*) is the only Persian Clover with the ability to withstand temperatures as low as -15 F°.

It has a notable root development speed that is similar to that of Daikon Radish, making it highly suitable for sandier soils.

Advanced seedling vigor allows eNhance to establish at a rate similar to Cereal Rye.

The low C:N ratio makes it a good choice to mix with Cereal Rye as the contrasting ratios provide balance and help reduce the yield drag often experienced in corn following a Cereal Rye cover crop.

This variety has a large hollow stem adding palatability for livestock and wildlife.



WINTER PEAS (*Pisum sativum*)

RECOMMENDED VARIETY

Survivor Winter Pea has been bred for advanced cold tolerance, providing more confidence and consistent results for farms. It also provides greater biomass production which translates into higher nitrogen production capacity.

ADDITIONAL BENEFITS:

Weed Suppression - Quick establishment and more robust plants help suppress weeds.



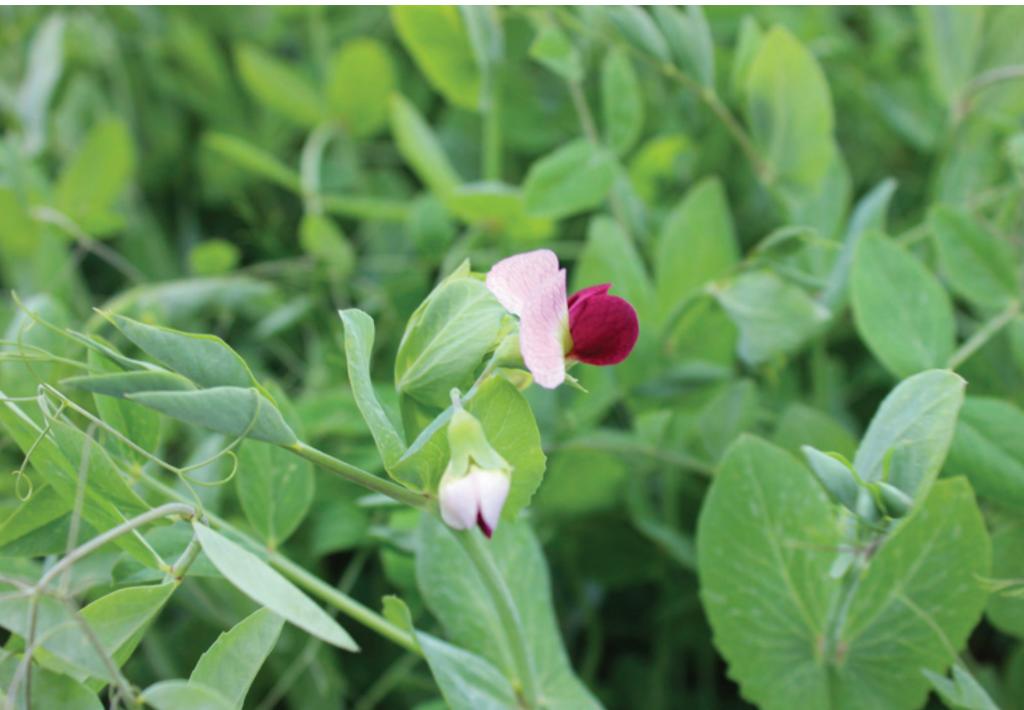
Nitrogen Fixation - With a low C:N ratio, the nitrogen contribution is quickly made available to the next crop.

Spring Green Up - Survivor has shown to be superior in early Spring green-up when compared to other commercial varieties.

As their name suggests, Winter Peas (also known as field peas) exhibit reasonable winter hardiness.

The viney plants grow thin and hollow stems up to 4-foot-long. They feature curled tendrils and purple to reddish-pink flowers.

Peas are generally known for their nitrogen-fixing capacity that provides an extra boost to your cover crop mix. This cool-season annual is capable of fixing over 200 pounds of nitrogen per acre. Peas are one of the most moisture efficient crops at producing biomass. Their root system improves water infiltration and the holding capacity of the soil.





HAIRY VETCH (*Vicia villosa*)

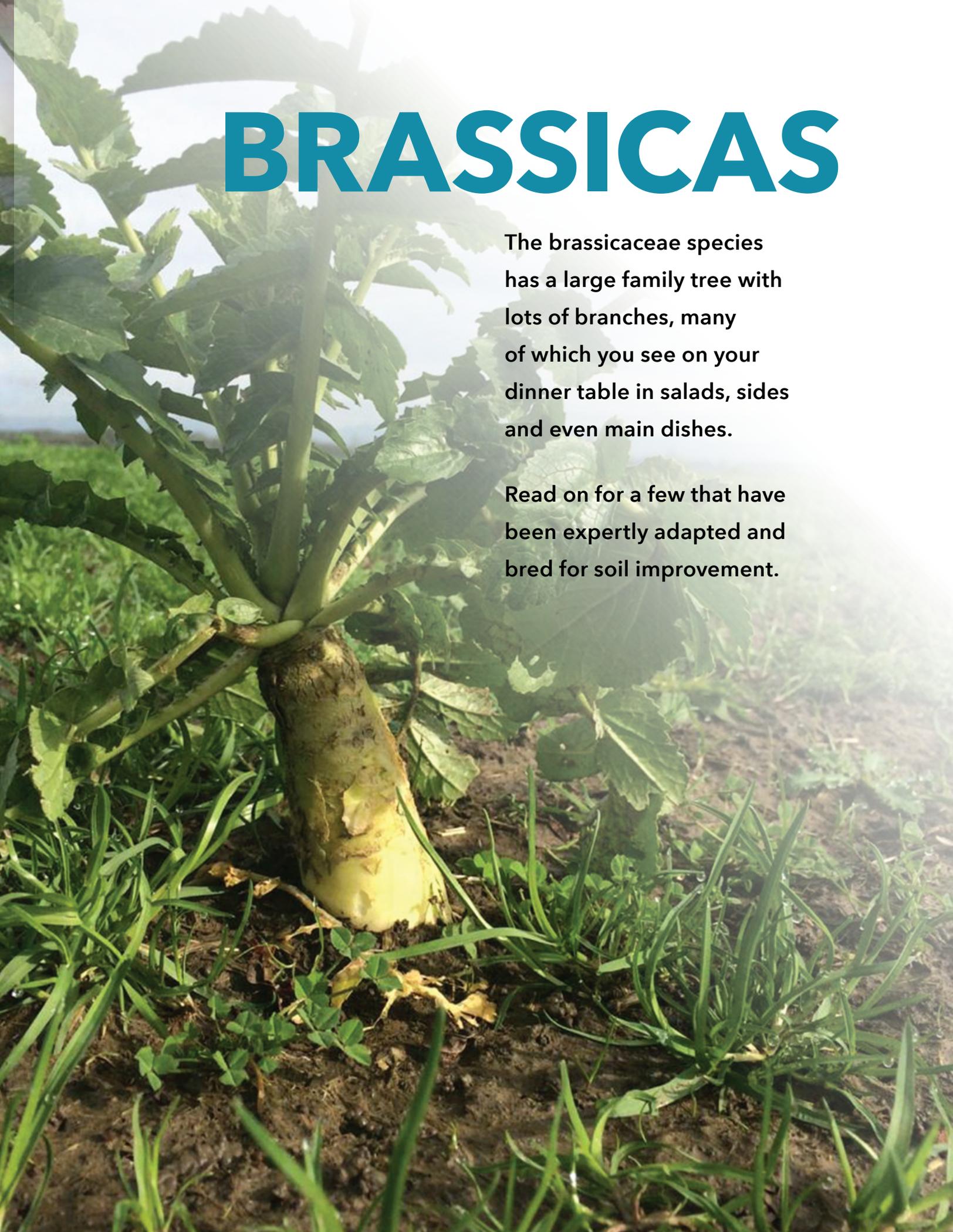
Hairy Vetch is viney and slow growing in the Fall. When Spring arrives with warmer temperatures, its growth explodes. In contrast to Peas, the stems are thin and somewhat stiff. The viney growth, which can reach 12 feet in length, is very beneficial as it smothers weeds. It also serves as a great nitrogen contributor. Hairy Vetch is indeterminate in maturity and nitrogen contribution will quickly decline upon flowering.

Pay attention to the flowering as this hard-seeded species has the potential to become a weed as pods quickly split, scattering seed, when they dry down.

When plants begin to flower, they quit producing green vegetation, at which point the nitrogen stored in the leaves and stems moves to the seed, diminishing the benefit to the following crops. Hard-seeded species have an unusually hard seed coat which is resistant to water and therefore slow to germinate unless treated mechanically or chemically. This is why hard-seeded species, if allowed to flower and set seed, have the potential to become weeds.



BRASSICAS

A large brassica plant, possibly a rutabaga or turnip, is the central focus. It has a thick, yellowish, cylindrical root that tapers slightly towards the top. The leaves are green and have a slightly serrated or lobed appearance. The plant is growing in a field with other similar plants in the background. The ground is dark brown soil with some green grass or weeds. The overall scene is brightly lit, suggesting a sunny day.

The brassicaceae species has a large family tree with lots of branches, many of which you see on your dinner table in salads, sides and even main dishes.

Read on for a few that have been expertly adapted and bred for soil improvement.



DAIKON RADISH (*Raphanus sativus*)

Daikon Radish is noted for its long tap roots.

When the Daikon Radish tap root hits compacted soil, it 'bio-drills' deeper, breaking up the compaction zone. The long roots improve water infiltration, and facilitate the movement of air and nutrients into the soil.

Equally impressive is the amount of above ground foliage. The leaves of daikon radish quickly shade the ground, smothering newly germinated weeds.

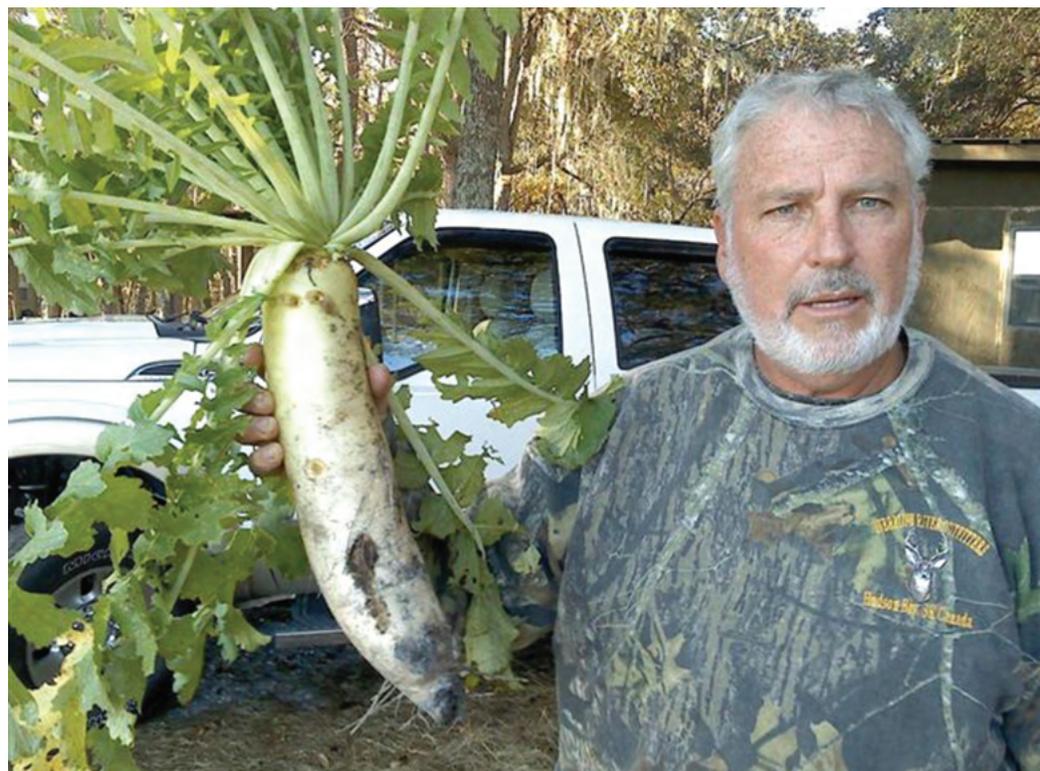
Daikon Radish also acts as a scavenger in the soil, collecting residual nitrogen and other key nutrients. Daikon Radish are not cold intolerant and will die after the first hard freeze.

As the plant material decays the sequestered nutrients are released for the benefit of the following crop.

RECOMMENDED VARIETY

Driller Radish provides impressive environmental and financial benefits. Its enormous tap root can reach depths of 30" or more. That means improved water infiltration and opening of root channels. In Fall, Driller's living canopy of top growth protects the soil from erosion. In Spring, the decaying organic matter enriches the soil

and improves water retention, the perfect conditions for creating glomalins - the living 'glue' that holds healthy soil together.





NEMATODE CONTROLLING RADISH (*Raphanus sativus*)

RECOMMENDED VARIETIES

It's important to keep in mind that each variety of nematode controlling Radish is bred to control a very specific nematode species. When concocting your cover crop mix, make sure to match the right variety to the known nematode pest present on your farm. If using as part of a mix, make sure the other components are non-hosts, otherwise you could wind up with more nematodes than you started with.



Controls Columbia
Root Knot Nematode
(*Meloidogyne chitwoodi*)

There are thousands of nematode species living in our soils, and many are beneficial to the eco-system. However, nematodes have been a profit-robbing pest in sugar beet and potato crops for decades.

Developed by European plant breeders, nematode controlling Radishes release a phytochemical which stimulates the hatching of cyst nematode eggs. The nematodes then attach to the Radish root, but are unable to adequately feed and die before reproducing, breaking the life-cycle. Nematode controlling Radishes target a narrow range of nematodes allowing the beneficials to survive. Presently there are only options for controlling Root Knot nematodes.

Another perk of these distinct Radishes is that the top-growth can develop extremely high levels of glucosinolates. If mulched and incorporated



into the soil, the glucosinolates break down and can serve as a biofumigant. Distinct from the smooth-sided Daikon Radish, nematode controlling radishes have branching roots, giving them an enhanced ability to break up compacted soils and improve water infiltration.



WHITE MUSTARD (*Brassica alba* or *Sinapis alba*)

White Mustard has been improved by plant breeders for use as a cover crop and as a biofumigant. The glucosinolate content of these new mustards is very high compared to other Brassicas. Management is the key to utilizing this species. The top growth must be finely chopped, incorporated into the soil, and allowed to decompose for a minimum of 45 days (ideally 60). The glucosinolates break down into isothiocyanates, which are effective at fumigating the soil.

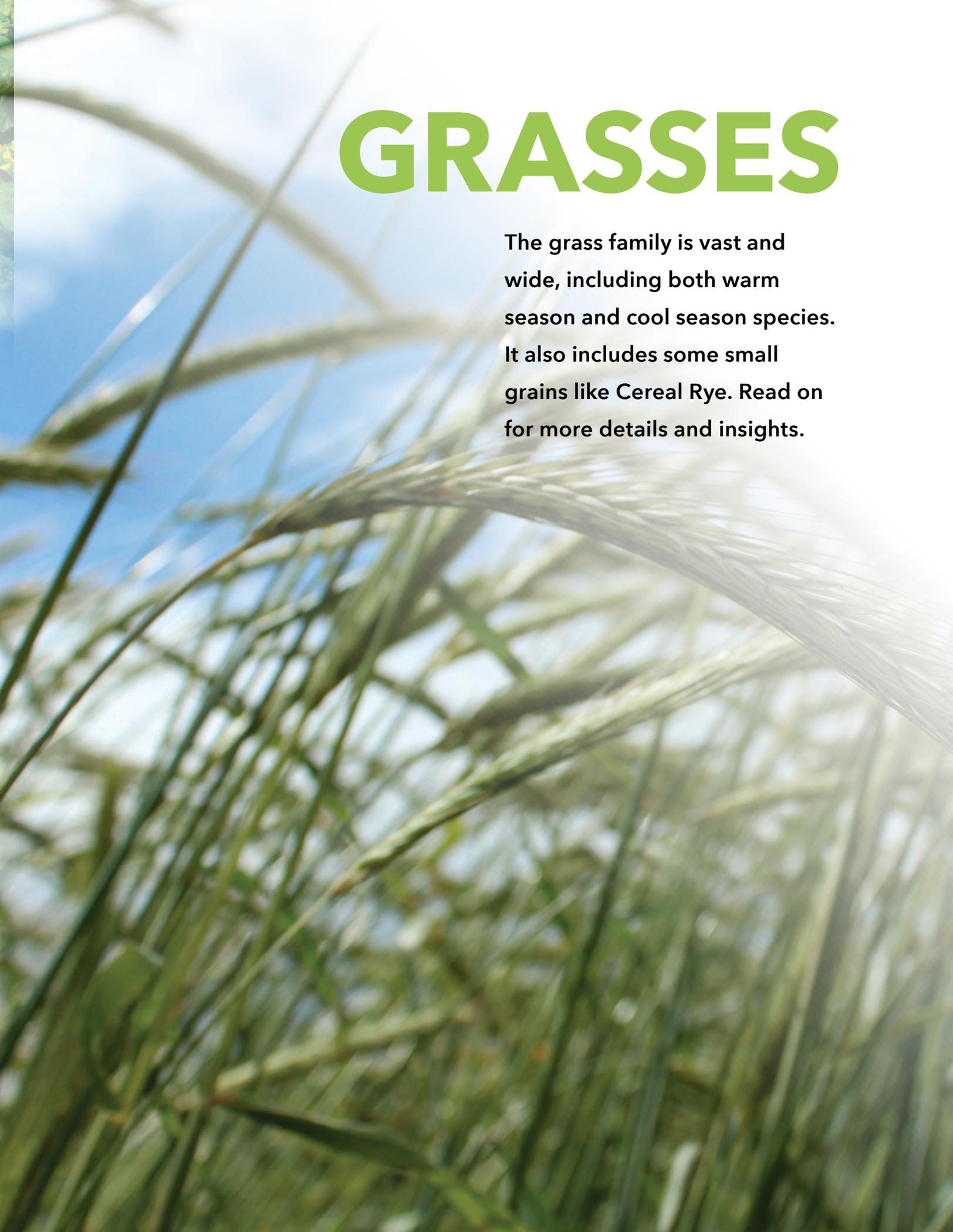
Rolling and watering the surface after incorporation improves efficacy as it helps seal the surface of the soil, holding the biofumigant in place so it can be effective. The good (and bad) news is, that it is non-discriminatory as a biofumigant and will kill good microbes as well.



DWARF ESSEX RAPE (*Brassica napus*)

Dwarf Essex Rape is similar to Canola. The plants are short and fine stemmed with a bright yellow flower. Dwarf Essex Rape originated in the United Kingdom in the late 1800's, it is widely adapted and utilized throughout the US due to its drought and cold tolerance. Quick germination and root growth make it useful for reducing compaction and for suppressing weeds.





GRASSES

The grass family is vast and wide, including both warm season and cool season species. It also includes some small grains like Cereal Rye. Read on for more details and insights.



CEREAL RYE (*Secale cereal*)

ANNUAL RYEGRASS (*Lolium multiflorum*)

Cereal Rye is one of the best species for planting in the late Fall to early Winter. Germinating and growing in cool weather, it provides needed winter soil protection. It develops an extensive root system, which can loosen up the soil, and some varieties may have an allelopathic effect on certain weed species (and possibly a few cover crops) making it a good weed suppressor. It is the most drought tolerant of the Cereal species and is adapted to a wide range of soil types.

Annual Ryegrass has long been favored in the southern regions of the United States as a winter-active companion crop and for seeding into dormant warm-season forages. It has quickly grown in popularity as a cover crop throughout the Midwestern states as Annual Ryegrass is quick to germinate and establish both above and below the ground. The aggressive, fibrous root structure makes it a good choice for breaking up compacted soils and opening up root channels for use by future crops.

CEREAL RYE VS. RYEGRASS

Cereal Rye is a member of the wheat tribe, closely related to barley and its seed looks very similar.



Cereal Rye Seed

Ryegrass is a cool-season grass species and its seed looks much like its grass cousins tall fescue and fine fescue.

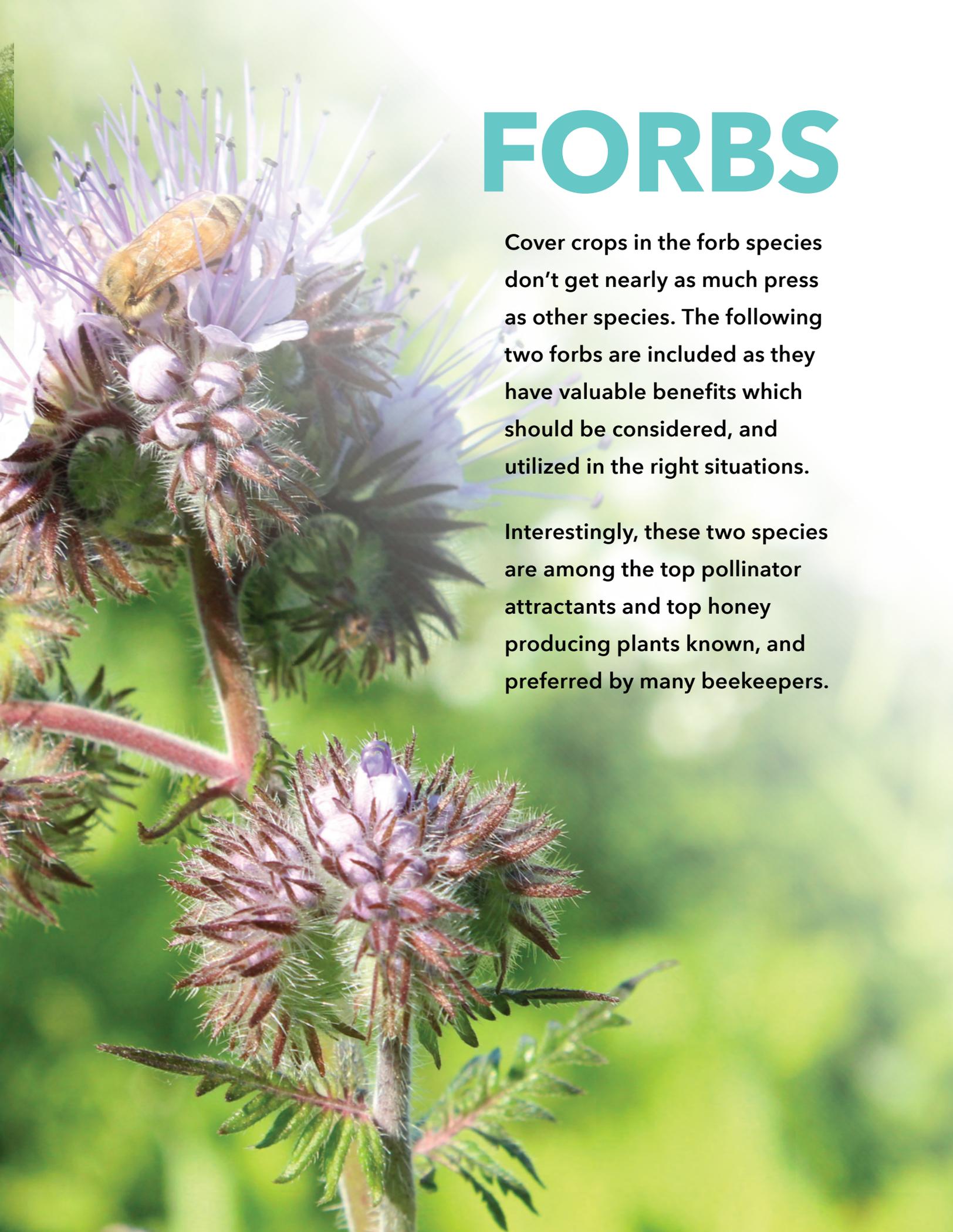


Ryegrass Seed

RECOMMENDED VARIETY

Lonestar's outstanding cold tolerance provides a wider window of opportunity for use as a cover crop. Bred for even faster germination and the ability to resist the diseases which commonly affect Annual Ryegrass, Lonestar offers superior forage that is readily grazed by cattle. Lonestar's impressive root system can scavenge nitrogen, Phosphorous, and other beneficial minerals in the soil, preventing the leaching into waterways.





FORBS

Cover crops in the forb species don't get nearly as much press as other species. The following two forbs are included as they have valuable benefits which should be considered, and utilized in the right situations.

Interestingly, these two species are among the top pollinator attractants and top honey producing plants known, and preferred by many beekeepers.



PHACELIA *(Tanacetifolia)*

BUCKWHEAT *(Fagopyrum esculentum)*

Phacelia, native to the USA, is a quick growing, flowering plant that can reach heights of up to 4 feet. Well-adapted to soils ranging in pH from 6.4 to 8.6. Phacelia exhibits excellent cold tolerance and will continue to grow in the Fall, surviving temperatures as low as 15 degrees F. Its ability to establish and grow under colder conditions makes it an excellent choice for combatting soil erosion.

Buckwheat is a fast-growing summer annual. Useful as a green manure smother crop, it germinates quickly, subsequently shading and cooling the soil. The biomass breaks down rapidly after incorporation into the soil. Thereby releasing nutrients it mined during its growth to the subsequent crop. This quick decay also improves the condition and moisture-holding capacity of the soil.

Certain studies indicate it may provide some nematode suppression. The quick-growing fibrous root system is effective at catching excess nitrates and phosphates before they can leach into waterways.

There are reports indicating Buckwheat may be highly effective in making Phosphorous available for the following crop.



COVER CROP CORNER: IT'S TIME TO DITCH DIXIE



Dixie Crimson Clover



Kentucky Pride Crimson Clover

While it should be noted that Dixie Crimson Clover was an achievement in its time, plant breeding advancements give agricultural producers much more powerful and fit for purpose tools.

Echoing remarks from North Carolina State University's Dr. Chris Reberg-Horton at the GO In-depth Cover Crop Summit, inconsistent corn varieties from the 1950s would never be accepted by the market today - and cover crop varieties shouldn't be viewed any differently.

When Dixie Crimson Clover was released in 1953, its trait for hard seeds filled a huge market need for a re-seeding pasture legume. The ability it gave producers to easily add natural nitrogen and protein into pasture quickly made it the industry standard variety - a title it still holds today. However, after decades of no varietal or production oversight, Dixie Crimson Clover, no longer has any varietal consistency.



Finding consistent alternatives

To get a better understanding of how the industry standard variety would perform against quality controlled varieties, University of Illinois researcher Nathan Johanning conducted a trial at the Ewing Demonstration Center.

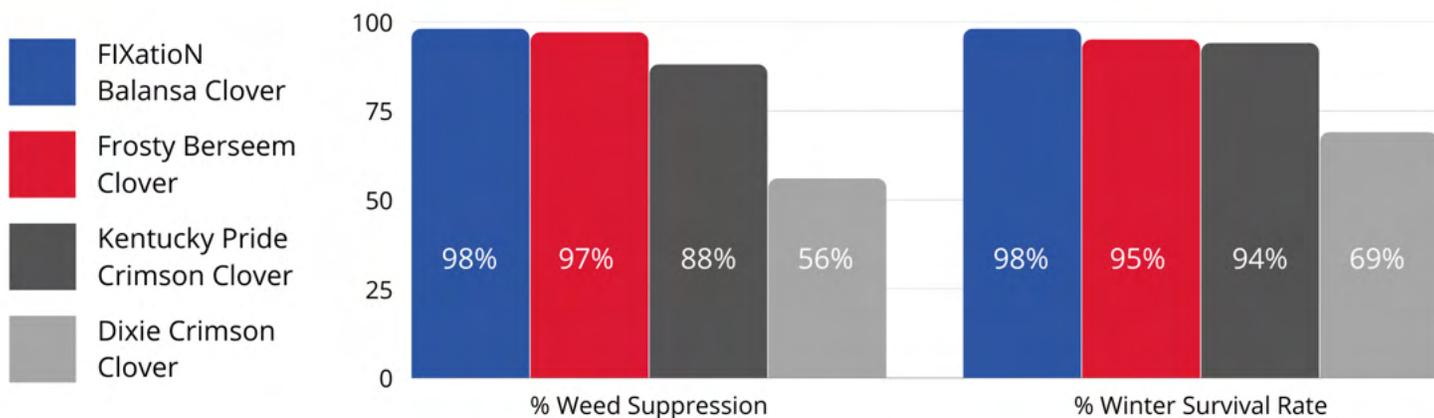
Planted in late September and terminated the following May, Dixie Crimson and three alternative clover varieties - Kentucky Pride Crimson, Frosty Berseem and FIXatioN Balansa- were analyzed for winter survival, root depth, weed suppression, biomass, nitrogen fixation and date of full bloom.

On average, the three alternative clover varieties had a 39% greater winter survival rate and average rooting depth than the industry standard (see Figure 1).

Figure 1: Ewing Demonstration Center Cover Crop Trial						
Variety	Seed Rate lbs/a (Planted 9/24/15)	% Winter Survival	Average Rooting Depth (In)	Max Rooting Depth (In)	% Weed Suppression	Date of Full Bloom
FIXatioN Balansa Clover	8	98	24	33	98	5/10/2016
Frosty Berseem Clover	15	95	25	32	97	N/A
Kentucky Pride Crimson Clover	15	94	25	31	88	4/25/2016
Dixie Crimson Clover	15	69	18	24	56	4/25/2016

Source: University of Illinois - Ewing Demonstration Center

Kentucky Pride Crimson Clover, FROSTY Berseem Clover and FIXatioN Balansa Clover also averaged a 67% advantage for weed suppression than Dixie Crimson Clover.



Fall and spring biomass and nitrogen in biomass measurements were taken (see Figure 2).

Figure 2: Biomass Contributions				
Variety	Fall Biomass (green; lbs/a)	Spring Biomass (dry; lbs/a)	Nitrogen in Biomass (lbs/a)	C:N Ratios
FIXatioN Balansa Clover	693	8,401	269	15:1
Frosty Berseem Clover	2,777	4,150	52	17:1
Kentucky Pride Crimson Clover	1,798	6,093	187	16:1
Dixie Crimson Clover	2,291	911	14	20:1

Source: University of Illinois - Ewing Demonstration Center

While Dixie Crimson had the greatest biomass measurement in the fall at 2,291 pounds per acre, it rapidly declined to 911 pounds per acre by the spring.

On the contrary, FIXatioN Balansa Clover's 693 pounds of biomass per acre grew to 8,401 pounds per acre by spring.

Dixie Crimson's 14 pounds of nitrogen per acre contribution also seemed negligible compared to FIXatioN's 269 pounds of nitrogen per acre.





From being established in late September to being destroyed the following May, FIXatioN Balansa Clover contributed 9,094 pounds of biomass per acre, while fixing 269 pounds of nitrogen per acre. Of the four varieties on trial, it also had the greatest max root depth and weed suppression percentage. FIXatioN's performance against Dixie Crimson Clover show the progress plant breeding has made in the last 65 years.

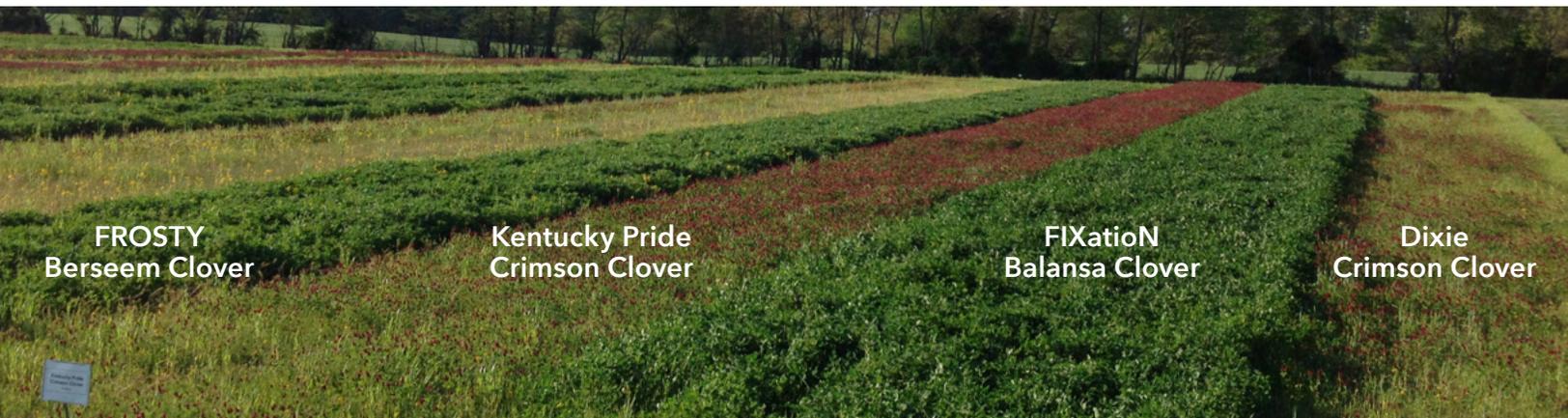
FROSTY Berseem Clover provided nearly 7,000 pounds of biomass per acre during the trial period. With the ability to thrive in temperatures as low as 5 degrees Fahrenheit and zero snow cover, FROSTY Berseem Clover gives new options when frost seeding.



Advancements in cover crop varieties

Whether you are selecting a legume like Crimson Clover or an Annual Ryegrass, making selections based on trait performance is essential to get the most from your cover crop and subsequent cash crop.

The future of cover crop varieties is here.



**FROSTY
Berseem Clover**

**Kentucky Pride
Crimson Clover**

**FIXatioN
Balansa Clover**

**Dixie
Crimson Clover**

