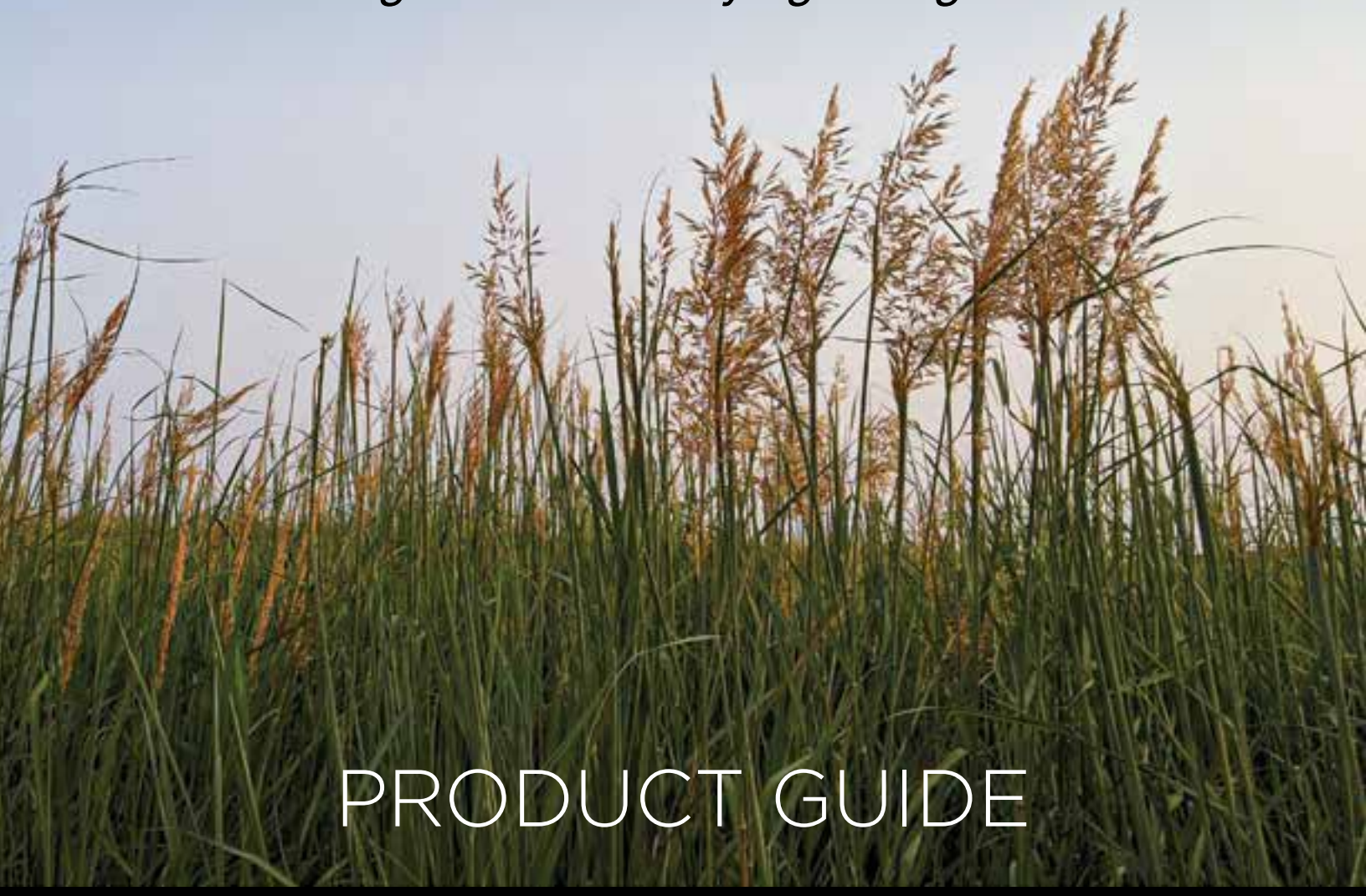
STAR® SEED INC.

green and always growing™



PRODUCT GUIDE

www.gostarseed.com

STAR® SEED INC.
green and always growing™

ALFALFA FORAGE PRODUCTS

INTRODUCTION TO **ALFALFA FORAGES**

Premium alfalfa seed has long been a pillar in the Star Seed forage lineup. Alfalfa varieties are carefully chosen to meet the growers needs and management system. From premium quality dairy forage to high-management Round-Up Ready® production options, Star Seed can provide the best alfalfa seed for YOU!

VARIETY	VNS	A-100	SLINGSHOT	L-446RR
DESCRIPTION	A blend of alfalfa varieties. Known to many as “Common” Alfalfa.	Conventional alfalfa with exclusive blended varietal genetics. Well adapted to a wide range of agronomic conditions.	High-yielding, high-quality, excellent digestibility. Exclusive genetics. Top production across wide range of agronomic conditions.	Round-Up Ready®, high-yielding, high-quality, alfalfa. Top production over wide range of soil conditions.
APPLICATION(S)	A low cost common alfalfa with excellent stand longevity potential.	Multipurpose, value forage, general beef production.	Dairy, high performance equine, beef production. High-value forage markets, maximum return on investment.	Beef, dairy markets. Round-Up management systems, areas with heavy weed pressure.

A-100
CONVENTIONAL ALFALFA

A-100 is a brand of alfalfa that works very well in our region. A-100 is a persistent brand that will give very good production for the more economically minded grower.

A-100 CHARACTERISTICS	
Fall Dormancy	4.0
WSI	2.2
DRI	30/30
Forage Quality	Very Good
Persistence	Excellent
Leaf-type	Trifoliate
Recovery after cutting	Fast
Hay	Excellent
Haylage	Excellent
Pre-inoculated	Yes
Treated with Fungicide	Yes
Seeding Rate	12-20 lbs drilled

A-100 DISEASE AND PEST RESISTANCE*	
Bacterial Wilt	R
Fusarium Wilt	R
Anthracnose	R
Phytophthora Root Rot	HR
Aphanomyces Root Rot (Race 1)	R
Aphanomyces Root Rot (Race 2)	NR
Verticillium Root Rot	R
Pea Aphid	NR
Potato Leafhopper	NR

NR = Not Rated
R = Resistant; HR = Highly Resistant
**Minimum Resistance for A-100*

SLINGSHOT
STAR PREMIUM ALFALFA

Slingshot is a high-yielding brand of alfalfa with a perfect score for winterhardiness. Packing an excellent disease and pest resistance package, this alfalfa stands out with the best of them. Slingshot's ability to handle an aggressive multi-cut regiment takesthis alfalfa to the next level.

SLINGSHOT CHARACTERISTICS	
Fall Dormancy	5.2
WSI	2.0
DRI	30/30
Forage Quality	Excellent
Leaf-type	Multifoliate
Recovery After Cutting	Fast
Hay	Excellent
Haylage	Excellent
Pre-inoculated	Yes
Treated with Fungicide	Yes
Seeding Rate	12-20 lbs drilled

SLINGSHOT DISEASE AND PEST RESISTANCE*	
Bacterial Wilt	R
Fusarium Wilt	HR
Anthracnose	HR
Phytophthora Root Rot	HR
Aphanomyces Root Rot (Race 1)	HR
Aphanomyces Root Rot (Race 2)	NR
Verticillium Root Rot	HR
Pea Aphid	HR
Potato Leafhopper	NR

NR = Not Rated
R = Resistant; HR = Highly Resistant
**Minimum Resistance for A-100*

L-446RR

GENUITY® ROUNDUP READY® ALFALFA

L-446RR is a very high-yielding and high-quality alfalfa. L-446RR was selected to be a top Roundup Ready® variety for the cash hay and dairy market. L-446RR has an excellent agronomic package that provides a very persistent and healthy plant for top production over a broad range of soils.

L-446RR CHARACTERISTICS	
Fall Dormancy	4.3
WSI	1.8
DRI	30/30
Forage Quality	Excellent
Leaf-type	Multifoliate
Recovery After Cutting	Very Fast
Hay	Excellent
Haylage	Excellent
Pre-inoculated	Yes
Treated with Fungicide	Yes
Seeding Rate	15-20 lbs drilled

L-446RR DISEASE AND PEST RESISTANCE*	
Bacterial Wilt	HR
Fusarium Wilt	HR
Anthracnose	HR
Phytophthora Root Rot	HR
Aphanomyces Root Rot (Race 1)	HR
Aphanomyces Root Rot (Race 2)	NR
Verticillium Root Rot	HR
Pea Aphid	HR
Potato Leafhopper	SR

NR = Not Rated
R = Resistant; HR = Highly Resistant; SR = Somewhat Resistant
**Minimum Resistance for A-100*

EXCEED SAR Plant Defense Booster

EPA REGISTERED CHITOSAN EXCLUSIVE BIO-STIMULANT

Exceed[SAR] and other legume inoculants manufactured by Visjon Biologics offer the grower an advantage in the field through the addition of fresh and plentiful nitrogen-fixing bacteria.

The symbiotic relationship the Rhizobium bacteria has with your legume crop enables the seed to germinate quickly and stimulates plant hormones responsible for root formation and development. This brings more nourishment to the plant, which is evident by rapid and healthy growth with high-yield return.

Soybeans require 4-6# of Nitrogen per bushel produced.

Do more than meet your yield goals... EXCEED them.

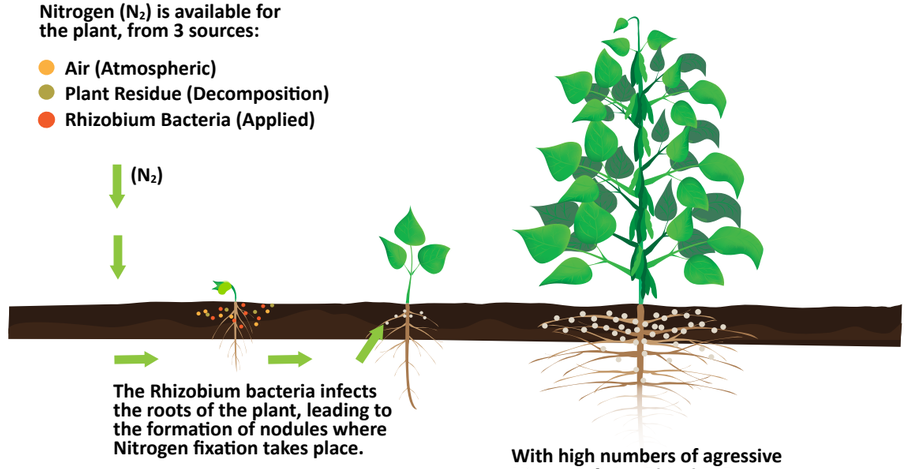
REV082319

The Benefits of Rhizobium Bacteria Inoculation.

Nitrogen-Fixation Process

Nitrogen (N_2) is available for the plant, from 3 sources:

- **Air (Atmospheric)**
- **Plant Residue (Decomposition)**
- **Rhizobium Bacteria (Applied)**



The Rhizobium bacteria infects the roots of the plant, leading to the formation of nodules where Nitrogen fixation takes place.

Field conditions such as High or Low pH, Saturated Soil, Low Organic Matter and Longer Crop Rotations, can have adverse effects on Native Rhizobia in the soil. Inoculating with fresh Rhizobium Bacteria assures high numbers for the benefit of the plant.

With high numbers of agressive Nitrogen-fixing Rhizobia Bacteria:

- **Every soybean planted can fully yield.**
- **Yield is improved in challenged areas.**
- **Full-field Yield Averages increase.**

Visjon Biologics is a family-owned and operated company.

MADE IN THE USA

Visjon BIOLOGICS
The Inoculant Experts

4385 Seymour Highway
Wichita Falls, TX 76309
940-264-0343 | 940-264-0344 fax
visjonbiologics.com

SORGHUM FORAGE PRODUCTS

QUALITY STAR SEED
SORGHUM LINE

TYPE	PEARL MILLET	HYBRID SUDAN	SORGHUM SUDAN	FORAGE SORGHUM
DESCRIPTION	Low prussic acid levels, very leafy and palatable grazing choice. Slow re-growth and lower yield potential.	Fine stemmed, high quality, rapid re-growth potential. Poor leaf retention after heading.	Yields between sudan and forage sorghum, very flexible forage type.	Highest yielding for large volume feed production.
MOST POPULAR USES	Premium grazing choice.	High quality rotational grazing, or multi-cut premium leafy hay.	Flex forage choice for grazing, multi-cut hay, or green chop.	Baled feed and silage production.

POPULAR TRAITS

BROWN MID-RIB (BMR)

Promote better animal performance by increased palatability and digestibility because of its low lignin levels.

PHOTOPERIOD SENSITIVE (PS)

Plant stays in vegetative growth period that is controlled by the length of day.

BRACHITIC DWARF (BD)

The shortening of the internodes allows more leaves per plant, which results in greater feed quality and resistance to lodging.

MALE STERILE (MS)

The absence of pollen grain or the incapability of the plant to produce viable pollen grain results in sugar accumulation in the stock.

PREMIUM FORAGES
AVAILABLE THROUGH THE STAR SEED DEALER NETWORK

			CONVENTIONAL HYBRID	BROWN MID-RIB	PHOTO SENSITIVE	BRACHYTIC DWARF	SUGGESTED USES
HYBRID SUDAN	BLUE RIBBON 3D	Premium Quality Sudan - very dry and quick to cure for baling; on average 3 days to cure after cutting.		■			Fine stemmed for high value markets; breeding stock, or show cattle.
SORGHUM X SUDAN	EXCEL II	High Performing Tonnage - consistent performer over a wide range of environmental conditions.	■				Very flexible feed uses including single cut baled feed, green chop, multi-cut OR grazing feed choices.
	NUTRIMAXX BMR	Long season BMR sorghum sudan with superior drought tolerance; high yielding, very aggressive tillering and fast recovery for multi-cut and intense grazing.		■			
	DRYLANDER	Photo period sensitivity makes this a good choice for upland acres, continuing to produce feed following periods of drought and severe heat.		■	■		
	BRUISER	Dwarf variety but is high yielding with plentiful moisture and delivers very rapid re-growth for intensive grazing or planned multiple cuts.		■		■	
FORAGE SORGHUM	MAGNUM	A conventional hybrid produces sweet and palatable baled feed and performs over a wide range of environmental conditions. Special order available with 80% LDP eligibility. Can be ordered male sterile.	■				High yielding baled feed production.
	MAGNUM ULTRA BMR	BMR Market Leader - delivers more TDN than conventional hybrids. Male sterile or special order available with 80% LDP eligibility.		■			High quality baled feed OR non-grain producing silage.
	BRUTIS	Dwarf variety is shorter, but high yielding with plentiful moisture produces a very dense leaf pack. Great choice for irrigation or plentiful moisture.		■		■	High quality BMR grain silage.
	PACKER HGY	100% LDP heavy grain production. Compare and use as conventional alternative to NK300 or FS5.	■				Conventional silage with high grain yield.
	QUICK CHOP	Good disease resistance. 90-Day Grain. One-third less water compared to corn.		■			Short season silage. Good winter grazing. Great after wheat harvest.
PEARL MILLET	ALL STAR PEARL MILLET	Tall and leafy, reaching pre-boot between 60 and 75 days. Tillers profusely with very fine stems for excellent quality hay. Does not produce prussic acid.	■				Premium market forage or grazing for horses and show cattle.
	BMR PEARL MILLET	Shorter Brachyitic Dwarf hybrid pearl millet that produces high yields. It typically will reach boot stage in around 60 days. This high leaf mass assures high concentrations of protein and TDN values.		■		■	

Concep Herbicide Safener and Insecticide Treatment is Available on Most Products

SORGHUM FORAGES
PRODUCT SELECTION GUIDE

BALED FEED

LACTATING COWS & GROWING ANIMALS		DRY COWS OR MAINTENANCE		HORSES & SPECIALTY LIVESTOCK	
SINGLE CUT	MULTI-CUT	SINGLE CUT	MULTI-CUT	SINGLE CUT	MULTI-CUT
Magnum Ultra, Drylander, BMR All-Star Pearl Millet	Bruiser, Blue Ribbon 3D, NutriMaxx BMR, DryLander	Magnum, BMR All-Star Pearl Millet	Excel II	All-Star Hybrid Pearl Millet, BMR All-Star Pearl Millet	

GRAZING PASTURE

BEEF CATTLE LIVESTOCK			HORSES & SPECIALTY LIVESTOCK
CONTINUOUS SUMMER	ROTATIONAL	STANDING WINTER	ROTATIONAL OR CONTINUOUS
AllStar Hybrid, Pearl Millet, BMR All Star	Bruiser, Blue Ribbon 3D	Magnum Ultra (Sterile)	AllStar Hybrid Pearl Millet, BMR All Star Pearl Millet

SILAGE

LACTATING COWS & GROWING ANIMALS		DRY COWS OR MAINTENANCE	
WITH GRAIN	NO GRAIN	WITH GRAIN	NO GRAIN
Brutis, Packer HGY, Quick Chop	Magnum Ultra (Sterile)	Packer HGY, Magnum LDP, Quick Chop	Magnum Sterile

BALED FEED HARVESTING TIPS

When planning to harvest baled feed, its best to harvest it around 48 inches and when the plant has reached the boot stage of maturity. Cut the feed down to 6-8 inches leaving three nodes for regrowth if desired. This added height will also help reduce the risk of nitrate poisoning. Using wide windrows will aid in drying, along with aggressive crimping.

GRAZING TIPS

Rotational grazing is encouraged. Do not begin grazing until growth exceeds 20-24 inches or more. Remove when leaves have been removed but before stalks are consumed. Return to grazing only when growth exceeds 18 inches; this gives best animal performance, best growth, and reduces prussic acid and nitrate risks.

SILAGE HARVESTING

The best stage of growth to harvest grain producing Forage Sorghums is at the soft dough stage. Finding the optimal timing to harvest male sterile, or non-grain producing hybrids can be more challenging. It is recommended to harvest male sterile hybrids when the whole plant moisture has dropped to around 60-70 percent.

MANAGING PRUSSIC ACID & NITRATES WITH SORGHUM FORAGES

Prussic acid occurs when a compound in the leaf epidermis combines with a compound in the leaf mesophyll cells to release prussic acid (cyanide).

Crushing, chewing, freezing can burst cells and allow these compounds to come in contact with each other; **do not graze during frost risk.**

Prussic acid is most concentrated in new re-growth therefore, sorghum forages **should not be grazed until more than 18" tall.**

Prussic acid is not generally a concern in well-cured hay, silage that has been stored more than 30 days, or in foliage that has been frosted and dried out.

Pearl Millet is the forage choice when prussic acid is a major concern.

Toxic levels of **nitrate** can develop in sorghum forages, especially when excessive nitrogen combined with drought conditions occur at or near the time of harvest. High levels of nitrate in sorghum forage is dangerous and can be fatal to livestock if not managed properly. To prevent and manage nitrate concerns, follow these general guidelines...

- Wait 7 to 10 days after a drought breaking rain before harvesting; test before harvesting during extended periods of stress.
- Balanced fertility reduces risks for nitrate problems. Split applications of N on multi-cuts is a constructive management practice, half at planting, and the rest after each hay harvest.

GUIDELINES FOR ROTATIONAL STOCKING SORGHUM FORAGE

The nutritional requirements of the livestock being grazed should be considered when deciding when to end grazing. The closer a pasture is grazed, the lower forage quality will be toward the end of that particular grazing cycle. Greater residual heights may be desired for animals with higher nutritional requirements (for example: stocker cattle vs. cows and calves).

	BEGIN GRAZING	END GRAZING	RETURN TO GRAZING
Forage Sorghum & Sorghum Sudan	20-24 inches	8-12 inches	Regrowth >18 inches

BLUE RIBBON 3D

BMR HYBRID SUDANGRASS

Blue Ribbon 3D is a premium quality sudan forage with the dry stalk gene and quickness to cure for baling. This hybrid produces a fine stemmed sudan forage suitable for grazing or baling. With excellent regrowth, this sudangrass makes for exceptional multicut feed.

BLUE RIBBON 3D CHARACTERISTICS	
Plant Height	5-6 Feet
Grain	N/A
Days to Pollination	60-75
Typical Seeds / lb	22,500
Dryland Seeding Rate	13-19 lbs drilled
Irrigated Seeding Rate	22-32 lbs drilled
Advanced Genetics	Brown Mid Rib (BMR)

BLUE RIBBON 3D PRODUCT INFORMATION	
Hay	Excellent
Silage	Good
Continuous Grazing	Very Good
Rotational Grazing	Excellent
Palatability	Excellent

EXCEL II
CONVENTIONAL SORGHUM SUDANGRASS

Excel II is a hybrid sorghum sudangrass that produces high-quality forage and has a quick regrowth. This variety produces tons of palatable forage. EXCEL II is a multicut hybrid that will perform over a wide range of environmental conditions.

EXCEL II CHARACTERISTICS	
Plant Height	6-8 Feet
Grain	Yes
Days to Pollination	90-95
Typical Seeds / lb	19,000
Dryland Seeding Rate	13-24 lbs drilled
Irrigated Seeding Rate	22-32 lbs drilled
Advanced Genetics	Conventional Hybrid

EXCEL II PRODUCT INFORMATION	
Hay	Very Good
Silage	Good
Continuous Grazing	Very Good
Rotational Grazing	Very Good
Palatability	Very Good

NUTRIMAXX BMR
LATE MATURING BMR SORGHUM SUDAN

Nutrimaxx BMR is a full season sorghum sudan alternative to photoperiod sensitive (PPS) genetics. Nutrimaxx BMR hybrid features include a very high green leaf retention, aggressive tillering, re-growth and recovery, all packaged with excellent drought tolerance. This variety has a wide harvest window and produces full season forage.

NUTRIMAXX BMR CHARACTERISTICS	
Plant Height	7-9 Feet
Grain	Yes
Days to Pollination	85-90
Typical Seeds / lb	17,000
Dryland Seeding Rate	13-24 lbs drilled
Irrigated Seeding Rate	22-32 lbs drilled
Advanced Genetics	Brown Mid-Rib (BMR)

NUTRIMAXX BMR PRODUCT INFORMATION	
Hay	Excellent
Silage	Good
Continuous Grazing	Excellent
Rotational Grazing	Excellent
Palatability	Excellent

BRUISER

BRACHYTIC DWARF (BD) BMR SORGHUM SUDAN

Bruiser is a brachyc dwarf BMR sorghum sudan that overcomes many of the difficulties of grazing or haying older tall varieties. Brachytic Dwarf means a hybrid that has shortened internodes but additional leaves, so quality is enhanced without sacrificing yield. BRUISER has excellent grazing qualities with rapid and abundant regrowth after grazing or swathing. The BMR genetics coupled with the shortened internodes, makes this hybrid very palatable and nutritious, while at the same me, leaving foliage accessible to livestock.

BRUISER CHARACTERISTICS	
Plant Height	5-6 Feet
Grain	Yes
Days to Pollination	70-85
Typical Seeds / lb	14,000
Dryland Seeding Rate	13-24 lbs drilled
Irrigated Seeding Rate	22-32 lbs drilled
Advanced Genetics	Brown Mid Rib (BMR) Brachytic Dwarf (BD)

BRUISER PRODUCT INFORMATION	
Hay	Excellent
Silage	Good
Continuous Grazing	Excellent
Rotational Grazing	Excellent
Palatability	Excellent

DRYLANDER

PHOTOPERIOD SENSITIVE (PPS) SORGHUM SUDAN FOR UPLAND ACRES AND COVER CROPPING MIXES

Daylight rather than environmental condition triggers **Drylander** to switch from vegetative to the reproductive stage. This means environmental extremes have less impact on **Drylander** with better recovery and resumed vegetative growth after periods of drought and heat stress.

DRYLANDER CHARACTERISTICS	
Plant Height	8-9 Feet
Grain	No
Days to Pollination	Varies by Day Length; <12.5 hours daylight repro.
Typical Seeds / lb	17,000
Dryland Seeding Rate	13-24 lbs drilled
Irrigated Seeding Rate	22-32 lbs drilled
Advanced Genetics	Brown Mid Rib (BMR) Photo Sensitive (PS)

DRYLANDER PRODUCT INFORMATION	
Hay	Excellent
Silage	N/A
Continuous Grazing	Excellent
Rotational Grazing	Excellent
Palatability	Excellent

MAGNUM

CONVENTIONAL, SINGLE CUT HYBRID

Magnum has been a standout forage sorghum, producing outstanding tonnage as well as quality feed. Magnum can be ordered as a male sterile conventional, single cut hybrid that will perform over a wide range of environmental conditions.

MAGNUM CHARACTERISTICS	
Plant Height	7-9 feet
Grain	Yes*
Days to 50% Anthesis	75
Typical Seeds / lb	15,500
Dryland Seeding Rate	15-20 lbs drilled
Irrigated Seeding Rate	20-24 lbs drilled
Advanced Genetics	Conventional Hybrid

**Can be ordered sterile*

MAGNUM PRODUCT INFORMATION	
Hay	Very Good
Silage	Very Good
Continuous Grazing	Good
Rotational Grazing	Good
Palatability	Very Good

MAGNUM ULTRA BMR

SINGLE CUT BALED FEED OR PREMIUM QUALITY SILAGE

Magnum Ultra is a single cut forage sorghum hybrid with the BMR trait, leading to exceptional feed quality and high tonnage. This means that the feed production will always rank very high with respect to quality and value. MAGNUM ULTRA can also be ordered as a sterile product, making it adaptable to many different environmental factors and farming practices.

MAGNUM ULTRA BMR CHARACTERISTICS	
Plant Height	7-9 feet
Grain	Yes *(Can be ordered sterile)*
Days to 50% Anthesis	80-85
Typical Seeds / lb	19,500
Dryland Seeding Rate	15-20 lbs drilled
Irrigated Seeding Rate	20-24 lbs drilled
Advanced Genetics	Brown Mid Rib (BMR)

MAGNUM ULTRA BMR PRODUCT INFORMATION	
Hay	Very Good
Silage	Excellent
Continuous Grazing	Good
Rotational Grazing	Good
Palatability	Excellent

BRUTIS

BRACHYTIC DWARF (BD) BMR FORAGE SORGHUM

Brutis is a brachytic dwarf, long maturity forage sorghum. Brachytic Dwarf means a hybrid that has shortened internodes, resulng in additional leaves, so quality is enhanced without sacrificing yield. This hybrid has a long maturity that adds to total yield, about 50% more leaves that are much longer and wider than taller forage sorghums. Quality is exceptional due to BMR genetics, good grain yield, and a very high leaf-to-stem ratio. The shorter mature height makes the standability exceptional. If planted after July 1, BRUTIS makes an ideal winter grazing for livestock.

BRUTIS CHARACTERISTICS	
Plant Height	5-7 feet
Grain	Yes
Days to 50% Anthesis	100-105
Typical Seeds / lb	16,000
Dryland Seeding Rate	5-6 lbs row planted
Irrigated Seeding Rate	6-8 lbs row planted
Advanced Genetics	Brown Mid Rib (BMR) Brachytic Dwarf (BD)

BRUTIS PRODUCT INFORMATION	
Hay	N/A
Silage	Excellent
Continuous Grazing	N/A
Rotational Grazing	N/A
Palatability	Excellent

PACKER HGY

EXCELLENT ALTERNATIVE TO FS5 AND NK300; A CONVENTIONAL HYBRID FORAGE SORGHUM FOR HIGH PRODUCTION SILAGE.

Packer HGY produces a high grain yield and is a strong standing forage sorghum. The high grain-to-stover ratio significantly increases digestible dry matter produced per acre when harvested for silage feed. The high-protein content and total digestible nutrients make this an excellent hybrid for feedlot and dairy operations. Packer HGY is an excellent alternative to FS5 and NK300 for a high production silage.

PACKER HGY CHARACTERISTICS	
Plant Height	6-7 feet
Grain	Yes
Days to Pollination	85-90
Typical Seeds / lb	16,000
Dryland Seeding Rate	5-6 lbs row planted
Irrigated Seeding Rate	6-8 lbs row planted
Advanced Genetics	Conventional Hybrid

PACKER HGY PRODUCT INFORMATION	
Hay	N/A
Silage	Excellent
Continuous Grazing	N/A
Rotational Grazing	N/A
Palatability	Very Good

QUICK CHOP

SHORT SEASON BMR FORAGE SORGHUM

Quick Chop is a medium maturity one cut silage with grain for maximizing tonnage and digestibility. This hybrid grows quickly making it suitable for double cropping after wheat harvest. It should be ready to harvest in 90 days or in the soft dough stage. Quick Chop has good stalk strength giving it excellent standability. Reduced lignin in the plant improves the digestibility significantly.

QUICK CHOP CHARACTERISTICS	
Plant Height	7-9f feet
Grain	Yes
Days to Pollination	80-90
Typical Seeds / lb	18,000
Dryland Seeding Rate	5-6 lbs row planted
Irrigated Seeding Rate	6-8 lbs row planted
Advanced Genetics	Brown Mid Rib (BMR)

QUICK CHOP PRODUCT INFORMATION	
Hay	N/A
Silage	Excellent
Continuous Grazing	N/A
Rotational Grazing	N/A
Palatability	Excellent

MILLET FORAGE PRODUCTS

ALL-STAR
HYBRID PEARL MILLET

All-Star is a high protein, very palatable, no prussic acid millet forage type for grazing or high quality hay. A forage choice for horses and other livestock sensitive to the prussic acid levels in other sorghum forage types.

ALL-STAR CHARACTERISTICS	
Plant Height	5-6 feet
Grain	Yes
Days to 50% Anthesis	65-70
Typical Seeds / lb	80,000
Dryland Seeding Rate	10-20 lbs drilled
Irrigated Seeding Rate	20-28 lbs drilled
Advanced Genetics	Conventional Hybrid

BMR ALL-STAR
BMR PEARL MILLET

BMR All Star is a shorter Brycitic Dwarf hybrid pearl millet that produces high yields. It typically will reach boot stage in around 60 days. It has a short plant structure, therefore the plant is mostly all leaves. This high leaf mass assures high concentrations of protein and TDN values. It may not yield as much as typical sudangrass but tolerance to sugar cane aphids can offset that tonnage difference.

BMR ALL-STAR CHARACTERISTICS	
Plant Height	4-5 feet
Grain	Yes
Days to 50% Anthesis	55-60
Typical Seeds / lb	60,000
Dryland Seeding Rate	10-20 lbs drilled
Irrigated Seeding Rate	20-28 lbs drilled
Advanced Genetics	Brown Mid-Rib (BMR); BD

JAPANESE MILLET
ECHINOCHLOA FRUMENTACEA

Japanese Millet (Echinochloa frumentacea) is a higher yielding forage than foxtail (German) millet and much higher yielding than proso millet, but not as high yielding as pearl millet or sorghum sudangrass. Forage quality is similar to foxtail or pearl millet. It is very early maturing, able to produce seed in 60 days and has high seed yield. It is perhaps the most tolerant summer annual forage grass to flooded or wet conditions, making it a favorite plant to use in plantings for waterfowl.

JAPANESE MILLET CHARACTERISTICS	
Plant Height	3-4 feet
Grain	Yes
Days to 50% Anthesis	45 to 60
Typical Seeds / lb	142,800
Dryland Seeding Rate	15-25 lbs drilled
Advanced Genetics	None

GERMAN MILLET
FOXTAIL MILLET (SETARIA ITALICA)

German, or **Foxtail Millet**, is rapid growing and drought tolerant but matures early, which limits its yield potential to less than pearl millet or sorghum sudan. The forage of foxtail millet cures rapidly after swathing due its naturally fine stems, making it very easy to put up as dry hay. The regrowth after cutting is very poor, making it best suited as a one cut, short term hay crop.

GERMAN MILLET CHARACTERISTICS	
Plant Height	2-3 feet
Grain	Yes
Days to 50% Anthesis	40 to 60
Typical Seeds / lb	165,000
Dryland Seeding Rate	20-25 lbs drilled
Advanced Genetics	None

PROSO MILLET
PANICUM MILLEACEUM

Proso Millet (panicum milleaceum) is a very water efficient grain crop, but due to shallow roots it is not tremendously drought tolerant and has a low yield potential compared to grain sorghum. It has prickly hairs on the leaves which reduce forage palatability. It is often used in food plots due to its short height (grain heads are often within reach of pheasants) and early maturity. The seed is similar in quality and nutritional value as grain sorghum.

PROSO MILLET CHARACTERISTICS	
Plant Height	2 feet
Grain	Yes
Days to 50% Anthesis	60 to 65
Typical Seeds / lb	150,000
Dryland Seeding Rate	20-25 lbs drilled
Advanced Genetics	None

ROX ORANGE
OPEN POLLINATED SORGHUM

Rox Orange is a selection of forage sorghum released by Kansas Agriculture Experiment Station in circa 1934. It is a selection from Kansas Orange, a variety first selected in 1857. Compared to earlier forage sorghums, it had more palatable stalks with a higher sugar content and less tannin in the seeds. It is distinctly inferior in both yield and quality to modern BMR hybrids.

ROX ORANGE CHARACTERISTICS	
Plant Height	6 feet
Grain	Yes
Days to 50% Anthesis	105
Typical Seeds / lb	17,000
Dryland Seeding Rate	20-25 lbs drilled
Advanced Genetics	None

SUMAC
OPEN POLLINATED SORGHUM

Early Sumac is a forage sorghum variety first released to the public by the Kansas Agriculture Experiment Station in 1925. It has small seeds, which give it a high plant population per pound of seed, giving finer stems at similar seeding rates. It is distinctly inferior to modern BMR hybrids in both yield and quality.

SUMAC CHARACTERISTICS	
Plant Height	7.5-8.5 feet
Grain	Yes
Days to 50% Anthesis	100
Typical Seeds / lb	30,000 to 32,000
Dryland Seeding Rate	20-25 lbs drilled
Advanced Genetics	None

COVER CROP PRODUCTS

CRITICAL COVER CROP DECISION MAKING CONSIDERATIONS

1. PLANTING WINDOW: WHAT IS THE PLANTING WINDOW FOR THE COVER CROP?

SPRING COVER COOL SEASON · FEB-MAR-APR	SUMMER COVER WARM SEASON · JUN-JUL	FALL-WINTER COVER COOL SEASON · AUG-MID SEP
Buckwheat, Oats, Cool Season Peas, Spring Barley, Spring Triticale	Sorghum Forages, Millets, Cowpeas, SunnHemp, Hybrid Brassica, Safflower, Flax, Buckwheat	Cool Season Peas, Lentils, Chickling Vetch, Crimson Clover, Tillage Radishes, Turnips, Ethiopian Cabbage, Oats, Triticale, Annual Ryegrass

2. COVER CROP OBJECTIVES: WHAT ARE THE PRIMARY GOALS OF THE COVER CROP?

OBJECTIVE	GENERAL PURPOSE	COVER CROP SPECIES
Nitrogen Fixing	To generate nitrogen credits beneficial for the next primary crop.	Cool Season Peas, Cowpeas, SunnHemp, Chickling Vetch, Hairy Vetch, Clovers, Alfalfa
Nutrient Scavenge	To consume and temporarily sequester (tie-up) nitrogen or to reclaim unreachable reservoirs of nutrients.	**N Scavenge:** Millets, Oats, Triticale, Annual Ryegrass. **P Scavenge:** Brassicas including Tillage Radish, Hybrid Brassicas, Sunflower.
Mulching & Organic Matter	To improve soil health (moisture retention and water holding capacity) as well as to reduce soil erosion.	Oats, Triticale, Annual Ryegrass, Millets, SunnHemp
Soil Conditioning	To reduce soil compaction, fracture hard-pan, and generally improve soil structure.	Tillage Radish, Annual Ryegrass, Hybrid Brassica
Soil Pest Management	To suppress nematodes and disrupt pest cycles.	SunnHemp (many species including soybean cyst), Annual Ryegrass (suppresses SCN), Sorghum sudan (many species but not SCN), Ethiopian cabbage
Upland Birds	Creates brood rearing cover when planted in the spring through late summer.	Cowpeas, Cool Season Peas, Yellow Blossom Clove, Hybrid Brassica, Buckwheat, Sunflower, SunHemp

3. CROP ROTATION: WHAT IS THE INTENDED PRIMARY CROP FOLLOWING COVER?

CORN	Corn is best preceded by legumes (like SunnHemp, Cowpeas, Chickling Vetch, or Cool Season Peas) and brassicas (like Tillage Radish, Hybrid Brassica, and Turnip). These are plants that either produce nitrogen or decay quickly to release nitrogen and/or other nutrients they have scavenged and stored.
SORGHUM	Sorghum is best preceded by the same crops as corn. In addition, crimson clover and hairy vetch can also be included because the later sorghum planting date allows these species to bring value as well.
SOYBEANS	Soybeans are best preceded by crops that sequester nitrogen such as annual Ryegrass and Rye. These crops will tie up nitrogen the next spring, suppressing weed pressure in soybeans while slowly decaying to release nitrogen later in the soybean crop when beans are podding.
WHEAT	Wheat is best preceded by legume dominated mixtures. A cover crop can be utilized during traditional fallow periods such as spring seeded mix of oats that produce a light colored, persistent mulch, as well as legumes to provide a slow release nitrogen source. It is recommended to terminate or harvest spring seeded covers by mid-June to allow time for a rain to recharge the profile prior to wheat planting. In areas suited to continuous wheat, a summer legume such as SunnHemp or Cowpeas planted immediately after harvest and terminated a month prior to wheat planting fixes nitrogen and produces a rapidly decaying mulch to release that nitrogen. SunnHemp also leaves a stiff-stalked residue that excels at trapping snow.

CONSIDERATIONS FOR COVER CROP MIXES

QUICK PICK Cover Crop Selection		Intended Primary Crop After Cover Crop: SOYBEANS	CORN/SORGHUM	WHEAT
Current Primary Crop Before Cover Crop	SOYBEANS	**Rye or Annual Ryegrass** Seed following soybean harvest... may be seeded as late as mid-November.	**GreenWing B2C** Seed into standing beans when leaves yellow; a mix designed for aerial application. Requires irrigation or timely rainfall to initiate seed establishment.	**Green-Up or Green Spring** Fallow alternative: Seed in March and terminate by mid-June to recharge moisture before fall wheat planting.
	CORN/SORGHUM	**GreenWing C2B** Seed into standing corn when corn matures and canopy opens; a mix designed for aerial application.	**GreenWing B2C** Seed into standing corn when corn matures and canopy opens; a mix designed for aerial application.	**Green-Up or Green Spring** Fallow alternative: Seed in March and terminate by mid-June to recharge moisture before fall wheat planting. **Chick Magnet** A combination of cool and warm season broad leaves designed primarily for providing brood cover to upland game birds, but it has legumes for nitrogen fixation and deep top rooted crops for benefit to succeeding crops.
	WHEAT	**GreenShift SB** Seed in August through early September; options include mix with Oats (winter kills), Triticale (does not winter kill; produces hay or graze), or Annual Ryegrass (does not winter kill; produces graze.)	**GreenShift CS or Chickling Vetch** Seed in August through early September. Oats can be added to the GreenShift CS to produce a very productive fall grazing cover crop. **Chick Magnet** A combination of cool and warm season broad leaves designed primarily for providing brood cover to upland game birds, but it has legumes for nitrogen fixation and deep top rooted crops for benefit to succeeding crops. **No-Vol CS** An all broad leaf blend designed to allow over-the-top use of grass herbicides to kill volunteer wheat and reduce risk of transmitting wheat streak mosaic.	**SunnHemp or Green Field** For continuous wheat cropping, seed immediately following wheat harvest, terminate prior to fall wheat seeding. **Chick Magnet** A combination of cool and warm season broad leaves designed primarily for providing brood cover to upland game birds, but it has legumes for nitrogen fixation and deep top rooted crops for benefit to succeeding crops.

Maximize Performance: A mix can accomplish multiple objectives at the same time, better than a single species. For example, a half-seeding rate of Tillage Radish may provide nearly as much compaction alleviation as a full rate, while a half seeding rate of field peas can fix nearly as much nitrogen as a full rate. Combining a half-seeding rate of each can accomplish both objectives at the same time.

Reduce Risk of Seeding Failure: Mix diversity reduces the risk of seeding failure, insect problems, diseases, variable soils, etc. A diverse mix will often exhibit the phenomenon of "over-yielding" in which the total yield far exceeds the weighted average of the components in the mix.

Mix Design: Many factors must be considered when developing cover crop mixes. For example, mixing species may reduce herbicide options in the event weed control is needed or may be limited dependent upon previous herbicide use. Species compatibility is important, some species during certain seasons may be so dominant that mixing other species brings little value (such as Rye in a very late fall planting). Conversely some species may not compete well in a mix yet have great value when planted alone (such as Chickling Vetch).

FEATURED MIXES DESIGNED FOR THE STAR SEED DEALER NETWORK

MIX	PLANTING WINDOW	MIX DESCRIPTION & BEST USE
Green Spring	**SPRING COOL SEASON** Feb-Mar-Apr 65-105 lbs/a	Designed to be planted in March to produce an early hay or pasture crop, or simply left in place to convert the ordinarily abundant spring rain into a water-saving mulch, improving late-season drought tolerance. In areas with more abundant rain, it can precede soybeans or sorghum; in more droughty areas, it is used prior to wheat and is recommended to be terminated by mid-June to allow soil profile recharge. **OATS, COOL SEASON PEAS**
Green Up	**SPRING COOL SEASON** Feb-Mar-Apr 63-85 lbs/a	Green Up is similar in function to Green Spring but with five (5) species for increased diversity and better adaptability to variable soils. It is designed to be planted in spring to produce early hay or pasture or can remain undisturbed to convert spring rain into a water-saving mulch. In areas with more abundant rain, it can precede soybeans or sorghum; in more droughty areas, it is used prior to wheat and it should be terminated by mid-June to allow soil profile recharge. **OATS, COOL SEASON PEAS, SPRING BARLEY, CHICKLING VETCH, SPRING TRITICALE**
Chick Magnet	**SPRING COOL SEASON** Feb-Mar-Apr 20-25 lbs/a	A combination of cool and warm season broad leaves designed primarily for providing brood cover to upland game birds, but it has legumes for nitrogen fixation and deep top rooted crops for benefit to succeeding crops. **COWPEAS, COOL SEASON PEAS, YELLOW CLOVER, WIN HYBRID BRASSICA, SUNFLOWER, BUCKWHEAT**
Green Field	**SUMMER WARM SEASON** May-Jul 20-30 lbs/a	Six (6) mixed species designed to agronomically contribute to organic matter, fix nitrogen, scavenge nutrients, and condition soil. Green Field also provides the option for supplemental grazing and later season hay potential. **SORGHUM SUDAN, HYBRID PEARL MILLET, COWPEA, HYBRID BRASSICA, SUNFLOWER, RADISH**
No-Vol CS	**SUMMER WARM SEASON** May-Jul **AND COOL SEASON** Feb-Mar-Apr 28-40 lbs/a	An all broadleaf blend designed to allow over-the-top use of grass herbicides to kill volunteer wheat and reduce risk of transmitting wheat streak mosaic. **COOL SEASON PEAS, COWPEAS, CHICKLING VETCH, RADISH, PURPLE TOP TURNIP**
Green Shift SB	**FALL COOL SEASON** Aug-Sep 48-78 lbs/a	GreenShift SB mix is designed for fall cover crop preceding soybeans the next spring. The grass based components will sequester nitrogen to prevent N loss during the winter and then reduce weed pressure the following spring while the other components condition the soil and contribute bio-diverse eco structure. **OATS, ANNUAL RYEGRASS, WINTER TRITICALE, COOL SEASON PEA, RADISH, HYBRID BRASSICA**
Green Shift CS	**FALL COOL SEASON** Aug-Sep 32-65 lbs/a	GreenShift CS is designed for fall cover crop preceding nitrogen hungry corn or sorghum the next spring or summer. The heavy legume cool season pea based mix will fix nitrogen for the corn and/or sorghum to follow while the other grass and mixed species provide quick fall cover to reduce erosion and increase snow catch through the winter. **COOL SEASON PEAS, OATS, SPRING BARLEY, RADISH, HYBRID BRASSICA**
Green Wing B2C	**FALL COOL SEASON** Aug-Sep 12-18 lbs/a	Designed for aerial seeding into soybeans at leaf yellowing under irrigation or with timely rainfall and to precede corn (B2C, stands for Beans To Corn). It is composed of species that have a low seeding rate, have small seeds that germinate from the surface, and do not produce protruding roots (like radishes) that may interfere with soybean harvest if harvest is delayed. This mixture is composed of legumes and brassicas to produce and then rapidly release nitrogen to a following corn crop. **CRIMSON CLOVER, SWEET CLOVER, HAIRY VETCH, RAPE SEED, HYBRID BRASSICA**
Green Wing C2B	**FALL COOL SEASON** Aug-Sep 22-35 lbs/a	Designed for aerial seeding into standing corn, prior to growing soybeans the following year. (C2B stands for Corn to Beans) sequester nitrogen to prevent N loss during the winter and then reduce weed pressure the following spring while the other components condition the soil and contribute bio-diversity. **ANNUAL RYEGRASS, SPRING TRITICALE, OATS, SWEET CLOVER, RAPE SEED, TURNIP**

FEATURED MIXES DESIGNED FOR THE STAR SEED DEALER NETWORK

COVER SPECIES	PURE STAND SEEDING RATE, LBS/ACRE	SEEDING DEPTH, IN.	SEEDING SEASON
GRASSES			
Annual Ryegrass	20-25	0-.5	Fall
Winter, Spring Barley	60-90	1-2	Spring, Fall
Spring, Winter Triticale	60-120	1-1.5	Fall, Spring
Oats	60-90	1	Spring, Fall
Cereal Rye	60-120	1-2	Fall
German Millet	15-25	0-.5	Spring, Summer, Fall
Japanese Millet	15-25	0-.5	Spring, Summer, Fall
Proso Millet	15-25	.5	Spring, Summer, Fall
Pearl Millet	12-15	.5-1	Spring, Fall
Sudan	15-20	.5-1	Spring, Fall
BRASSICAS			
Appin, Purple Top Turnips	3-5	0-.5	Fall, Spring
Daikan Radish	6-8	.5-.75	Fall
Ethiopian Cabbage	5	0-.5	Fall
Kale	3-5	0-.5	Spring, Fall
Pajsa*, Winfred*	5	0-.5	Spring, Fall, Summer
Rapeseed	4-8	0-.5	Fall, Spring
BROADLEAFS			
Buckwheat	40-60	1	Spring, Fall
Collards	8	.5	Summer, Fall
Flax	30-50	1	Spring, Fall, Summer
Phacelia	5-10	.25	Spring, Fall
Safflower	15-20	1	Summer
Sunflowers	4-7	1-2	Summer
LEGUMES			
Austrian Winter Pea	30-60	1-2	Fall
Berseem Clover	10-12	0-.5	Spring
Chickling Vetch	20-50	1-2	Spring, Fall
Hairy Vetch	20	.5-1	Fall
Cowpeas	30-60	1	Summer
Mung Beans	15-20	1	Summer
Crimson Clover	10-20	0-.5	Fall
Spring Field Peas	60-100	1-2	Spring, Fall
Sunn Hemp	20	.5-1	Summer
Sweetclover Yellow/White Blossom	10-12	0-.5	Spring, Fall

MANY OTHER SPECIES AVAILABLE

COVER CROPS CONVERT ENERGY TO ORGANIC MATTER

› **INCREASED WATER HOLDING CAPACITY**
Organic matter has a very high water holding capacity that can be utilized by plant roots as the soil dries out.

› **RELEASE OF NUTRIENTS**
When organic matter is mineralized in the summer months nutrients become available to the plant.

› **INCREASE WATER INFILTRATION**
With improved soil structure and water holding capacity, the permeability of the soil can be greatly increased.

› **IMPROVE SOIL STRUCTURE**
Abundance of organic matter along with soil biology can help form soil aggregates.

WHAT ARE THE BENEFITS OF ORGANIC MATTER?

› **NUTRIENT SUPPLY**
Organic matter is a reservoir of nutrients that can be released to the soil. Each percent of organic matter in the soil releases 20 to 30 pounds of nitrogen, 4.5 to 6.6 pounds of P2O5, and 2 to 3 pounds of sulfur per year. The nutrient release occurs predominantly in the spring and summer, so summer crops benefit more from organic-matter mineralization than winter crops.

› **WATER-HOLDING CAPACITY**
Organic matter behaves somewhat like a sponge, with the ability to absorb and hold up to 90 percent of its weight in water. A great advantage of the water-holding capacity of organic matter is that the matter will release most of the water that it absorbs to plants. In contrast, clay holds great quantities of water, but much of it is unavailable to plants.

› **SOIL STRUCTURE AGGREGATION**
Organic matter causes soil to clump and form soil aggregates, which improves soil structure. With better soil structure, permeability (infiltration of water through the soil) improves, in turn improving the soil's ability to take up and hold water.

› **EROSION PREVENTION**
This property of organic matter is not widely known. Data used in the universal soil loss equation indicate that increasing soil organic matter from 1 to 3 percent can reduce erosion 20 to 33 percent because of increased water infiltration and stable soil aggregate formation caused by organic matter.

KEYS TO COVER CROP SUCCESS

1. PLANNING CROP ROTATION

Look 3 to 5 years down the road and the possibility of cover crops to enhance flexibility and value.
Simple rotation rule... alternate grass and broadleaf crops (G-G).

GRASS CROPS
- Corn
- Sorghum
- Wheat
- Millets
- Triticale
- Oats
- Barley
- Rye

BROADLEAF CROPS
- Soybeans
- Sunflower
- Brassicas (turnips & radish)
- Cowpeas
- Winter Peas
- Chickling Vetch
- Alfalfa
- Clovers

2. LOOK AT THE BIG PICTURE AND CONSIDER THE MANAGEMENT IMPLICATIONS OF ONE CROP UPON THE NEXT

- Weed Control
- Growing Season
- Fertility Management
- Residue Management

3. PATIENCE AND REALISTIC EXPECTATIONS

Long-term challenges such as soil loss, low organic matter, soil structure, pest pressures, and fertility deficiencies require long-term management strategies to manage, correct, and then build upon.

CONSIDERATIONS CONCERNING NITROGEN AND COVER CROPS

Legume cover crops can be used to fix atmospheric nitrogen and incorporate it into their tissues, which is released upon decay of the residue. It is important to match the proper strain of rhizobia inoculant to the species of plant you intend to plant. Soybean inoculant will not nodulate alfalfa or any other legume. Refer to this table to match the correct bacteria to the plant you grow.

PLANT	INOCULANT
Alfalfa, Sweetclover	Alfalfa
Red Clover, White Clover, Ladino Clover, Crimson	Clover
Peas, Vetch	Pea
Soybeans	Soybean
Cowpea, Peanut, Lespedeza, SunnHemp, Partidge Pea	Peanut
Field beans (navy, pinto) Green beans	Garden

Nitrogen is in plants in the form of protein. When the protein breaks down it releases nitrogen. There is very little breakdown of legume residue below 50 F. Crops that do most of their growth during the cool weather, like wheat, will not respond as well to legume cover crops as well as warm season crops like sorghum and corn.

The “slow release” nature of nitrogen from cover crops can be advantageous in conditions in which readily available nitrogen sources can be lost. Nitrate nitrogen can be lost from either leaching or denitrification under conditions of standing water or high rainfall; ammonia sources of nitrogen are rapidly converted into nitrate nitrogen. Since nitrogen in cover crop residue is in the form of protein, it is not subject to loss until it is thoroughly decayed.

Cover crops can also be used to reduce the amount of available nitrogen in the soil and convert it into protein. In areas where nitrate leaching into groundwater is a concern. High nitrogen uptake covers like Cereal Rye, Annual Ryegrass, Triticale, and Sudangrass are very effective at taking up excess nitrate and sequestering it for a long period of time. Brassica crops can take up nitrogen from deep in the soil profile and deposit it into their taproots. Since brassicas decay very rapidly their nitrogen taken in is available rather quickly.

SPECIES	TEMPERATURE
Fracking Radish	20°
Purple Top Turnip	10°
Rapeseed	0°
Winfred	0°
Collard	5°
Hairy Vetch	-20°
Spring Forage Pea	20°
Austrian Winter Pea	10°
Crimson Clover	5°
Red Clover	-10°
Yellow Sweet Clover	-10°

KILLING FREEZE THRESHOLDS FOR BRASSICAS AND LEGUMES

Sometimes it is convenient to use the weather to help us terminate our cover crops. Generally speaking warm season cover crops will die at or around 32° F. However cool season brassicas and legumes can have a wide range of winter kill temperatures. This chart provides a general idea of thresholds some of these species can withstand.

COVER CROP FORAGES

MOST COVER CROPS CAN BE USED FOR GRAZING
AND CAN PROVIDE BOTH HIGH YIELDS AND HIGH QUALITY.

Doesn't grazing reduce the value of cover crops?
Since mulch is a major benefit of cover crops, it is often assumed that grazing will reduce the benefit of cover crops. While true that grazing to the point where the soil is left bare will reduce cover crop benefits, moderate grazing that leaves enough residue to provide full soil coverage can be used to realize immediate cash returns to cover cropping. It is becoming more evident that much of the improved drought tolerance seen following cover crops is due to enhanced microbial activity in the soil, and the deposition of manure pats creates a perfect growing medium for soil microbes. Although only a small percentage of the soil gets covered by manure pats during the grazing of a single cover crop, if cover cropping and grazing are continued over several years then a higher and higher amount of soil gets permanently improved by manure pats.

Doesn't grazing cause compaction?
Many landowners do not want cattle grazing on their land because they are afraid of compaction. The University of Nebraska has conducted over 100 grazing trials on corn stalks to see if grazing stalks has a negative effect on yields of subsequent crops. These trials encompassed both no-till and conventional tillage, both continuous corn and corn-soybean, both fall and spring grazing, and soil types ranging from sandy to heavy clay. In no trial was yield decreased from stalk grazing. The depth of compaction is directly related to the total weight of the compacting agent, in this case a cow. Compaction caused by cattle is relatively shallow and is usually alleviated through natural processes of freezing and thawing, wetting and drying and action of plant roots and soil organism (earthworms, fungi, bacteria, etc.). Compaction caused by vehicles, tractors, combines and grain carts is much deeper and less likely to be removed by natural processes. Since many of the cover crops that can be used for grazing have very aggressive root systems that can break up compaction, having a system of grazed cover crops can actually reduce compaction over time. Additionally, a soil with additional root mass, additional surface residue and additional organic matter is much less subject to compaction than unprotected soil. A cover-cropped, no-till soil usually has a firm sod-like condition that resists compaction. If pugging during extreme mud is a concern, planning for a means by which livestock can be removed during wet conditions to a perennial pasture sod, a rocky area or a fenced off sacrifice area can spare an entire field from pugging that can create planting issues.

Why should I plant cover crops for grazing if I have plenty of grass?
Perennial grass pastures are most productive and nutritious during the first half of the growing season. About 70% of total pasture production of cool-season pastures like brome and fescue is produced in April, May and June, while 70% of native grass production is produced in May, June and July. However, the nutrient demands of a typical spring calving cowherd are increasing as the season progresses at the same time the forage production is decreasing. Cover crops can be selected to provide grazing during times when perennial pastures are not productive or are not nutritious. Additionally, grazing cover crops rather than perennial grasses can allow for rest during critical times of grass growth, like late summer for native grass. This can result in better, deeper root formation and more drought tolerant pastures in future years.

COVER CROP FORAGES

COVER CROPS FOR LATE SUMMER GRAZING:

- Sorghum sudangrass (brown mid-rib varieties most nutritious)
- Pearl millet
- Crabgrass
- Japanese millet
- Teff grass
- Cowpeas
- Forage soybeans
- Annual lespedeza

COVER CROPS FOR FALL GRAZING:

- Oats
- Spring barley
- Winfred hybrid brassica
- Turnips
- Radish
- Spring field peas
- Chickling vetch
- Spring seeded sweetclover
- Winter barley
- Rye
- Winter Triticale
- Wheat (varieties differ greatly)
- Annual ryegrass
- Crimson clover

COVER CROPS FOR WINTER GRAZING:

- Stockpiled male-sterile BMR forage sorghum, or late-planted long maturity BMR forage sorghum
- Fall planted oats
- Fall planted spring barley
- Rye (most active winter growth)

COVER CROPS FOR SPRING GRAZING:

- Fall planted rye (earliest to green up), triticale (best total tonnage for mechanical harvest), winter barley, wheat, ryegrass (last to green up, but best quality and most regrowth)
- Fall planted hairy vetch or crimson clover
- Spring planted oats or spring barley
- Spring planted field peas or chickling vetch

GUIDELINES FOR ROTATIONAL STOCKING OF SELECTED FORAGE CROPS[1]

	BEGIN GRAZING	BEGIN GRAZING[a]	DAYS OF REST
		Target Height (inches)	
Alfalfa (hay types)	10-16	2-4	35-40
Alfalfa (grazing types)	10-16	2-4	15-30
Clover, white[b]	6-8	1-3	7-15
Clovers, all others[b]	8-10	3-5	10-20
Pearl millet	20-24	8-12	10-20
Ryegrass, annual	6-12	3-4	7-15
Small grains	8-12	4	7-15
Sorghum, forage	20-24	8-12	10-20
Sorghum/sudan hybrids	20-24	8-12	10-20

[a]The nutritional requirements of the livestock being grazed should be considered when deciding when to end grazing. The closer a pasture is grazed, the lower forage quality will be toward the end of that particular grazing cycle. Greater residual heights may be desired for animals with higher nutritional requirements (for example, stocker cattle vs. cows and calves).

[b]Clovers are typically grown in pastures in mixtures with grasses. White clover and subterranean clover are quite tolerant of close defoliation; most other clovers are not.

[1]Source: *Rotational Grazing* Publication (ID: 143) from the University of Kentucky Extension Service.

RECOMMENDED STAGES TO HARVEST VARIOUS HAY CROPS[2]

PLANT SPECIES	TIME OF HARVEST
Alfalfa	Bud stage for 1st cutting, 1/10 bloom for 2nd and later cuttings. For spring seedings, allow the 1st cutting to reach mid- to full-bloom.
Orchardgrass, timothy, tall fescue	Boot to early head stage for 1st cut, aftermath cuts at 4 to 6 week intervals.
Red, arrowleaf, crimson clovers	Early bloom.
Oats, barley, wheat	Boot to early head stage.
Soybean	Mid-to-full-bloom and before bottom leaves begin to fall.
Annual lespedeza	Early bloom and before bottom leaves begin to fall.
Ladino clover, white clover	Cut at correct stage for companion grass.
Hybrid bermudagrass	15-18 inch height for 1st cutting; thereafter every 4 to 5 weeks.
Birdsfoot trefoil	Cut at correct stage for companion grass.
Sudangrass, sorghum sudan hybrids, pearl millet	Height of 30-40 inches.
Smooth bromegrass	Boot to mid-bloom.
Big bluestem, indiangrass, switchgrass	Early head stage.

[2]Adapted from: J.D. Burns, J.K. Evans, and G.D. Lacefield, *"Quality Hay Production," Southern Regional Beef Cow Calf Handbook*, SR 5004. (Appendix A.26).

HOW DO I SET MY DRILL FOR THIS COVER CROP BLEND?

› **43,560 ft²/acre**
(wheel circumference ft x drill width ft) = Tire revolutions to cover 1 acre

Example: If you had a 12ft drill with a drive tire that covers 8 ft, your equation would look like this:

› **43,560 ft²/acre** **43,560 ft²**

(8 ft x 12 ft) = 96 ft² = **453.75 tire rotations to reach 1 acre**

To make calibration a little easier you can divide it down into a tenth of an acre, so you do not need to spin your tire as many times. This can be done by dividing your rotations by ten and then your pounds per acre by ten.

Example: If you need to rotate your tire 453.75 times to reach 1 acre, and you are wanting to plant 60 lbs per acre, your 1/10th equations would be as follows.

453.75 rotations **60 lbs/acre**

10 = **45.375 revolutions for .1 acre** 10 = **6.0 lbs/ .1 acre**

After spinning your tire slightly over 45 times the weight of seed collected should be around 6.0 lbs., if it is not, adjust the drill setting and spin the tire again to see how close you are to the desired weight.

Now some of these are just arbitrary numbers, your numbers will most likely be different in some way than what is given in the examples. The only number that stays as a constant is the square feet within an acre, because that number will never change. As long as you follow the same basic steps as shown above you should be able to reach the right calibration.

INTRODUCTION
TO CEREAL CROPS

BARLEY

Barley is normally planted in mid fall and harvested, grazed, or cut for silage the following Spring. Winter barley has a very similar growing season to winter wheat. Barley is an annual, cool season cereal that grows 2–4 ft tall. In early stages before flowering, barley looks like many other small grains. Barley can be identified by examining the leaf collar when it is pulled away from the stem which will have two overlapping appendages that clasp the stem, called auricles.

There are two different groups of barley, the six-rowed and two-rowed types. These are identified by the arrangement of the seeds on the head. Six-rowed barley will have six rows of kernels, three on each side of the stem. Two-rowed barley appears to have only two kernels on each side of the stem.

Using barley in cover crops protects from erosion, especially when grown as a winter annual. Barley roots can reach a depth of 6.5 feet protecting soil from the wind and water erosion at the same time helping to break soil compaction.

Barley is less winter hardy than wheat or rye and should be seeded earlier in the fall. Winter barley is typically planted from August 1 through October 10 at a seeding depth of 1 – 2 inches.

CEREAL RYE

Cereal rye is very winter hardy and grows and tillers rapidly allowing it to be grazed as early as 4 to 6 weeks after planting. Cereal rye can be planted later than most all other cover crops and still provide excellent fall and spring grazing. Rye should be grazed or harvested prior to heading.

Rye's fibrous roots system allows it to scavenge and hold nitrogen well into Spring. The massive root system also makes it an exceptional erosion control plant as a monoculture or within a cover crop blend.

Many studies have shown that the allelopathic benefit for weed suppression in Cereal Rye plantings is exceptional.

WHAT IS **TRITICALE?**

Triticale is a cereal crop developed by human intervention from crosses between wheat (Genus Triticum) and rye (Genus Secale). It has been developed to incorporate the high yield potential and quality of wheat and the adaptability of rye and is adapted to a wide range of soil types and environments. Triticale has an aggressive root system that binds light soils better than wheat, barley and oats. Under ideal conditions researchers have found that triticale can out yield wheat, barley, and oats. Triticale is well established as an ingredient in livestock rations.

SEEDING RATES FOR TRITICALE

RATE	DEPTH
80-120lbs per acre	1/2" - 1"

348 WINTER TRITICALE

KEY ATTRIBUTES

- Awnletted (very short beards)
- Semi-erect fall growth habit
- Good winterhardiness
- High silage yields
- Tolerant of wheat streak mosaic virus
- Proven variety for 12+ years
- Long season maturity for optimized grazing
- Adapted to Large area including Central and Southern Plains

813 WINTER TRITICALE

KEY ATTRIBUTES

- Awnletted (very short beards)
- Semi-erect fall growth habit
- Very good fall seedling vigor
- Good winterhardiness
- Medium maturity
- Good straw strength
- Tolerant of rust
- Tolerant of wheat streak mosaic virus
- High silage yields
- Adapted to the Southern and Central Great Plains

AG-135 WINTER TRITICALE

KEY ATTRIBUTES

- Medium maturity
- Semi-erect fall growth habit
- Vigorous fall growth
- Tolerant of rust and wheat streak mosaic virus
- Tall stature with good straw strength
- Excellent green leaf duration (holds its leaves well into spring)
- Adapted to the southern and central plains
- Very good silage yields

FRIDGE TRITICALE

KEY ATTRIBUTES

- Easy to grow and control
- Excellent for grazing
- High silage value
- Rapid early season growth
- Excellent weed suppression
- Quickly established cover crop
- Outstanding erosion control
- Excellent winter survival
- Excellent control
- Excellent lodging resistance

TRITICALE COMPARISON

	FALL FORAGE YIELD[1]	SILAGE YIELD[2]	SILAGE QUALITY[3]	MATURITY[4]	HEIGHT[5]	LODGING[6]	LEAF RUST	STRIPE RUST
TriCal 131	8	7	7	5	5	2	R	MR
TriCal 813	7	7	7	6	7	2	R	MR
TriCal 348	5	5	4	8	8	8	S	R
TriCal 135	7	8	6	4	7	2	R	R
Fridge	5	7	7	8	7	5	S	–
Slick Trit II	5	6	5	9	7	5	S	–

[1] Dry matter production measured by repeated hand clippings simulating fall and winter grazing.
[2] Yields expressed at 35% dry matter. 1=Poor: 9=Excellent.
[3] Comparative relative feed values.
[4] 1=very early: 9=very late.
[5] 1= short: 9=tall.
[6] 1=no lodging: 9=Prone to lodging
[7] 1=No damage from cold winter temperatures: 9=all leaves burned, seedling plant dead from cold temperatures.

OTHER **CEREALS**

CEREAL RYE

- Very Winter Hardy
- Extensive Soil Holding Root System
- Excellent Weed Suppression
- Vigorous Growth In Spring
- Excellent Cover Crop
- Reduces Eroison
- Fits Many Crop Rotations

JERRY OATS

- Tall & Leafy
- Produces Well In High PH Soils
- Cut Prior to Boot Stage For Optimal Quality
- Very Good Cover Crop
- Mixes Well With Cool Season Peas For Quality Spring Hay

SPRING BARLEY

- Produces High Quality Forage
- Excellent Feed Quality
- Very Vigorous Spring Growth
- Reduces Erosion
- Excellent Weed Suppression
- Available With or Without Beards

GOLIATH OATS

- Premium Forage
- White-Hulled
- Late Maturity
- Tall &Leafy
- Mixes Well With Cool Season Peas For Quality Spring Hay

WINTER BARLEY

- Midseason
- Produces High Quality Forage
- Mediocre Winter Hardiness
- Greenbug Resistant
- Tolerant to BYDD

CONSERVATION

INTRODUCTION TO **CONSERVATION**

CUSTOM MIXES

For nearly 100 years, we have been designing custom mixes here at Star Seed Inc. We understand that a "cookie cutter" mix may not fit with what you have in mind for a desired outcome. Answer some of the simple questions below, then give us a call! We can't wait to discuss your goals for your property.

- Where will this be planted?
- What is the soil type of the area?
- How is the water drainage?
- What is currently established?
- What benefits do you wish to see form the planting?
- What is your budget?
- Do you have USDA program specifications that you need to follow?

CRP SEGMENT

The Conservation Reserve Program (CRP) is a land conservation program administered by the Farm Service Agency (FSA). Farmers who enroll in the program agree to remove land from agricultural production and plant species that will improve environmental health and quality, in exchange for yearly rental payments. CRP contracts are generally 10-15 years in length. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat.

To inquire about the enrollment process, stop by your local USDA Service Center. Once you are enrolled into the CRP program, the NRCS will provide a seeding sheet for your specific site. Give us a call to quote your custom seed mixture once you receive your seeding sheet!

PURE LIVE SEED

Why buy seed on a Pure Live Seed (PLS) basis?
Purchasing seed by the PLS weight ensures that you are only buying seed that is pure, and not paying for seeds that are not viable, weed seeds, stems, and leaves. We test each individual lot of seed on a regular basis. This tells us germination, purity, inert matter, and other crop seeds that we use to calculate the PLS %. The PLS % tells you that out of every bulk pound of seed, only a certain percentage of each pound would be good viable seed. When buying on a BULK basis, you have no way of knowing how much of that seed will actually germinate, or how much of that seed is inert matter and weed seed.

$$\frac{(\%\ \text{Germ} + \%\ \text{Firm Seed}) \times \text{Purity}}{100} = \text{Percent PLS}$$

POLLINATOR SEGMENT

What are pollinators?

- Pollinators include: bees, birds, butterflies and other animals and insects
- Pollinators fertilize plants by moving pollen from one flower to another

Why are pollinators important?

- Pollinator populations are diminishing worldwide
- About 3/4 of our major food crops require pollinators (flowers, fruit, coffee, chocolate, and many more)
- Higher quality crops and increased yields
- Pollinators are key to maintaining habitats and ecosystems that many animals rely on for food and shelter

Tips on establishing a healthy pollinator habitat

- Consider sunlight, soil type, and drainage when selecting which species to grow
- Choose a diverse range of flower colors and bloom periods to attract many different pollinators
- Select high quality seed that is native to your area

WILDLIFE SEGMENT

Tips on establishing a wildlife habitat

- Clear set of objectives & habitat requirements
- Prepare the area
- Go native
- Establish a diverse plant community
- Light disking
- Burn or mow

Cover

- Native grass clumps create ideal nesting habitat, brood, fawning, bedding, escape cover for wildlife
- Many native grasses remain standing throughout winter, unlike non-native grasses, creating crucial thermal protection from brutal winds and snow for all types of wildlife

Food

- Forbs & legumes attract beneficial insects that serve as the primary food source for most upland birds from spring to fall
- Seeds from forbs & legumes are eaten throughout fall and winter months by deer and other wildlife
- Most non-native plants cannot provide the food source that native grasses, forbs, and legumes are able to

HOW TO **PLAN, PREPARE, AND PLANT**

Understanding
Native warm season grasses are slow to establish. It is not uncommon to think that your first year was a failure. It takes longer to establish native warm season grasses than it does to establish cool season grasses. Weed competition the first year after planting is likely, but can be prevented or controlled with proper management.

Site Preparation
Weeds and unwanted grasses need to be killed the year prior to planting. It is very beneficial to remove as much vegetation from the site as possible the fall or spring before the desired planting. Some ways to do this include burning, grazing, haying, or mowing. If there is regrowth before planting, final application of glyphosphate may be required to help eliminate competition.

Seeding Methods
Seeding your site properly could either make or break your planting. Planting too deep results in seeds that are unable to sprout. Ideal planting depth is 1/4 to 1/2 inch. It is important to make sure your drill is properly calibrated before seeding your entire area. A native grass drill is the preferred method of seeding, but a conventional till drill will also work. When using a conventional till drill, it may be a good idea to use a “filler” like rolled milo or rice hulls to help the fluffy seed properly flow into the drill. Another method of seeding is broadcast seeding. This can be done by hand over a large or small area. Before broadcasting your seed, be sure you have a firm, weed free seed bed to ensure good seed to soil contact.

When to Plant
As a general rule of thumb, planting 2 weeks prior to average last frost and at least 6 weeks prior to hot, dry summer weather is recommended. During planting, soil temperature between 55-75 degrees is preferred. Planting too early may not give competing plants enough time to emerge and cannot be effectively killed. Planting too late may result in competition for soil moisture among other plants. Dormant seedings are planted from late fall to late winter. A hard freeze on the seed can help to break any dormancy in seeds.

Seed Quality
Buying seed by the PLS (pure live seed) weight ensures that you are only buying seed that is pure, and not paying for seeds that are not viable, weed seeds, stems, and leaves. Understanding the origin of the seed helps to find species that are well suited for your location. After purchasing your seed, be sure to store your seed in a cool, dry place that is out of sunlight.

Seeding Rates
Seeding rates vary by soil, precipitation, and intended use of the seeding. For help on seeding rates and mixtures, contact us for more information.

STAR SEED MIXES

HONEY BEE MIX

Our **Honey Bee Mix** is packed with 18 different clovers and wildflowers that are loved by honey bees and many other pollinators. The Honey Bee Mix produces brilliant flowers across all bloom periods providing pollen and nectar throughout the growing season. The best time to plant this mix is in early spring at a rate of 6 PLS lbs per acre. The Honey Bee mix contains low maintenance perennials and reseeding annuals:

- Maximilian Sunflower
- Red Clover
- Sainfoin
- White Blossom Sweet Clover
- Hoary Vervain
- Purple Prairie Clover
- Yellow Blossom Sweet Clover
- Wild Bergamot
- Western Yarrow
- Partridge Pea
- Crimson Clover
- Clasping Coneflower
- Lemon Mint
- Indian Blanket
- Alsike Clover
- Blackeyed Susan
- Ladino White Clover
- Lanceleaf Coreopsis

BIG 12 WILDFLOWER MIX

The **Big 12 Wildflower Mix** is comprised of 12 native wildflower species that are both easy to grow and highly showy. Containing long lived perennials and reseeding annuals, this mix will provide many years of beautiful flowers with very little maintenance. This mix contains:

- Maximilian Sunflower
- Blackeyed Susan
- Lanceleaf Coreopsis
- Illinois Bundleflower
- Partridge Pea
- Plains Coreopsis
- Butterfly Milkweed
- Purple Prairie Clover
- Blanketflower
- Purple Coneflower
- Clasping Coneflower
- Upright Prairie Coneflower

KANSAS FOOD PLOT MIX

Our **Kansas Food Plot Mix** is packed with millets and forage and grain sorghums. This high-yielding blend provides quail and pheasants with crucial winter cover and food. 1-25# bag plants 4-5 acres. This blend contains:

- 2 millets
- 7 forage sorghums
- 5 grain sorghums

NATIVE SHORTGRASS MIX

Our **Native Shortgrass Mix** contains a mixture of warm season grasses that will reach heights between 6 inches and 3 feet. This mix is perfect for shortgrass pasture reclamation, soil stabilization, or native landscape in residential areas. Our Native Shortgrass Mix contains:

- Little Bluestem
- Sideoats Grama
- Blue Grama
- Buffalograss

STAR SEED MIXES

NATIVE TALLGRASS MIX

Our **Native Tallgrass Mix** contains a mixture of warm season grasses that will reach heights between 2 and 6 feet. This mix is perfect for tallgrass pasture reclamation, creating wildlife habitat, or a living snow fence. Our Native Tallgrass Mix contains:

- Big Bluestem
- Indiangrass
- Sideoats Grama
- Switchgrass

PRETTY PRAIRIE SHORTGRASS MIX

The **Pretty Prairie Shortgrass Mix** is a combination of our Native Shortgrass Mix and the Big 12 Wildflower Mix. This mix provides the highly showy wildflowers and short grasses that are common in a native shortgrass prairie. Pretty Prairie – Shortgrass Mix contains:

- Little Bluestem
- Sideoats Grama
- Blue Grama
- Buffalograss
- Maximilian Sunflower
- Blackeyed Susan
- Lanceleaf Coreopsis
- Illinois Bundleflower
- Partridge Pea
- Plains Coreopsis
- Butterfly Milkweed
- Purple Prairie Clover
- Blanketflower
- Purple Coneflower
- Clasping Coneflower
- Upright Prairie Coneflower

PRETTY PRAIRIE TALLGRASS MIX

The **Pretty Prairie Tallgrass Mix** is a combination of our Native Tallgrass Mix and the Big 12 Wildflower Mix. This mix provides the highly showy wildflowers and tall grasses that you would typically find in a mixed or tallgrass prairie. Pretty Prairie – Tallgrass Mix contains:

- Big Bluestem
- Indiangrass
- Sideoats Grama
- Switchgrass
- Maximilian Sunflower
- Blackeyed Susan
- Lanceleaf Coreopsis
- Illinois Bundleflower
- Partridge Pea
- Plains Coreopsis
- Butterfly Milkweed
- Purple Prairie Clover
- Blanketflower
- Purple Coneflower
- Clasping Coneflower
- Upright Prairie Coneflower

COOL SEASON PASTURE MIX

The **Cool Season Pasture Mix** provides high quality forage for all classes of livestock. This mix does most of its growing in the cooler temperatures of Spring and Fall. Our budget friendly cool season pasture mix performs exceptionally well under a variety of conditions. This mix contains:

- Smooth Bromegrass
- Timothy
- Orchardgrass
- Annual Ryegrass

STAR SEED MIXES

ASYLUM INSANE DEER BEDDING

Asylum is a blend of carefully selected native grass varieties designed to provide superior bedding and escape cover for whitetail deer. Asylum is a perennial mix, so you plant only one time to provide your deer herd with what it needs to reach its full potential year after year! This mix contains:

- Big Bluestem
- Switchgrass, Cave in Rock
- Indiangrass
- Switchgrass, Kanlow

BARRICADE CONCEALMENT MIX

Barricade is an annual sorghum mix designed to provide concealment of your property, undetected stand entrance, and hidden travel corridors for wildlife. Barricade has the potential to reach 14 feet in height to help you hide what you do not want seen. This unique mixture is designed to withstand winters harsh abuse and continue to provide concealment through hunting season. Barricade will produce grain that deer and other wildlife will find attractive. If you do not want to attract deer to the planting, such as along a road, you can delay your planting so the plants freeze out before producing grain. Not allowing the plants to produce seed will also aide in managing volunteer plants the following year.

FALL DEER FOOD PLOT MIX

Our **Fall Deer Food Plot Mix** provides the perfect blend of oats, Austrian peas, 4010 peas, turnips, and radishes to keep your deer returning day after day throughout fall and winter months.

SPORTSMAN'S SUNFLOWERS

Sunflowers are crowd favorite among sportsman and wildlife lovers alike. Dove and game birds will favor our high energy, high oil, sunflower blend. 1-25# Bag will plant 4-5 acres.

STAR SEED MIXES

GRASSES

SCIENTIFIC NAME	COMMON NAME	ANNUAL/PERENNIAL	WARM/COOL SEASON	FULL SEEDING RATE	HEIGHT
Andropogon gerardii	Big Bluestem	P	W	6	6-8 ft
Bouteloua gracilis	Blue Grama	P	W	2	10-20 in
Bromus biebersteinii	Bromegrass, Meadow	P	C	10	2-4 ft
Bromus inermis	Bromegrass, Smooth	P	C	15	2-4 ft
Bouteloua dactyloides	Buffalograss	P	W	5	6-8 in
Calamagrostis canadensis	Bluejoint	P	C	1	2-6 ft
Sporobolus heterolepis	Dropseed, Prairie	P	W	6	1-3 ft
Sporobolus compositus	Dropseed, Rough	P	W	3	2-4 ft
Sporobolus cryptandrus	Dropseed, Sand	P	W	1	1-3.5 ft
Tripsacum dactyloides	Eastern Gamma	P	W	8	8 ft
Glyceria striata	Fowl Mannagrass	P	C	10	7-11 in
Carex vulpinoidea	Fox Sedge	P	C	1	1-3 ft
Alopecurus arundinaceus	Garrison Creeping Foxtail	P	C	2	3-6 ft
Sorghastrum nutans	Indiangrass	P	W	6	3-7 ft
Schizachyrium scoparium	Little Bluestem	P	W	4	1.5-3 ft
Dactylis glomerata	Orchardgrass	P	C	4	15-18 in
Spartina pectinata	Prairie Cordgrass	P	W	6	6-8 ft
Koeleria macrantha	Prairie Junegrass	P	C	2	1/2-2 ft
Calamovilfa longifolia	Prairie Sandreed	P	W	4	3-5 ft
Phalaris arundinacea	Reed Canarygrass	P	C	7	6-8 ft
Lolium multiflorum	Rye Grass, Annual	A	C	25	2-3 ft
Lolium perenne	Rye Grass, Perennial	P	C	25	1-2 ft
Andropogon hallii	Sand Bluestem	P	W	6	2-6 ft
Eragrostis trichodes	Sand Lovegrass	P	W	2	2-5 ft
Bouteloua curtipendula	Sideoats Grama	P	W	6	1-3 ft
Panicum virgatum	Switchgrass	P	W	3	3-5 ft
Phleum pratense	Timothy	P	C	10	1.5-3.5 ft
Eragrostis curvula	Weeping Lovegrass	P	W	5	2.5-3.5 ft
Agropyron cristatum	Wheatgrass, Crested	P	C	7	1-3 ft
Agropyron intermedium	Wheatgrass, Intermediate	P	C	12	3-4 ft
Agropyron trichophorum	Wheatgrass, Pubescent	P	C	10	3-4 ft
Elymus trachycaulus	Wheatgrass, Slender	P	C	6	2-2.5 ft
Thinopyrum ponticum	Wheatgrass, Tall	P	C	12	3-10 ft
Elymus lanceolatus	Wheatgrass, Thickspike	P	C	6	1-3 ft
Pascopyrum smithii	Wheatgrass, Western	P	C	10	1-3 ft
Leymus cinereus	Wildrye, Basin	P	C	8	3-6 ft
Elymus canadensis	Wildrye, Canada	P	C	8	2.5-5 ft
Elymus virginicus	Wildrye, Virginia	P	C	6	2-3 ft
Elymus riparius	Wilerye, Riverbank	P	C	10	3-6 ft

WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME	BLOOM PERIOD	PERENNIAL/ ANNUAL/BIENNIAL	FLOWER COLOR	HEIGHT
Heuchera richardsonii	Alumroot	E	P		1-3 ft
Teucrium canadense	American Germander	E-M	P		3 ft
Rosa arkansana	Arkansas Rose	M	P		.5-3 ft
Symphyotrichum oblongifolium	Aster, Aromatic	L	P		1-3 ft
Boltonia asteroides	Aster, False	M-L	P		3-5 ft
Doellingeria umbellata	Aster, Flat Top	M-L	P		3-5 ft
Heterotheca villosa	Aster, Hairy	E-M-L	P		3 ft
Aster ericoides	Aster, Heath	L	P		1-3 ft
Aster novae-angliae	Aster, New England	L	P		3-6 ft
Aster tanacetifolia	Aster, Prairie	E-M-L	P		3 ft
Aster sericeus	Aster, Silky	L	P		1 ft
Aster azureus	Aster, Sky Blue	L	P		2-3 ft
Aster laevis	Aster, Smooth Blue	L	P		2-3 ft
Aster puniceus	Aster, Swamp	L	P		3-6 ft
Aster ptarmicoides	Aster, Upland White	M-L	P		1-2 ft
Bidens aristosa	Beggars Tick, Bearded	M-L	A		1-5 ft
Bidens frondosa	Beggars Tick, Common	L	A		1-3 ft
Lotus corniculatus	Birdsfoot Trefoil	M	P		2-3 ft
Rudbeckia hirta	Blackeyed Susan	M-L	A/B		1-2 ft
Rudbeckia subtomentosa	Blackeyed Susan, Sweet	M-L	P		3-5 ft
Gaillardia aristata	Blanketflower	M	P		1-2 ft
Liatris punctata	Blazingstar, Dotted	L	P		1-2.5 ft
Liatris spicata	Blazingstar, Marsh	L	P		3-4 ft
Liatris pycnostachya	Blazingstar, Prairie	M	P		2-5 ft
Liatris aspera	Blazingstar, Rough	L	P		2-5 ft
Liatris squarrosa	Blazingstar, Scaly	M-L	P		1-3 ft
Iris virginica	Blue Flag Iris	E	P		1-3 ft
Agastache foeniculum	Blue Giant Hyssop	M	P		2-4 ft
Eupatorium perfoliatum	Boneset	M-L	P		3-6 ft
Brickellia eupatorioides	Boneset, False	L	P		1-3 ft
Eupatorium altissimum	Boneset, Tall	M-L	P		3-6 ft
Rudbeckia triloba	Brown-eyed Susan	M-L	P		2-5 ft
Lobelia cardinalis	Cardinal Flower	M-L	P		3-6 ft
Silene armeria	Catchfly	M	P		1-1.5 ft
Silene antirrhina	Catchfly, Sleepy	E-M	A		.5-1.5 ft
Nepeta cataria	Catnip	M-L	P		1-4 ft

WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME	BLOOM PERIOD	PERENNIAL/ ANNUAL/BIENNIAL	FLOWER COLOR	HEIGHT
Silphium laciniatum	Compass Plant	M	P		3-10 ft
Echinacea angustifolia	Coneflower, Black Sampson	M	P		1.5-2 ft
Rudbeckia amplexicaulis	Coneflower, Clasping	E-M	A		2-3 ft
Rudbeckia laciniata	Coneflower, Cutleaf	M-L	P		3-6 ft
Ratibida pinnata	Coneflower, Greyhead	E-M-L	P		3-6 ft
Echinacea pallida	Coneflower, Pale Purple	M	P		2-4 ft
Echinacea purpurea	Coneflower, Purple	E-M-L	P		1-3 ft
Ratibida columnifera	Coneflower, Upright	E-M-L	P		1-3 ft
Coreopsis lanceolata	Coreopsis, Lanceleaf	E-M	P		.5-2 ft
Coreopsis tinctoria	Coreopsis, Plains	E-M	A		1-3 ft
Coreopsis palmata	Coreopsis, Prairie	M	P		1-3 ft
Coreopsis tinctoria	Coreopsis, Red Dwarf	E-M	A		1-3 ft
Coreopsis tripteris	Coreopsis, Tall	M	P		3-6 ft
Papaver rhoeas	Corn Poppy, Red	M	A		1-2 ft
Centaurea cyanus	Cornflower	M	A		1-3 ft
Gentiana flavida	Cream Gentian	M-L	P		1-3 ft
Veronicastrum virginicum	Culver's Root	M-L	P		3-6 ft
Silphium perfoliatum	Cup Plant	M-L	P		3-6 ft
Grindelia squarrosa	Curly Cup Gumweed	M-L	A/B		1-3 ft
Englemannia peristenia	Daisy, Engleman	E-M	P		.5-2 ft
Leucanthemum ×superbum	Daisy, Shasta	M	P		3-4 ft
Monarda punctata	Dotted Mint	E-M	A		1-3 ft
Froelichia floridana	Field Snake Cotton	M	A		3-6 ft
Linum lewisii	Flax, Blue	E-M	P		1-2 ft
Linum grandiflorum	Flax, Scarlet	M	A		1-3 ft
Penstemon digitalis	Foxglove Beardtongue	M	P		1-3 ft
Zizia aurea	Golden Alexander's	E-M	P		1-3 ft
Solidago canadensis	Goldenrod, Canada	L	P		3-6 ft
Solidago ulmifolia	Goldenrod, Elm-Leaf	L	P		3-6 ft
Solidago gigantea	Goldenrod, Giant	L	P		3-6 ft
Solidago graminifolia	Goldenrod, Grass-Leaved	L	P		2-4 ft
Solidago nemoralis	Goldenrod, Gray	M-L	P		1-2 ft
Solidago missouriensis	Goldenrod, Missouri	M	P		1-3 ft
Solidago riddellii	Goldenrod, Riddell's	L	P		2-3 ft
Solidago speciosa	Goldenrod, Showy	M	P		3-6 ft
Solidago rigidium	Goldenrod, Stiff	L	P		3-5 ft
Angelica atropurpurea	Great Angelica	M	P		6-12 ft
Lobelia siphilitica	Great Blue Lobelia	M-L	P		1-3 ft
Hypericum pyramidatum	Great St. John's Wort	M	P		2-5 ft
Desmanthus illinoensis	Illinois Bundleflower	E-M-L	P		1-3 ft
Gaillardia pulchella	Indian Blanket	M	A		1-2 ft
Baptisia australis	Indigo, Blue False	E-M	P		3-5 ft

WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME	BLOOM PERIOD	PERENNIAL/ ANNUAL/BIENNIAL	FLOWER COLOR	HEIGHT
Baptisia bracteata	Indigo, Cream False	E-M	P		1-3 ft
Batisia alba	Indigo, White Wild	E-M	P		2-4 ft
Vernonia fasciculata	Ironweed	M	P		2-4 ft
Vernonia baldwinii	Ironweed, Baldwin's	M-L	P		3-6 ft
Helianthus tuberosus	Jerusalem Artichoke	M-L	P		3-6 ft
Eupatorium fistulosum	Joe-Pye Weed	M-L	P		2-7 ft
Eupatorium maculatum	Joe-Pye Weed, Spotted	M-L	P		3-6 ft
Eupatorium pupureum	Joe-Pye Weed, Sweet	M	P		3-6 ft
Delphinium virescens	Larkspur, Prairie	E-M	P		3-6 ft
Consolida ajacis	Larkspur, Rocket	M	A		2-4 ft
Amorpha canescens	Lead Plant	M	P		3-6 ft
Monarda citriodora	Lemon Mint	M	A		1-3 ft
Lespedeza capitata	Lespedeza, Roundhead	M	P		3-6 ft
Lespedeza virginica	Lespedeza, Slender	M	P		3-6 ft
Lupinus perennis	Lupine, Perennial	E-M	P		1-3 ft
Bidens cernua	Marigold, Nodding Bur	L	A		1-3 ft
Bidens coronata	Marigold, Tall Swamp	L	A		1-2 ft
Senna marilandica	Maryland Senna	M	P		3-6 ft
Ratibida peduncularis	Mexican Hat	E-M-L	P		2-3 ft
Astragalus canadensis	Milkvetch, Canada	M	P		1-3 ft
Astragalus cicer	Milkvetch, Cicer	M	P		1-3 ft
Asclepias tuberosa	Milkweed, Butterfly	E-M-L	P		1-3 ft
Asclepias syriaca	Milkweed, Common	M	P		3-6 ft
Asclepias arenaria	Milkweed, Sand	M-L	P		2-4 ft
Asclepias speciosa	Milkweed, Showy	E-M-L	P		1-3 ft
Asclepias sullivantii	Milkweed, Smooth	M	P		1-3 ft
Asclepias incarnata	Milkweed, Swamp	M-L	P		3-6 ft
Asclepias verticillata	Milkweed, Whorled	M	P		1-3 ft
Mimulus ringens	Monkeyflower	M	P		1-3 ft
Pycnanthemum tenuifolium	Mountain Mint, Slender	M	P		1-3 ft
Pycnanthemum virginianum	Mountain Mint, Virginia	M	P		1-3 ft
Ceanothus americanus	New Jersey Tea	E	P		1-3 ft
Allium cernuum	Nodding Pink Onion	M	P		1-3 ft
Physostegia virginiana	Obedient Plant	L	P		3-6 ft
Chamaecrista fasciculata	Partridge Pea	M-L	A		.5-1 ft
Phlox drummondii	Phlox	E-M	A		.5-1 ft
Callirhoe alcaeoides	Pink Poppy Mallow	E	P		1-3 ft
Salvia azurea	Pitcher Sage	L	P		3-6 ft
Monarda pectinata	Plains Bee Balm	M	A		1-3 ft
Potentilla arguta	Prairie Cinquefoil	M	P		1-3 ft
Dalea purpurea	Prairie Clover, Purple	M	P		1-3 ft
Dalea villosa	Prairie Clover, Silky	M	P		..5-2 ft

WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME	BLOOM PERIOD	PERENNIAL/ ANNUAL/BIENNIAL	FLOWER COLOR	HEIGHT
Dalea candida	Prairie Clover, White	M	P		1-2 ft
Silphium terebinthinaceum	Prairie Dock	M-L	P		1-3 ft
Eustoma grandiflorum	Prairie Gentian	M-L	P		.5-1 ft
Phlox pilosa	Prairie Phlox	E	P		1-3 ft
Packera plattensis	Prairie Ragwort	E-M	B		1-3 ft
Oenothera biennis	Primrose, Common Evening	M	B		3-6 ft
Oenothera rhombipetala	Primrose, Four-Point	E-M	A		1-3 ft
Oenothera missouriensis	Primrose, Missouri	M	P		.5-1 ft
Thalictrum dasycarpum	Purple Meadow Rue	E-M	P		3-6 ft
Callirhoe involucrata	Purple Poppymallow	E-M	P		0-1 ft
Eryngium yuccifolium	Rattlesnake Master	M	P		4-6 ft
Thelesperma megapotamicum	Rayless Greenthread	E-M-L	P		1-3 ft
Cleome serrulata	Rocky Mountain Bee Plant	M	A		3-6 ft
Silphium integrifolium	Rosinweed	M	P		3-6 ft
Agalinis aspera	Rough Purple Gerardia	L	A		.5-2 ft
Salvia coccinea	Sage, Scarlet	E-M-L	P		1-3 ft
Artemisia ludoviciana	Sagewort, Cudweed	M-L	P		1-3 ft
Artemisia frigida	Sagewort, Fringed	M	P		1-3 ft
Sphaeralcea coccinea	Scarlet Globemallow	E-M-L	B		3-6 ft
Ludwigia alternifolia	Seedbox	M-L	P		2-3 ft
Mimosa quadrivalvis	Sensitive Briar	E-M-L	P		0-3 ft
Penstemon grandiflorus	Shell-Leaf Penstemon	M	P		1-3 ft
Penstemon gracilis	Slender Beardtongue	M	P		1-3 ft
Sanguisorba minor	Small Burnett	M	P		.75-2 ft
Polygonum pensylvanicum	Smartweed, Pennsylvania	E	A		1-4 ft
Helenium autumnale	Sneezeweed	M-L	P		2-5 ft
Tradescantia ohiensis	Spiderwort, Ohio	E-M	P		1-3 ft
Tradescantia occidentalis	Spiderwort, Prairie	M	P		0-1 ft
Cosmos sulphureus	Sulphur Cosmos	M	A		2-6 ft
Helianthus annuus	Sunflower, Annual	M-L	A		3-6 ft
Helianthus mollis	Sunflower, Ashy	M-L	P		2-6 ft
Heliopsis helianthoides	Sunflower, False (OX-EYE)	M-L	P		3-6 ft
Helianthus maximiliani	Sunflower, Maximilian	M-L	P		3-6 ft
Helianthus angustifolius	Sunflower, Narrow-Leaf	L	P		1-3 ft
Helianthus petiolaris	Sunflower, Plains	M-L	A		1-3 ft
Helianthus grosseserratus	Sunflower, Sawtooth	M-L	P		3-5 ft
Helianthus laetiflorus	Sunflower, Showy	M-L	P		3-6 ft
Helianthus pauciflorus	Sunflower, Stiff	M	P		2-4 ft
Helianthus occidentalis	Sunflower, Western	M-L	P		2-4 ft
Helianthus salicifolius	Sunflower, Willowleaf	L	P		8-10 ft
Anemone cylindrica	Thimble Weed (Candle Anemone)	M	P		.75-1.5 ft
Desmodium illinoense	Tick Trefoil, Illinois	M-L	P		3-6 ft

WILDFLOWERS

SCIENTIFIC NAME	COMMON NAME	BLOOM PERIOD	PERENNIAL/ ANNUAL/BIENNIAL	FLOWER COLOR	HEIGHT
Desmodium canadense	Tick Trefoil, Showy	M-L	P		3-6 ft
Verbena hastata	Vervain, Blue	M-L	B		3-6 ft
Verbena stricta	Vervain, Hoary	E-M-L	P		2-4 ft
Vicia americana	Vetch, American	E-M	P		.5-1.5 ft
Monarda fistulosa	Wild Bergamot	E-M-L	P		2-5 ft
Parthenium integrifolium	Wild Quinine	E-M	P		2-4 ft
Rosa woodsii	Wild Rose, Western (Woods Rose)	M	P		3-6 ft
Senna hebecarpa	Wild Senna	M	P		4-6 ft
Krascheninnikovia lanata	Winterfat	E-M	P		1-3 ft
Achillea millefolium occ.	Yarrow, Western	E	P		1-3 ft
Achillea millefolium	Yarrow, White	E-M-L	P		1-3 ft

STAR SEED CLOVERS

ALSIKE CLOVER

Trifolium hybridum L.

Alsike clover is used for hay, pasture, and soil health, and works best in wet and acidic soils. It does not yield as well as other clover species. Alsike clover is not normally grown as a pure stand but rather in grass or cover crop mixes and serves best as a one cut forage.

Alsike clover is a short-lived perennial similar to red clover. It can be distinguished from red clover by the absence of crescent-shaped marks on each leaflet and more conspicuously toothed leaves. Alsike clover grows from the crown and the plant can reach a height of 2-4 feet with a tendency to lodge.

Alsike clover is adapted to a wide range of soil types and grows well in northern latitudes and at high elevations. It survives severe winters and performs best where summers are cool. It grows well in soils that are too acidic for red clover (pH < 6.0) and can tolerate more alkalinity than most clovers. It will tolerate wetter soils better than other clovers. It prefers silty clay loams where moisture is sufficient throughout the growing season or can be supplied by irrigation. Alsike clover does not tolerate droughty sites but will tolerate soils that are completely waterlogged and can withstand some flooding, however is not shade tolerant.

ARROWLEAF CLOVER

Trifolium vesiculosum Savi

Arrowleaf clover is utilized for haying, grazing, and soil improvement and a great wildlife attractant for deer and turkey. Arrowleaf clover is an upright, cool-season, annual legume that grows to a height of 40 to 50 inches under good conditions. Seeds germinate in the fall and grow slowly during the winter. Blossoms are a cluster up to 2 inches long. Initially, the blossoms begin white to pinkish in color and later turn brown when mature. The plant is suited to a wide range of soil conditions from slightly acidic to slightly alkaline.

Seed should be planted at 1/4 to 1/2 inch deep or may also be planted in an established summer perennial grass sod by light disking or with a no-till drill. Interseeding into a grass sod should be done around the first frost date at a rate of 10 lbs of seed per/acre.

STAR SEED CLOVERS

BERSEEM CLOVER / EGYPTIAN CLOVER
Trifolium alexandrinum

Berseem Clover, also known as Egyptian clover, is a winter annual legume. It resembles alfalfa but produces small seed heads with white flowers.

It is a heavy nitrogen producer but is the least winter-hardy of all annual clovers. Berseem clover will provide the highest yields when planted in fertile, well-drained soil. It will grow on a wide range of soils, from loam to clay, but does not do well in very wet soils. Lighter loamy and silty soils produce excellent crops and the plant is tolerant of relatively high salt concentrations.

CRIMSON CLOVER
Trifolium incarnatum L.

Crimson clover, as a winter annual, planted in the late summer to early fall. It is often used in pasture, hay, pollinator enhancement, and cover cropping for soil health.

Crimson clover is a winter annual legume that resembles red clover. The plant will grow on soils of poorer quality than most other clovers, thriving on both well drained sandy and clay soils and prefers a pH range of 6.0 to 7.0. After seedling establishment, growth at lower temperatures is superior to other clovers and has been used for a cover cropping well into the northern states.

Crimson clover seed should be inoculated before planting. On sites that have been in pasture or hay, inoculating may not be necessary. Nitrogen should not be necessary unless planting sites are of poor quality. Plant in the spring, late summer, or frost seed in late winter. The best planting method is to drill the seed into a firm, weed free seedbed. No-tilling can be used successfully if effective weed control is employed. Seed should be planted at about 1/4 inch depth with seeding rates from 10 to 15 pounds per acre when seeded alone and 5 to 10 pounds per acre when seeded in a mixture.

WHITE CLOVER
Trifolium repens L. (Ladino vs Dutch)

White clover is an important pasture legume. It is highly palatable and nutritious for all classes of livestock. White clover is commonly companion planted with a variety of pasture grasses. Grass benefits from the nitrogen produced by white clover when included in a pasture mix. The plant seldom grows tall enough to be a high tonnage hay or silage producer.

White clover is seeded at 2 pounds per acre with grass and establishes best on moist soils. White Clover has other common advantages such as being a choice food for deer and other wildlife. Solid stands of white clover form a good erosion controlling cover on moist fertile soils, but may not establish well in dry areas. White clover seldom roots deeper than 2 feet, which makes it adapted to shallow soils when adequate moisture is available. It should produce Pink flower heads consisting of 40 to 100 florets on a plant.

The standard seeding rate is two pounds per acre of seed and should be inoculated before seeding. The proper time of seeding is determined by seasonal and moisture conditions. This may vary from April to May. Late summer and fall seedings should be done well before freezing and planted into soils with adequate moisture.

RED CLOVER
Trifolium pratenese L.

Red clover is primarily used for hay, pasture, silage, and soil improvement. It is a quick growing crop, easily established, and produces high quality forage. Red clover is very shade tolerant making it a good companion cover crop under crops such as corn.

Red clover is a biennial or short-lived perennial that grows from crowns. There are generally two types of red clover, Medium, and Mammoth. Stem lengths of Medium types average 18 inches and have about 4 branches per stem. Medium will mature earlier than Mammoth, making it possible for multiple harvesting operations. Mammoth stems grow to 24 to 30 inches long, has 6 branches and a longer maturity, making it a one harvest crop. The taproot of red clover is extensively branched, and the flowers are pink in color.

Red clover seed should be inoculated prior to seeding. It can be planted with a drill at a depth of 1/4 to 1/2 inch or broadcast. Red clover may be seeded in pure stands, but it is often mixed with grain or grass. Seeding rate is 8 to 12 lbs per acre in a pure stand or 4 to 8 lbs in a mix. Establishment may occur in spring or late summer or over seeded in the spring on fall seeded grasses.

Graze or cut for hay when the red clover is 1/4 to 1/2 in bloom. A second cutting may occur when red clover is 1/4 in bloom. Leave at least 2 inches of growth after each harvest..

YELLOW BLOSSOM CLOVER
Melilotus officinalis L.

WHITE BLOSSOM SWEETCLOVER
Melilotus alba Medik

Sweetclover is an introduced species to North America from Europe in the 1700's and is now widespread throughout North America in multiple wildlife habitats and uses. Yellow and white sweetclover are separated by scientists because of flower color and by flower size, white clover having a somewhat smaller flower. Yellow sweetclover is shorter growing, finer stemmed, more drought tolerant and easier to establish than white sweetclover.

Both sweetclovers are used for hay, silage and pasture however, Cattle graze it sparingly as it can have a bitter taste. It is preferred by livestock in spring and early summer before stems become course and woody. Hay should be cut at 10% bloom stage, waiting until full flowering results in stemmy, lower-quality hay.

Sweetclover provides exceptional habitat to a variety of wildlife species. Deer, turkeys, and upland birds utilize sweetclover as a vital part if their diet. The abundant flowers are attractive to bees and butterflies making sweetclover a popular plant in pollinator mixes nation-wide.

Rapid growth and ease of establishment make sweetclover a popular choice for reclamation seedings. Roadside seedings, mining, and fire restoration are just a few of the areas which sweetclovers have become an important part. The plants increase nitrogen in poor soils and a large taproot decreases soil compaction and aides in aeration and water absorption by opening the soil.

Prior to planting seed should be inoculated with the proper inoculant for nitrogen fixation. If starting a monoculture stand, sweetclover should be planted at a rate of 4 lb/ac. When sweetclover is used in a mix it should not exceed 10% of the total mix due to its competitive growing pattern. Rangeland seedings can be done in late fall but no later than 6 weeks prior to a first frost. This will allow for natural stratification of the seed, helping with germination. Seed should be planted in a firm, seedbed at a depth of 1/8 to 1/2 inch.

LAWN AND TURF GRASSES

WARM-SEASON LAWN GRASSES

Warm-season species, such as bermuda and buffalograss, tend to be more drought tolerant and therefore require less maintenance than cool-season species, such as fescue or bluegrass. While buffalograss requires less fertilizer and mowing, buffalograss and bermudagrass tend to be more resistant to high traffic and weed pressure. Both buffalo and bermuda have earned a reputation as having a much lower water requirement than their popular cool-season alternatives.

Bermuda or buffalo should be seeded at a minimum of 2 lbs. per 1,000 ft^2 of lawn area in late spring or summer, depending on availability of irrigation. If irrigation is available, waiting until mid-summer can help avoid competition from spring weeds. If unable to water or irrigate, seed into a clean seedbed in early spring to ensure moisture availability from spring rains.

COOL-SEASON LAWN GRASSES

Cool-season species, such as fescue and bluegrass, can make a dense, beautiful, deep green lawn. In general, these species do require more watering, mowing, and fertilizer, than buffalo and bermudagrass. Fescue is a popular choice in the Midwest, due to its versatile ability to grow in a variety of light conditions, in both sunny and shaded areas.

Fescue should be seeded at a minimum of 8 lbs. per 1,000 ft^2 of lawn area to be seeded in mid to late spring or early fall.

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