



Green Lands
Blue Waters



grassLAND 2.0

Establishing and managing warm-season pastures

September 2020

Why warm-season pastures?

Much of the Mississippi River basin in what is now called the Corn Belt was originally blanketed by tallgrass prairie. These deep-rooted, warm-season perennials once covered over 240 million acres, providing habitat for a wide array of grassland wildlife species and pollinators and over many centuries, building the rich, deep soils that are now considered America's most productive farmland. Today, more than 95% of that land has been converted to annual crop production and the loss of that perennial cover and grassland habitat have wide-ranging detrimental consequences to human and ecosystem health.

Native warm-season grass (NWSG) pastures provide opportunities to build resilience and ecosystem benefits back into livestock agriculture. Today, most pastures consist of introduced cool-season species such as meadow fescue, orchard grass and smooth brome. Cool-season grasses provide good yields of high-quality forage under cool, moist conditions, but often undergo a 'summer slump' during the hottest months of the growing season. Native warm season grasses do most of their growing during the hottest months of the year. In June, July, and August, they yield as much or more than a cool-season pasture for the entire growing season. This is in part because warm-season grasses use a different photosynthetic pathway that is more efficient than cool-season grasses when moisture and/or nutrients are in short supply. At 86°F, cool-season grasses lose three times as much water per CO₂ molecule fixed as NWSG.

Warm-season plants represent about 5% of the earth's plant biomass, but account for about 30% of terrestrial carbon fixation. Well-managed NWSG pastures are a good solution for climate adaptation for livestock producers and rival trees in their carbon sequestration potential.

Prairie root system

Photo source: Lime Creek Nature Center, Mason City, IA, photograph of display



NWSG pastures can complement cool-season pastures by producing well during the summer slump. Because of their deep root system, they can scavenge water and nutrients more effectively than cool-season grasses and contribute more organic matter to the soil profile. This has multiplying positive effects on water retention, erosion, and a pasture's ability to handle severe weather. A sequential grazing system with both warm- and cool-season pastures can help extend the grazing season and increase long-term resilience of our grazing systems.

With all of these benefits, why aren't NWSG more widely used in pasture systems in the region? The challenges to adoption include high seed costs, slow establishment (typically one to three years), and lack of information about managing them in grazing systems, especially in northern regions. Forage quality also tends to be lower than cool-season pastures, but when managed well is appropriate for beef cattle and non-lactating dairy cattle.

Well-established and managed NWSG pastures can be productive for decades with minimal inputs. This fact sheet provides practical management guidelines for managing NWSG pastures for livestock farmers who wish to incorporate them into their grazing systems.

Planning, patience, and attention to detail bring success

For many farmers, establishing NWSG is likely to present new challenges. Establishment is difficult due to small, bearded seeds that require a special drill for planting. Their slow germination and slow seedling growth make them susceptible to weed competition and drought conditions in the first years. Expect a full year or two of establishment before you can graze or harvest for hay. Once established and managed properly, NWSG will last for decades with few purchased inputs. Their deep root systems provide significant drought tolerance and add organic matter to the soil.

Site and seed selection:

Tallgrass prairie once covered the Upper Mississippi River basin on a continuum from very dry, sandy soils to wetlands. Species mixes can be developed that are well-suited to almost any site in the region (Table 1). The common species of tallgrass prairie are Big bluestem, Indiangrass, Switchgrass, and Little bluestem. These species perform well under managed grazing and seed is widely available. Eastern gamagrass may be a good choice for wetter sites. Junegrass and side-oats grama are other potential species you can include in the mix. Some native seed companies offer pre-made mixes for different soil types and locations. Do not mix native warm-season species with non-native cool-season species. Cool-season grasses are very competitive and will reduce the chances of establishing a strong stand of native grasses.

Remember: Sleep, Creep, Leap

NWSG use their energy in establishment years building deep, fibrous root systems. The old saying about NWSG is: the first year they SLEEP; the second year they CREEP; and the third year they LEAP!

Prepare the soil:

Because you are establishing a stand of long-lived perennials, the best opportunity to correct fertility deficiencies is prior to planting. Test your soil and make sure pH, phosphorus, potassium, and micronutrient levels are adequate. Optimal phosphorus levels are 15 to 30 ppm depending on soil type. Potassium levels should be in the 100 to 130 ppm range. Lime should be added when pH tests below 5.5. If you plan to plant legumes in the stand, pH should be 6.5 to 7.

Control weeds prior to planting:

Because of their slow establishment, NWSG are highly vulnerable to weed competition. Stand failure is a possibility if weeds are not controlled. Check with your Extension service or the seed company for suggestions on weed control options. A clean seedbed, as free as possible from both annual and perennial weeds, is one of the best investments you can make toward a successful stand.

Table 1. Native grass characteristics					
	Switchgrass	Big bluestem	Little bluestem	Indiangrass	Eastern gamagrass
Yield	Very high	High	Moderate	High	Very high
Wet Site Tolerance	High	Moderate	Low	Moderate - Low	High
Dry Site Tolerance	Moderate	Moderate	High	Moderate - High	Low
Maturity	Early	Middle	Late	Late	Earliest
Palatability	Moderate	Highest	Moderate	High	High

Planting:

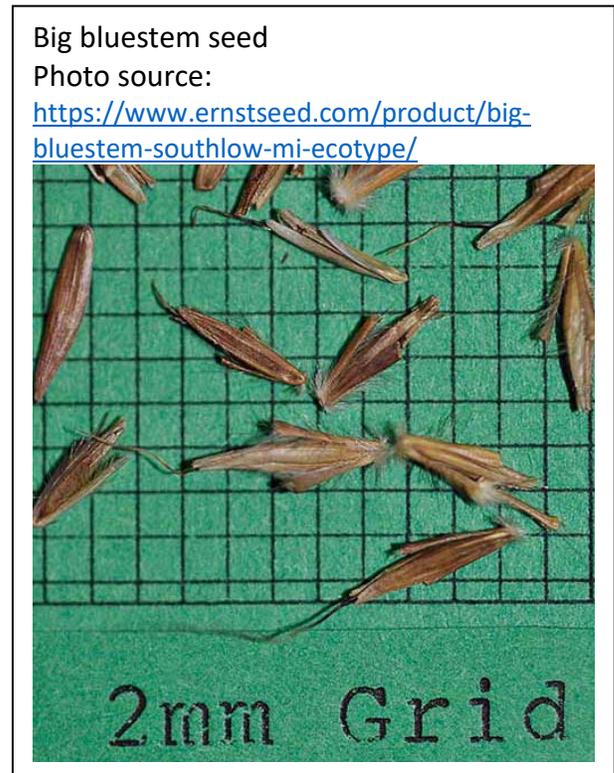
A firm seedbed and shallow seeding depth are key to establishment of NWSG. This can be achieved with either no-till or conventional tillage. With no-till establishment, herbicides are used to decrease the competition from weeds prior to planting. With conventional establishment, weed competition can be reduced prior to planting through one or more passes of tillage equipment, with or without herbicides.

Use a native grass drill:

Big bluestem, Little bluestem, and Indiangrass have long-awned, ‘bearded’ seed. Some vendors of commercial varieties of native seeds clean their seed and remove most of these awns. This is less common among companies that produce ‘local ecotype’ seed. The cleaned seed passes easily through standard grass seed boxes on most drills. If you purchase seed that is not cleaned, it will be necessary to use a drill equipped with a specialized “native grass box” that is constructed to distribute the ‘fuzzy’ seed uniformly. Truax and Great Plains are two brands of native seed drills. Such drills may be available for rent from state or local natural resources agencies or wildlife organizations such as Pheasants Forever. Switchgrass and Eastern gamagrass do not have bearded seed. Switchgrass has a very small, smooth seed that is best planted using the legume box on a standard drill. Eastern gamagrass has a large, smooth seed that can be planted with a corn planter.

Seeding depth and seedbed preparation:

Besides weed pressure, planting too deep is probably responsible for more failed NWSG plantings than any other factor. A clean, firm seedbed is required, similar to what is required for alfalfa establishment. Seed should be planted at 1/4 inch for silty, loamy, or clayey soils, or 1/2 inch for sandy soils. Broadcast seedings, followed by a cultipacker, can also be successful.



Species	Pure stand		Seeding mixes				
	Drilled	Broad-cast	2-species mix #1	2-species mix #2	2-species mix #3	3-species mix #1	3-species mix #2
	<i>Pounds per acre</i>						
Big bluestem	11	15	8	10	-	8	8
Little bluestem	10	14	-	1.5	1.5	1.5	-
Indiangrass	10	14	4.5	-	9	4.5	4.5
Switchgrass	7	10	-	-	-	-	2.5
Eastern gamagrass	12	nr*	nr	nr	nr	nr	nr

*nr = not recommended

Seeding rates:

Recommended seeding rates are listed in Table 2 below. Use the drilled column for a single species seeding using a seed drill. If you are broadcasting on the surface, a slightly higher seeding rate is recommended (“Broadcast” column). If you are planning a blend of species, you can either purchase a seeding mix or create your own mixture using the seeding rates in the table. Another option is using Natural Resource Conservation Service (NRCS) seeding mixes. Contact your local NRCS office for sample seeding mixes for your area. Companies that specialize in native prairie seed may have recommendations or ready-made seeding mixtures.

Eastern gamagrass seed

Photo source:

<https://www.ernstseed.com/product/eastern-gamagrass/>



Request pure live seed:

Note that the rates in the table are given in “PLS” or “Pure Live Seed.” When you are ordering seed, always specify PLS, which refers to the proportion of a particular seed lot that is viable, germinable seed. It will always be expressed as a percentage. It is calculated as follows: $(\text{Germination \%} \times \text{Purity \%}) / 100 = \text{\% PLS}$. NWSG tend to have much lower germination percentages than conventional crop seed, so requesting PLS is very important.

Seed dormancy:

Special attention should also be paid to dormancy rate. Dormant seed usually requires stratification (a period under moist, cold conditions) to break dormancy and induce germination. Dormant seed is common in Eastern gamagrass and Switchgrass. It is rarely a concern for Big bluestem, Little bluestem, or Indiangrass. Reported dormancy rates are reported on NWSG seed tags. Thus, a seed lot may be 80% PLS but be 80% dormant – still viable seed, but requiring stratification to break dormancy. Check with your local Extension service or state or local natural resources agency for details on stratification or plan on a fall seeding to allow stratification to occur over the winter - see planting dates below.

Local ecotypes are encouraged:

A number of native seed companies specialize in local ecotypes. There are good reasons to select local ecotype native seeds that have been collected from prairie remnants in your local area. These remnants represent a bank of genetic material that is all that remains of your region’s prairies. In theory, they should be well-adapted to your climate and soils. However, the scarcity of this seed makes this very expensive and there has been no selection for qualities that would make them perform well in a grazing system. In a Wisconsin study, there were no significant yield or quality differences between local ecotypes and named cultivars, and local ecotypes performed better under drought conditions (see Chamberlain in reference list). These results may not be replicable in other areas and if your primary goal for planting NWSG pastures is forage production, selecting cultivars bred for this purpose may be desirable.

Planting dates: Warm-season grasses like warm soil

Spring seeding (May & June)

Eastern gamagrass can be seeded in the spring after soil temperatures reach about 60°F. Other NWSG species should be planted after soil temperatures reach 65°F. In the Upper Midwest, they can be successfully seeded from mid-May until the end of June. Planting at this time also allows for better pre-planting weed control than with fall seeding. Seeding prairies in the months of July and August is generally not recommended. The remaining growing season is often too short to allow for proper plant establishment prior to winter.

Fall seeding (Sep 1 to soil freeze-up):

Late-fall seeding can also be very successful, especially on dry soils and heavy clay soils. NWSG can be seeded from early September until the soil freezes. Fall plantings are considered “dormant seedings.” The NWSG seeds will not germinate that fall, but will overwinter in the soil and germinate the following spring. This is particularly beneficial when seeding on dry, sandy, or rocky soils or when stratification is needed. The seeds will germinate in early spring when soil moisture is abundant and become established before the heat of summer.

Fertilization

NWSG seedlings are small and require only modest fertility levels to thrive. Therefore, fertilizer should only be added prior to establishment if P or K tests indicate a deficiency or if pH needs to be corrected - see above. Nitrogen should never be added during establishment, as it will only contribute to aggressive weed growth.

After seeding

Once you have planted your warm season pasture, you have two jobs left to do: control weed pressure and be patient! Native warm-season grasses require three growing-seasons to become fully established - Remember: Sleep - Creep - Leap. That is because they grow extremely large and deep root systems – up to five tons of root mass per acre by year 10. This is one reason NWSG are so drought-tolerant. But it also is why the seedlings are slow in developing.

Establishment period weed control:

With a seedling stand of acceptable density - see Evaluating your stand below - your remaining challenge during the first summer is to ensure seedlings have reasonable relief from weed pressure. The key is to not allow weeds to form a canopy above the seedlings. A few scattered weeds are not a significant concern. The best way to handle this is to regularly inspect your field in the weeks following planting. Be prepared to either clip or spray weeds as needed. Timeliness is critical. If your first-year stand has substantial weed pressure going into fall dormancy, consider using a prescribed burn the following spring when the NWSG is just beginning to grow. Such fires will help suppress annual weeds and cool season grasses.

Evaluating your stand:

A stand with an average seedling density of one or more plants per square foot is your goal. Stands with densities of one per two square feet may be of some concern, but will likely be fine. Stands below one seedling per three square feet are candidates for reseeding. Drilling through a weak stand after appropriate weed control during the second year can be successful in thickening thin stands. Consider downloading the NRCS prairie seedling identification guide to help in your assessment (internet search “NRCS central region seedling ID guide”).

When can I start haying or grazing?

While NWSG continue to mature during their second growing-season, some forage can be taken without adverse impact to the continued development of the stand. You should take care not to stress the plants by taking off too much of the biomass – leave some residual to maintain continued growth. A single early cutting or grazing (in mid-June) will not damage a healthy second year stand. Waiting until the third year will promote even better establishment.

Grazing and haying management

NWSG pastures can complement cool-season pastures and provide much needed high quality forage during the hot months of summer when cool seasons grow more slowly. Because NWSG have a different growth pattern and rest requirements than cool-season grasses and because cool-seasons are more competitive than NWSG, it is not advisable to mix them in the same pasture. Establishing up to ¼ of your pasture system in NWSG can allow for a sequential grazing system where cool-seasons are grazed in spring and early summer, warm-seasons are grazed in the hot summer months, and then returning to the rested cool-season pastures in fall.

General grazing recommendations:

- Ready to graze in June-August in the third year after seeding.
- Rotationally graze - Rest periods are important!
- Plan on two passes or cycles through the established pasture with 30 to 60 days’ rest between grazings.
- Graze at 12 to 18 inches.
- Take half - Leave half; leave more residual than you would with cool-season pastures.
- If desired, fertilize with N in early summer, not early spring and only after well established.
- Frost seed legumes, if desired, after the stand is well-established. Native legumes like purple prairie clover are preferred but are extremely expensive. Red clover or birdsfoot trefoil are potential alternatives.
- Burning NWSG pastures every few years can enhance productivity and reduce cool season grass encroachment, but is optional.
- Consider a quick flash grazing in May if cool season grasses encroach into the stand.
- Consider increasing diversity and quality by including native legumes and/or forbs.

Yield and quality tradeoffs:

In the Upper Midwest, NWSG pastures yield between three and five tons of forage per acre per year over two rotational cycles in June through August. Research has shown that timing of grazing is the biggest factor in both the yield and quality of the forage. An early grazing schedule starting in June yields higher quality but lower tonnage of forage. A late grazing cycle starting after July 15th results in higher tonnages but lower quality forage.

Balancing forage production and conservation goals:

If you are focusing on forage production goals, determining nutritional needs for the class of livestock you are grazing is the first step. An early season grazing will provide forage quality levels ideal for growing steers or heifers that need moderate, balanced protein and energy levels. Delaying grazing until July provides undisturbed habitat for nesting grassland birds or pollinating insects, but will result in lower forage quality, adequate for dry cows but not growing or lactating animals. If forage quality is inadequate, supplementation can be considered.

Research results:

The following table provides average forage availability and quality from a 4-year study conducted in Columbia County, WI in 2009-2012. Each set of treatment plots were grazed twice in each of the four years of the study. Your results may differ, depending on location, soil type, and grazing management.

Table 3. Expected yield and nutritional quality of warm season grass pastures with different grazing timings.			
		Early-graze system	
June graze	Crude protein	14.1%	
	Relative Forage Quality	138	
	Available forage (lb/a)	2035	Late-graze system
July graze	Crude protein	9.3%	7.7%
	Relative Forage Quality	118	103
	Available forage (lb/a)	3690	6533
Sep graze	Crude protein		8.1%
	Relative Forage Quality		102
	Available forage (lb/a)		3227

Materials for this fact sheet borrowed liberally from:

- Chamberlain, S. K., L. K. Paine, J. L. Harrison, and R. D. Jackson. 2012 Tradeoffs in Performance of Native Warm-Season Grass Cultivars and Locally Harvested Seed Managed for Wildlife Habitat or Livestock Production. *Agronomy Journal*, 104 (1383-1391).
- Establishing Native Warm-season Grasses for Livestock Forage in the Mid-South, a University of Tennessee Extension publication: <http://nativegrasses.utk.edu/publications/SP731-B.pdf>
- Prairie Nursery Establishment Guide: <http://prairienursery.com/store/prairie-establishment-guide-ezp-15.html>
- Wisconsin NRCS. FORAGE AND BIOMASS PLANTING Code 512 Conservation Practice Standard. <https://efotg.sc.egov.usda.gov/references/public/WI/512.pdf>

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Thanks to the following individuals for reviewing this publication: Jeff Duchene, Meghan Filbert, Randy Jackson, Laura Judge, Gene Schriefer, Caroline van Schaik, and Carl Wepking

Green Lands Blue Waters is a vision for productive, profitable agriculture in the Upper Midwest based on the straightforward concept of getting as much value as possible from farmlands by growing crops that keep the soil covered year-round—what we call farming with Continuous Living Cover. The values from the crops we promote can be measured in yields and farm profits; but also as reduced risk, improved outlook for long-term productivity from the soil, more jobs, more wildlife, cleaner water, and resiliency in the face of a changing climate.

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