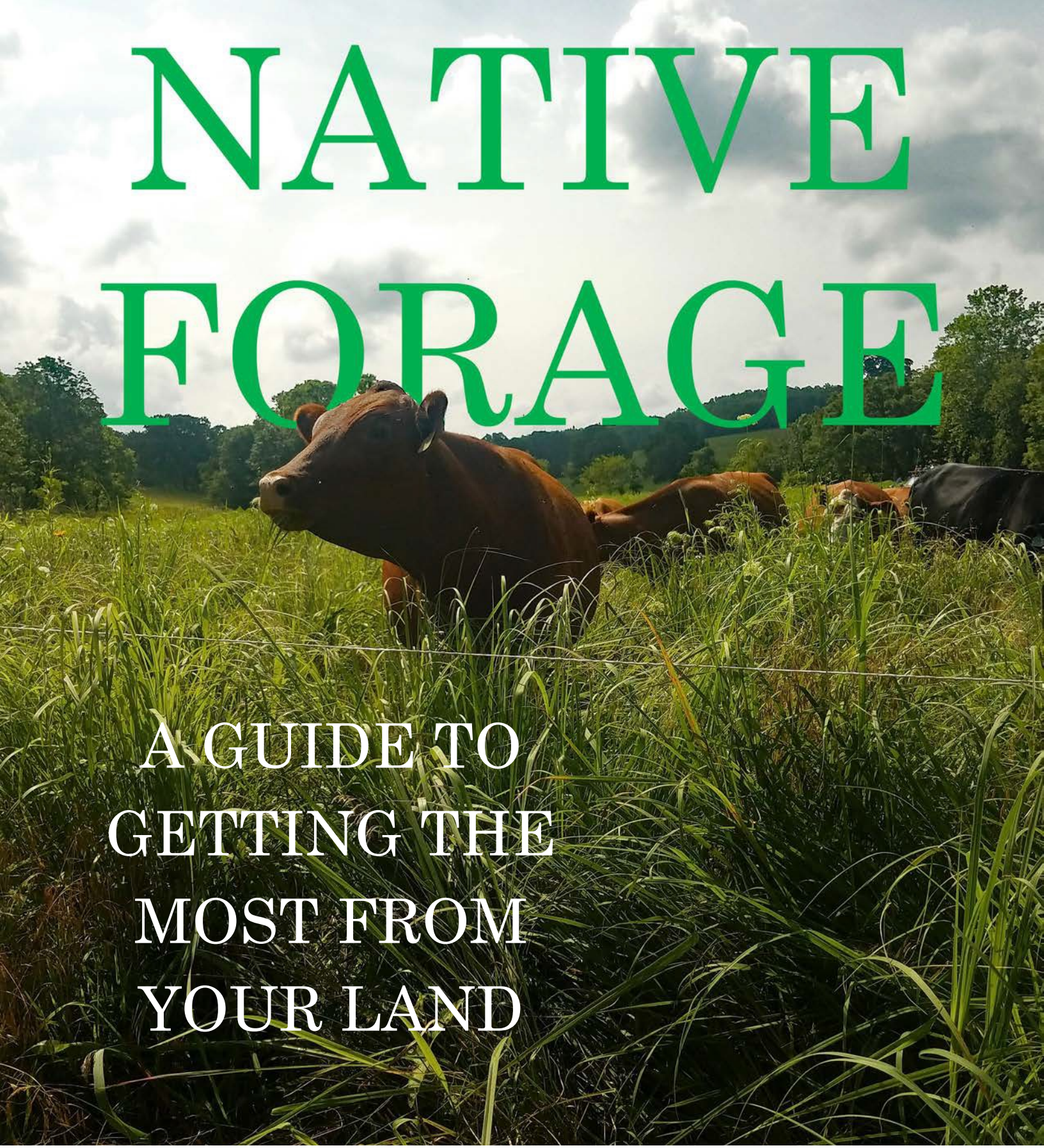
NATIVE FORAGE



A GUIDE TO GETTING THE MOST FROM YOUR LAND

PHEASANTS forever The Habitat Organization

QUAIL forever The Habitat Organization

USDA NRCS

U.S. Department of Agriculture

Natural Resources Conservation Service

CONSERVATION DEPARTMENT MISSOURI

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COVER PHOTO: JOSH MARSHALL

Get better weight gain with native warm-season grasses

Use plants designed to thrive during the heat

For the producer, one of the greatest benefits in using **native forages** is increased weight gain among livestock during late spring and throughout summer. Most pastures contain introduced **cool-season grasses (CSGs)**, and it is a challenge to keep them actively growing during the summer to maintain weight. Native **warm-season grasses (WSGs)** and broadleaf plants that grow well during summer will improve average daily gain (ADG) on stocker cattle by one pound per day compared to tall fescue (Table 1).

Animal Grazed	Forage	Average Daily Gain (ADG) Pounds
Stocker Cattle	Big Bluestem-Indiangrass Mixture	2.2
Stocker Cattle	Endophyte tall fescue	1.1

Table 1: Native warm-season grasses such as big bluestem and Indiangrass will put a pound more gain per day on each stocker during the summer compared to a cool-season grass such as KY-31 tall fescue. Sources: University of Tennessee - Center for Native Grasslands Management Grazing Guide SP731-C; University of Georgia Extension Bulletin 1392 Forage Systems for Stocker Cattle.

Spring calves on cows will gain 60 to 80 pounds more than on CSG by the end of the summer grazing season. Management of the grazing with proper stocking rate and rotation is critical.

Another benefit of grazing is improved soil health, which benefits the diversity of plant roots that occupy the space underground. With proper grazing, levels of organic matter have increased in pasture systems.

The diversity of plants that native forages provide in a pasture system will provide a diversity of plant height that offers a greater variety of wildlife cover (Figure 1).

For example, some grassland birds require short vegetation for nesting while other birds need taller, more dense vegetation. Native broadleaf plants added to the forage mixture in the pasture will provide better places for birds to raise chicks and find adequate insects for food.

During the fall and winter, the plant growth left in the pasture by the native forages will provide cover for a variety of wildlife, including a place for deer to bed. This same pasture can also provide cover for upland game, such as Northern Bobwhites or cottontail rabbits.

When pastures are mowed in late summer or early fall, quail will leave these pastures because of a lack of cover. Ideally, it would be best to not mow all the pastures at one time, and instead, leave one-quarter to one-third of the pasture unmown each year. Those portions of the pastures that were left idle this year can be mowed the following year. This is one simple way to provide more usable habitat for wildlife in the pasture system.

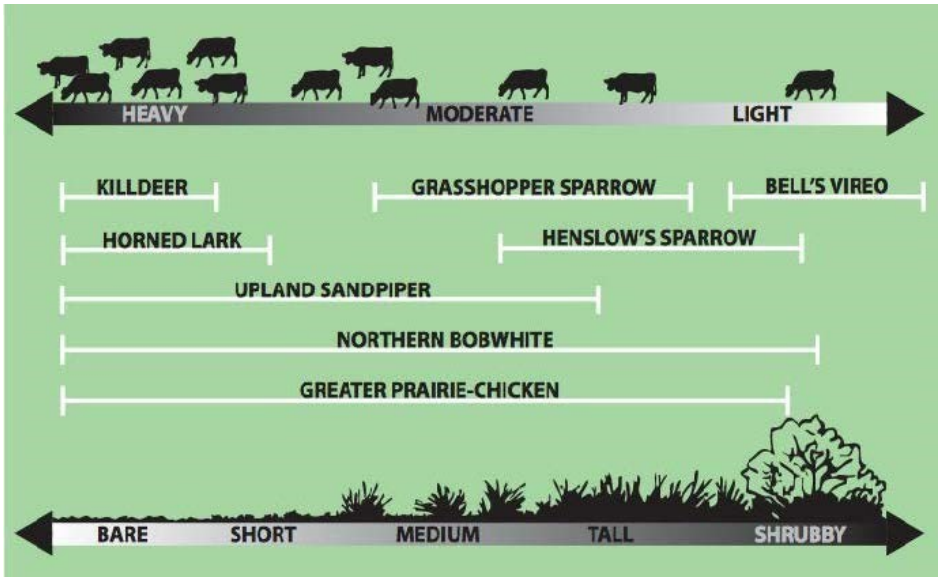

Figure 1: Songbirds and upland birds utilize different portions of fields within a grazing system depending on grazing intensity. Source: Modified from *Prairie Conservation* by Fritz L. Knopf.

CSG vs WSG

A plant's biggest source of energy is the sun. **Photosynthesis** is a process where plants gather sunlight and convert it into plant product, such as stems, leaves, **root exudates**, etc. Native warm-season grasses (NWSGs) are much more efficient at photosynthesis than CSGs. It is important to understand that CSGs are chemically and physically different than WSGs. CSGs actively grow at cool temperatures during the spring and again in the fall (Figure 2). Tall fescue, orchard grass, bluegrass, ryegrass, timothy, and smooth brome need nights above 50 degrees Fahrenheit and days below 80. NWSGs, such as big bluestem, Indiangrass, switchgrass or little bluestem, need nights above 60 degrees Fahrenheit and days above 70. WSGs will make optimum production when the temperatures are between 85 – 95 degrees Fahrenheit.

Plants grow in response to day length and temperature. CSGs are less efficient compared to WSG with the inputs of water, fertilizer and sunshine. CSG leaf blades have pores called **stoma** that open during the day and allow water to leave the plant through **transpiration**. WSGs also have pores on their leaves which are

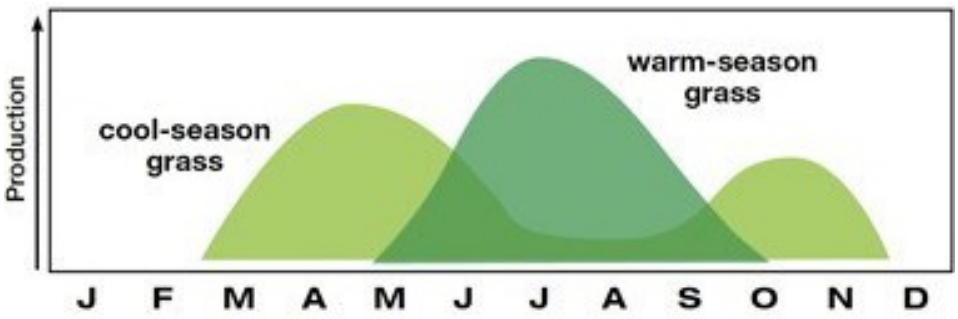

Figure 2: Seasonal production rates of cool– and warm-season grasses. Source: Natural Resources Conservation Service-Kansas

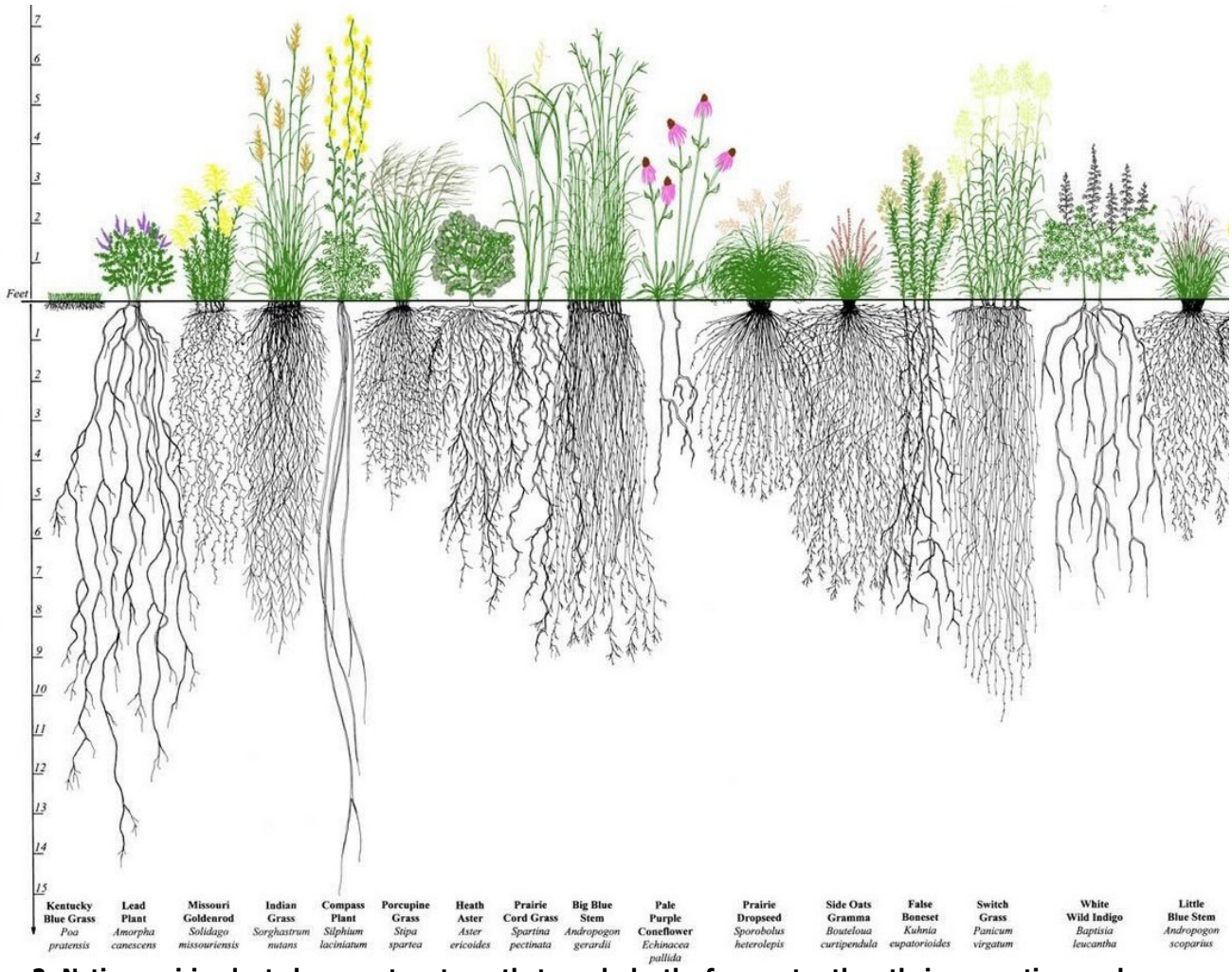

Figure 3: Native prairie plants have root systems that reach depths far greater than their non-native, cool-season plant counterparts providing many benefits to the overall soil health. Source: Conservation Research Institute.

closed during the day that help the plant conserve moisture.

CSG root systems are not designed to utilize nutrients efficiently because of the **soil biology**. CSGs grow in the spring and fall when there is more rainfall and soil moisture, allowing the plant to survive with a smaller root system and less root mass. During the spring and fall fertilizer is spread on CSGs, particularly tall fescue, to get maximum plant growth. NWSGs do not require added fertilizer to maintain maximum forage production. Instead, NWSG roots utilize the phenomenal relationship with the soil biology.

This relationship allows WSG plants to trade nutrients, minerals and water needed in their growth. CSGs, particularly tall fescue, do not associate with the soil biology nearly as well. In fact, tall fescue has adapted by producing a **fescue toxin** as a defense against being crowded out by other plants.

Roots of many native forages grow 6 to 10 feet deep, or more, depending on soil depth (Figure 3). During the heat of summer native forages can withstand longer periods of drought compared to the short-rooted CSGs. When NWSGs, native legumes and a variety of other native broadleaf plants are planted together, there will be an enhanced relationship among the intertwined roots that share nutrients.

Native forages have **mycorrhizal fungi** that are found in the roots and create an association between the plants and the soil. The plant's root mass and surface of the roots intertwine making the **mycelium** of the fungi an extension of the roots, which helps pull in nutrients and water. Therefore, NWSGs do well with limited inputs, such as water and nutrients. Fescue is not able to take advantage of this fungi function.

Grazing Systems

Grazing systems in Missouri have changed over the years to contain mostly CSGs, primarily tall fescue. This has made it challenging for producers to manage their pastures throughout the year. By converting acres to NWSGs in a CSG grazing system, overall productivity will increase. NWSGs will increase the tons of forage and pounds of beef that come off that grazing system.

Producers generally will ask how much of the NWSGs they need in their CSG grazing system. This will depend on how many months the NWSGs will be grazed.

In most grazing systems it is best to incorporate 25 to 40 percent of the acreage to NWSGs (Figure 4) with grazing generally beginning in May and continuing through the middle of September.

If the grazing system already has pastures with adequate water available in each paddock, then it is easier to determine which pastures will be converted from CSGs to NWSGs. The pastures will need to be close enough to each other to allow for rotating the livestock from pasture to pasture throughout the summer.

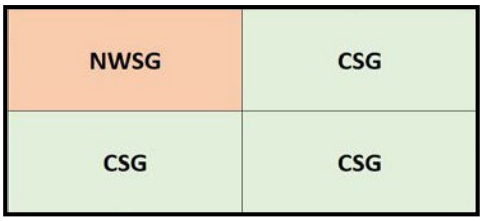

Figure 4: It's advised to convert 25% to 40% of the grazing acreage to NWSGs. Source: PFQF in Missouri

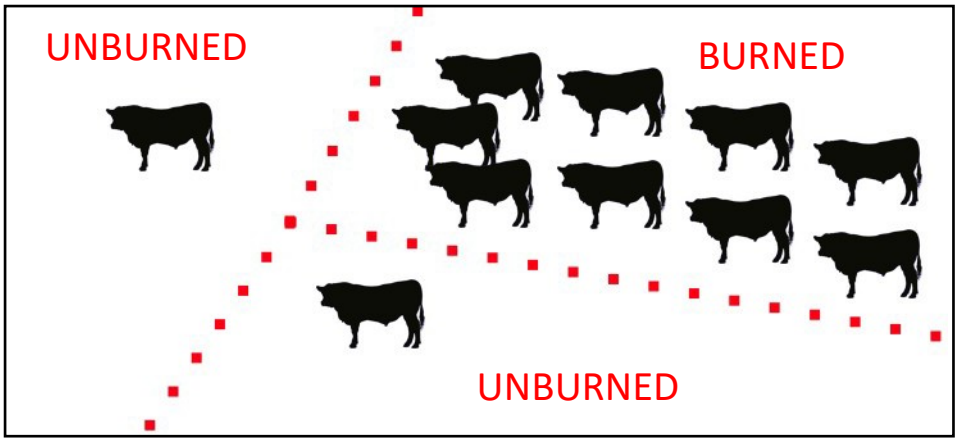

Figure 5: Cattle graze more on the burned portion of the pasture. Source: Pheasants Forever & Quail Forever in Missouri.

Remember, when the NWSGs are being grazed during the summer, the CSGs are being rested and will be in better condition when the livestock are moved to the CSGs for fall grazing beginning in September. In fact, having NWSGs as part of the grazing system will allow for more stockpiling of tall fescue that will extend winter grazing.

The grazing rotation can be a simple move every few days up to a week or more between each pasture. Usually, at least four paddocks/pastures are necessary.

Some producers will graze their native forages using a high density/short duration method in small paddocks by rotating animals every few hours for up to a day or two. Native forages work well in a patch-burn grazing system. Patch-burn grazing works best with pastures that are 160 acres or more in size but can work in smaller pastures as small as 40 to 60 acres. In this method, cattle have access to the whole pasture with no interior fencing. The pasture has 3 or more burn patches. Before a grazing season begins a patch is burned. When cattle graze the pasture they will graze the majority of the time on the recently burned patch with the most palatable forage and spend less time on the unburned patches (Figure 5).

No matter which grazing method is used, attention should be given to the number of animals that are grazing (stocking rate).

Stocking rate is the total pounds of grazing animal per acre and usually referred to in animal units (AU). One AU equals 1,000 pounds. For example, an 1,100-pound cow is 1.1 AU, while an 800-pound steer is 0.8 AU. The stocking rate is determined by the type of livestock being grazed, the amount and quality of forage available and the pasture system that is being managed. Seek advice from the local Natural Resources Conservation Service (NRCS), Missouri Department of Conservation

(MDC) Private Land Conservationist or Quail Forever and Pheasants Forever Farm Bill Wildlife Biologist to establish the proper stocking rate for pastures.

Including NWSGs as part of a grazing system will require appropriate stocking rate to sustain the forages in pastures. However, as NWSGs are incorporated stocking rates can often be increased over previous rates.

NWSGs have the highest protein content early in the grazing season (Figure 6). Protein levels drop gradually throughout the summer. To utilize the higher protein, grazing of NWSGs forages should begin in May, particularly when grazing stocker cattle.

When grazing native forages, particularly native grasses, the rule of thumb is to take half and leave half of the existing forage. At the end of the grazing season, or by the middle of September, there should be a minimum of 8 inches of forage height left to give the native grasses time to recover before frost. During this period, NWSGs replenish nutrients back into the roots used for growth the next spring.

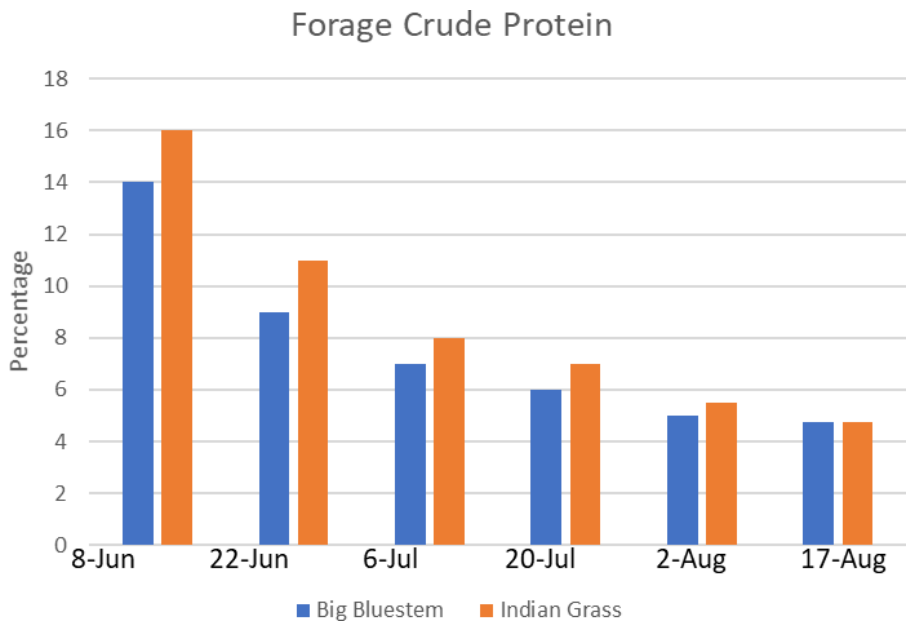

Figure 6: Native grasses such as big bluestem and Indiangrass have highest levels of crude protein early in the summer that gradually drop throughout the growing season as NWSGs mature. Source: Perry and Baltensperger, 1979. University of Tennessee Extension PB1752, Chapter 3, Using native warm-season grasses as forage for livestock.

What's in a NWSG mix?

Many years ago pastures or hayfields were planted to a single grass. Today a variety of grasses are recommended in each planting. Increased diversity of forage plants within your pastures will help improve the overall productivity. A typical NWSG mix will include big bluestem, Indiangrass, eastern gamagrass, switchgrass and little bluestem. Other NWSGs that may be added include sideoats grama, prairie dropseed and lovegrass. The mixture of NWSGs will depend on the soil types where the grasses are being planted. Some of these grasses do well in deeper soils while other grasses can grow in parts of the field with thin soils.

It is also recommended to add native broadleaf plants (forbs) in with NWSGs. Many of the native forb roots are longer than the NWSGs (Figure 3). Therefore, the forbs work well with NWSGs because they do not compete. Instead, they share nutrients through the root systems.

Native legumes are part of this group. Livestock graze the native legumes and broadleaf plants along with the NWSGs. The introduction of forbs in your grazing system increases the available minerals for the livestock, which they could not get by grazing the grasses alone. This will in return lower the amount of mineral supplement needed and lowers the input costs of your grazing operation. Having a variety of native plants in the warm-season pastures is key to the overall function of the grazing system.

If diversity of plants is a good thing then why not plant CSGs with WSGs in the same pasture? There is a physical difference between CSGs and WSGs, but it is known that the original prairies had both cool-season and warm-season grasses growing next to each other. Those CSGs are native CSGs, such as wild rye, June grass, etc.

Today, some producers are adding native CSGs to their native forage mixtures (NWSG, legumes and wildflowers) in their pastures to lengthen the grazing season.

With proper management this mixture with all the native forages together seems to work in grazing systems. Remember, there is a difference between *native* CSGs and *introduced* CSGs, such as tall fescue, smooth brome, etc. Therefore, it does not work to plant NWSGs with tall fescue because the fescue roots are toxic (allelopathic) and will subdue the growth of native forages.

Establishing Native Forages

Native forages are not as difficult to establish as some believe. It is important to know that good management is needed before and after planting native forages. As with any crops planted on a farm, proper preparation ahead of planting is critical.

Once a native forage planting location is determined, a plan will be needed to lay out each step in preparing the field. The plan will lay out the condition of the field, whether it had been in row-crop or if it's in grass that needs to be converted. Seek advice from someone knowledgeable on establishing native forages. Help is available through the local U.S. Department of Agriculture (USDA) office, MDC or Quail Forever and Pheasants Forever.

Not all ground on a farm has the same soil condition. There have been instances when a landowner has tried various forages in a pasture or hay field only to experience the same low production with each of the forages. Even though various natives are adapted to "thin" or poor soil, the production will still be low. Choose fields with better soil that will produce a higher tonnage of native forage.

That's why one of the first steps before establishing native forage is to conduct a soil test on the field. If the soil is brought up to test, it needs to be done six months ahead of planting. The type of soils will

help determine what natives are picked to make up the seed mix. Good soil and proper seed mix will greatly improve the success of establishment.

There are various recipes used to establish native forages. The key here is to get good seed-to-soil contact.

Native forage seeds range in size from very small and light to large and heavy. Some of the seed, particularly some of the native grasses, are fluffy because of the awns/beard attached to the seed. With this variety of seed, it is a challenge to get the seed planted with good seed-to-soil contact. Do not plant the native seed too deep (most less than ¼ inch deep).

Native grass and forb seed can be planted together with a farm drill or may be broadcast, depending on the seed mix. Much of the seed may be visible on the ground surface after planting. Planting can occur during dormant season (in winter) or at the beginning of the growing season in the spring.

Another requirement for a successful establishment is to plant the seed into a firm seed bed. This can be accomplished by planting into an untilled crop field or grass field. If the field is tilled, it needs to be rolled or packed with a farm implement, such as a cultipacker. The firm seedbed will create an even stand of native seedlings. A firm seedbed can make the difference from a poor–fair stand to a good–excellent stand of native forage.

Herbicides can be used to aid in the establishment of native forage. Both pre- and post-emergent herbicides have been used to kill existing vegetation and to control weedy vegetation while the native seedlings are beginning to grow.

Herbicide treatments are usually done twice before planting the native seed. That is why planning and preparation well ahead of planting is crucial for success. Not all native plant types are tolerant of herbicides. Be sure to read the herbicide label to determine this.

Maintenance of the field after planting is just as important as preparing the field prior to planting.

During the first growing season, native forage seedlings are focusing their energy into root development and need sunlight to maximize growth. If weeds grow above the native seedlings and shade them, they will not be able to grow deeper roots, thus resulting in

weakened plants. This may cause a failed stand and may result in the need to replant or start over.

In some instances, the weeds need to be high-clipped above the native seedlings to allow sunlight to reach them. High-mowing is critical for the seedlings during the first growing season and may need to be done several times depending on the weed pressure. This mowing may also need to be done the second year, depending on weed growth.

Most landowners that plant native forages are disappointed with the short growth during the establishment year. Many also want to know if they need to fertilize. Adding nitrogen fertilizer during establishment encourages weed growth and increases competition and is not recommended. Native pastures do not need added nitrogen during establishment. After establishment, if nitrogen (N) is applied to the NWSGs to increase the forage tonnage, apply no more than 40 pounds per acre. It is best to get soil samples of the pasture tested to determine the levels of nutrients available in the soil for the forages.

Haying Native Forages

Most of the prairies remaining in Missouri are hay prairies. Native forages will produce the same high-quality hay that prairies produce. Hay quality will change throughout the summer. Protein level in NWSGs is highest at the beginning of the growing season (Figure 6). That protein level drops off by September. The forage quality also drops when the NWSGs begin putting up seed heads and the forage becomes less palatable because of higher fiber in the seed stalks. Haying in July will produce better quality hay than hay baled in August (Figure 7). Native forages do not need fertilization when properly grazed, but when the natives are hayed, the phosphorus (P) and potassium (K) may need to be added back to the soil since hay removes those nutrients from the field in each hay bale.

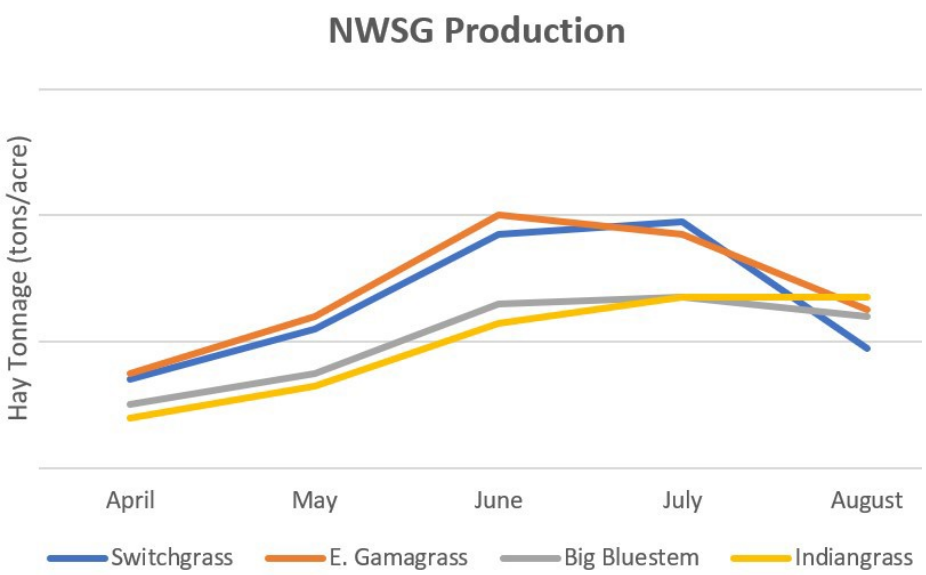

Figure 7: The production of NWSG increases through the summer until the grass matures. Hay tonnage is highest in July. Source: University of Tennessee - Center for Native Grasslands Management, SP 731-D.

As nutrients are depleted in hay fields, undesirable plants, such as broom grass (broom sedge), will become a dominant vegetation in the hay fields. Soil testing will help the producer to monitor the nutrients within the hay field.

Native forages may be hayed annually, but keep in mind, the nutrients need to be replenished. Some information indicates NWSGs can be hayed twice in the same year. Here again, the hay field will be depleted of nutrients much quicker and weaken the forage stand. Native forages need to be cut for hay 4 inches or more above the ground to help the plants recover sooner. Remember to allow the NWSGs time to grow at least 45 days prior to frost. This period is important for the NWSGs to replenish nutrients in roots that are needed for initial growth the next spring. The NWSGs should be 12 inches high at frost.

GLOSSARY

Cool-Season Grass (CSG) — any grass that grows and matures during the cool seasons of the year. May be native or introduced.

Fescue Toxin — 1) Allelopathic: exudes a substance into soil that inhibits growth of other plants. 2) Fungal endophyte: internal fungus that produces alkaloid which is toxic to other living things, particularly livestock.

Mycelium — vegetative part of a fungus that are threadlike white filaments which grow outwards seeking water and nutrients (nitrogen, carbon, potassium, & phosphorus) that are transported to the plant roots.

Mycorrhizal Fungi — fungi that colonize the root system of a host plant providing increased water and nutrient absorption capabilities while the plant provides the fungi with carbohydrates formed from photosynthesis. Used in a symbiotic relationship between fungi and plants.

Native Forages — any grass, legume, or wildflower native to the prairies that historically grew in an area or region.

Photosynthesis — process by which green plants use sunlight to synthesize foods (sugars) from carbon dioxide and water.

Root Exudates — substances (sugars/food) secreted by plant roots that influence soil nutrient availability to soil microbes and fungi.

Soil Biology — all organisms living in the soil including bacteria, fungi, protozoans (single-celled micro animals) and worms and their interaction with the soil chemistry.

Stoma/stomata — pore or tiny opening on underneath surface of plant leaf used for gas exchange. May open or close in certain conditions.

Transpiration — process where plants absorb water through the roots and give off water vapor through pores in their leaves.

Warm-Season Grass (WSG) — any grass that grows and matures during the warm season of the year. May be native or introduced. Native examples are big bluestem, Indiangrass, eastern gamagrass, switchgrass, little bluestem, etc. Introduced examples are Caucasian bluestem, forage bermudagrass, bahiagrass, etc.

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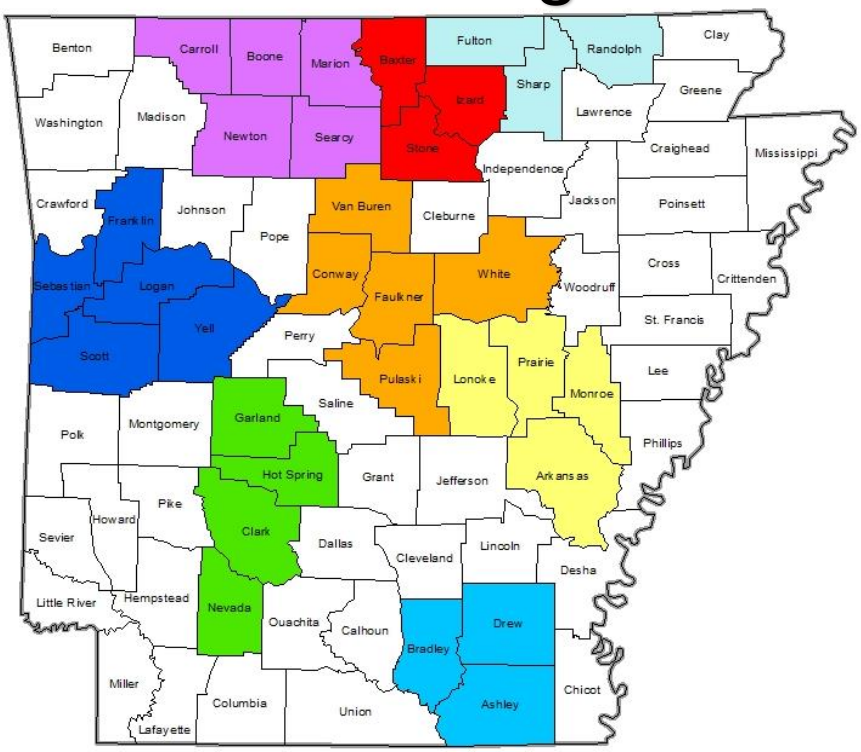

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