An Evaluation of Selected Native Grasses and Forbs for Use as a Forage to Replace Tall Fescue and for Enhanced Wildlife Habitat

Results of a Case Study

Extension
University of Missouri

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Contents

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Introduction and overview

A multiyear demonstration was developed at the MU Bradford Research Farm to determine the benefits of establishing native cool- and warm-season grasses, forbs and legumes as alternative forages that could potentially be used to replace tall fescue as a forage for use by livestock producers and to enhance wildlife habitat. One of the primary objectives of this project was to evaluate the yields and forage quality of native grasses and forb-legume mixtures compared to tall fescue, a nonnative cool-season grass that is the primary forage in pastures across Missouri (Figure 1).

Research has documented that the forage quality and yield of tall fescue is greatly reduced during the summer months and drought conditions. In addition, tall fescue provides extremely poor habitat for wildlife, particularly ground-nesting birds, such as bobwhite quail, wild turkey and numerous species of grassland birds. Establishment techniques, management practices, and yield and forage quality results from this demonstration are presented as a case study so that landowners can potentially implement similar practices on their property.

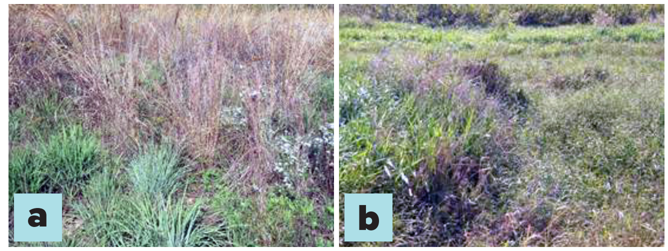

Figure 1. The clumping growth of native warm-season grass mixtures (a) compared to the thick turflike growth of tall fescue (b).

This report is a companion to these three MU Extension publications:

- G9422, Integrating Practices That Benefit Wildlife With Crops Grown for Biomass in Missouri[1]
- G9423, Establishing Mixtures of Native Warm-Season Grasses and Forbs for Potential Biomass, Forage and Wildlife Habitat[2]
- G9424, Using Native Warm-Season Grass, Forb and Legume Mixtures for Biomass, Livestock Forage and Wildlife Benefits: A Case Study[3]

This series of publications has been developed to provide research-based information to help landowners make informed decisions on the potential use of these native grasses and mixtures for forage production and for enhancing wildlife habitat on their property.

Selected native cool- and warm-season grasses and forb and legume mixtures used for this case study

Native warm-season and cool-season grasses have adapted strategies to take advantage of available resources with different growing conditions for vegetative growth, flowering and seed production. The two groups also have different habitat preferences. Although their habitats can sometimes overlap, native warm-season grasses are mostly found in prairies, glades and savannas, whereas native cool-season grasses are mostly found in open woodlands and wet prairies. The physiological differences between these two functional groups allow native cool-season grasses to grow in cooler conditions, offering forage in early spring, fall and part of winter, and seed by early summer. Native warm-season grasses offer forage during the late spring and continue growing during the summer when cool-season grasses are dormant.

All plants collect energy from the sun and through a process of photosynthesis produce resources that are used for growth and development. Cool-season grasses use the C3 photosynthetic pathway and are typically found in cooler and wetter areas. Warm-season grasses use the C4 photosynthetic pathway, which provides them with a competitive advantage in hot and dry conditions, allowing them to grow in environments in which C3 plants would struggle for survival. Many C4 grasses also have adapted to produce more biomass in the high-stress conditions that may occur during times of drought. Table 1 provides a general overview of the differences between these two types of grasses.

The native warm-season grasses used in this case study were selected based on their potential for forage production and their ability to provide the vegetative structure and cover at ground level needed by nesting birds. Their clumpy growth structure at ground level allows for seed-producing forbs and legumes to persist within a stand and improves access for wildlife to nest and rear their young. The native cool-season grasses Virginia wildrye and river oats were selected based on their potential to produce yields and forage quality comparable to nonnative tall fescue (Table 2).

Table 1. Growth and physiological characteristics and differences between native warm-season and cool-season grasses.

Characteristic	Warm-season grasses	Cool-season grasses
Photosynthetic pathway	C4	C3
Temperature/Moisture requirements	Hot and dry sites	Cool and wetter sites
Light requirements	Full sunlight to moderate shade	Prefer moderate shade; some grow under full sunlight
Vegetative growth	Late spring to early summer	Fall and spring
Blooming time	Summer	Spring
Seed matures	Fall	Early summer to early fall
Dormancy	Winter to early spring	Hottest summer periods and coldest winter periods
Habitat	Glades and prairies	Open woodlands and wet-to-mesic prairies

Table 2. Species of native warm-season grasses and native and nonnative cool-season grasses used in the case study.

Common name	Scientific name
Switchgrass (Cave-in-Rock)	*Panicum virgatum*
Big bluestem (Rountree)	*Andropogon gerardii*
Eastern gamagrass (Pete)	*Tripsacum dactyloides*
Virginia wildrye (Cuivre River)	*Elymus virginicus*
River oats	*Chasmanthium latifolium*
Tall fescue (nonnative): Kentucky 31	*Lolium arundinaceum*

Table 3. Species of native forbs and legumes in the mixtures used in the case study.

Common name	Scientific name
Gray-headed coneflower	*Ratibida pinnata*
Stiff goldenrod	*Solidago rigida*
Oxeye sunflower	*Heliopsis helianthoides*
Illinois bundleflower	*Desmanthus illinoensis*
Showy ticktrefoil	*Desmodium canadense*

Native forbs were selected based on their ability to potentially provide forage, improve soil fertility, and provide food sources — nectar and seeds — for pollinators and wildlife, and for the vegetative structure they provide at ground level that benefits ground-nesting birds. Other criteria included cost, availability and a species' ability to compete with other plants in the stand. Legume species were selected based on their potential nitrogen-fixing properties and production of seeds that are beneficial for wildlife (Table 3).

Although each of these species can be referred to as a "forb," we have chosen to differentiate between those species that can fix nitrogen — legumes — and those that cannot and refer to these species as "forbs/legumes" in the case study.

Description of the treatments used for the case study

Stands of native warm-season and cool-season grasses with species of native forbs/legumes were established in prepared seedbeds at the MU Bradford Research Farm. The soil at the site is a Mexico silt loam series, which has a characteristic claypan at about 12 to 15 inches below the soil surface unless heavily eroded. This type of claypan soil predominates in central and northeast Missouri. The area had been in a tall fescue pasture for many years and was converted to no-till soybeans during the two years prior to the establishment of the demonstration and case study.

Ten treatments, with four replications each, were established. These treatments included a monoculture of tall fescue and mixtures of both native warm-season and native cool-season grasses with native forbs/legumes (Table 4).

Table 4. Plot treatments of cool-season and warm-season grasses along with mixtures of forbs and legumes.

Plot	Treatment
1	Tall fescue (TF)
2	Tall fescue (TF) + forbs/legumes
3	Tall fescue (TF) + switchgrass (SG) + big bluestem (BB)
4	Virginia wildrye (VWR) + forbs/legumes
5	Virginia wildrye (VWR) + big bluestem (BB)
6	Virginia wildrye (VWR) + big bluestem (BB) + forbs/legumes
7	Virginia wildrye (VWR) + river oats (RO) + forbs/legumes
8	Switchgrass (SG) + forbs/legumes
9	Eastern gamagrass (EG) + forbs/legumes
10	Forbs/Legumes (without grass)

Establishment, management and harvesting strategies

During January and February 2007 (Year 0), the site was divided into 40 10-foot-by-30-foot plots (10 treatments, four replications each), and 50 pure live seeds (PLS) per foot were overseeded on each plot of the native warm-season and cool-season grasses, forbs and legumes and the nonnative cool-season grass, tall fescue (Figure 2). This seeding rate reflects the recommended seeding rate on a per-acre basis for native warm-season grasses of 7 pounds PLS per acre and forbs at 3 pounds PLS per acre. Overseeding in January and February by broadcast seeding allowed freezing and thawing to work seed into the soil.

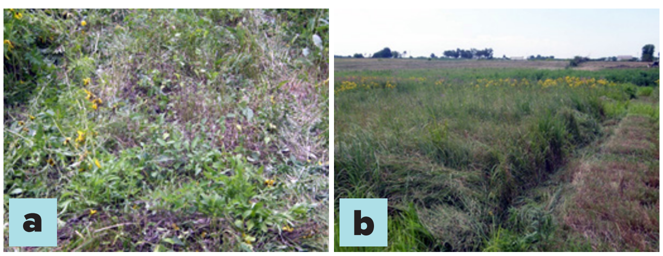

Figure 2. Mixtures of native forbs and legumes (a) and native cool- and warm-season grasses (b) were planted to evaluate ease of establishment and yield and quality of forage as compared with tall fescue.

Figure 3 depicts the growth of Virginia wildrye, a native cool-season grass, with that of tall fescue, a nonnative cool-season grass, two years after establishment. Note the thick matted turflike growth of tall fescue on the right as compared to the bunch-like vegetative structure of the wildrye on the left.

Figure 3. Virginia wildrye (left) and tall fescue (right) two years after establishment.

Figure 4 depicts the growth of the native cool-season and warm-season grass mixtures with forbs/legumes two years after establishment.

Figure 4. Native warm- and cool-season grasses planted with a forb/legume mix beginning to establish during the second year after planting.

By summer 2008 (Year 1), each forage treatment was successfully established. In July, a 3.3-foot-by-30-foot swath was harvested to a 6-inch height from each plot and weighed, and a subsample was taken for moisture adjustment and forage quality analysis (Figure 5). Forage regrowth was harvested in a similar manner in November 2008.

Figure 5. Harvesting forage plot mixes in the summer. Notice the mix of native grasses and forbs/legumes in each plot.

The following year, 2009 (Year 2), plots were split in half, and one side received a nitrogen application of 60 pounds nitrogen per acre while the other side did not receive a nitrogen application. This application was repeated each of the next two years, 2010 (Year 3) and 2011 (Year 4), with the same area of each plot either receiving or not receiving nitrogen fertilizer. No other fertilizers were applied. Nitrogen fertilizer treatments were applied to determine the competitiveness of the forbs and legumes within the stands that included the native grasses and to quantify the potential forage yield increase and quality that resulted from an increase in fertility. Forage samples were sent to Servi-Tech, and forage quality was determined by near-infrared reflectance (NIR) spectroscopy.

Forage yields

Total forage yield during the year after establishment (Year 1) was determined, with the nonnative cool-season grass tall fescue having slightly greater total forage production than the native cool- and warm-season grasses or forbs/legumes (Figure 6). This result is typical as it takes time for native grasses and forbs/legumes to establish.

Over the next three years (Years 2 through 4) the native cool- and warm-season grass forage yield was greater than the tall fescue yield during the summer and fall harvests (Figures 7 and 8). The fall harvests of native warm-season grass yielded more than double the amount of the summer harvests. Nitrogen fertilizer increased growth in both the native and nonnative cool-season grasses, such as tall fescue, but showed little effect on warm-season grasses or forbs/legumes. Forage yield data was summarized as a three-year average to showcase the results.

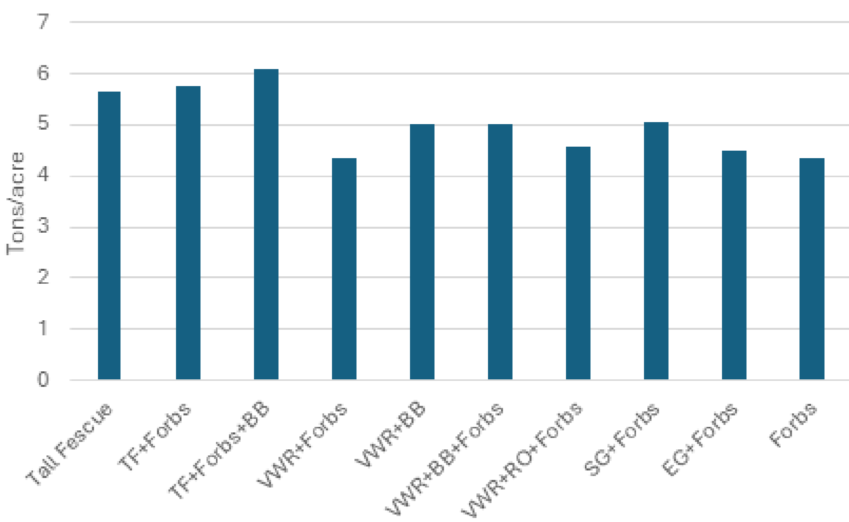

Figure 6. The total amount of forage produced during Year 1.

Legend: BB = big bluestem, EG = eastern gamagrass, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

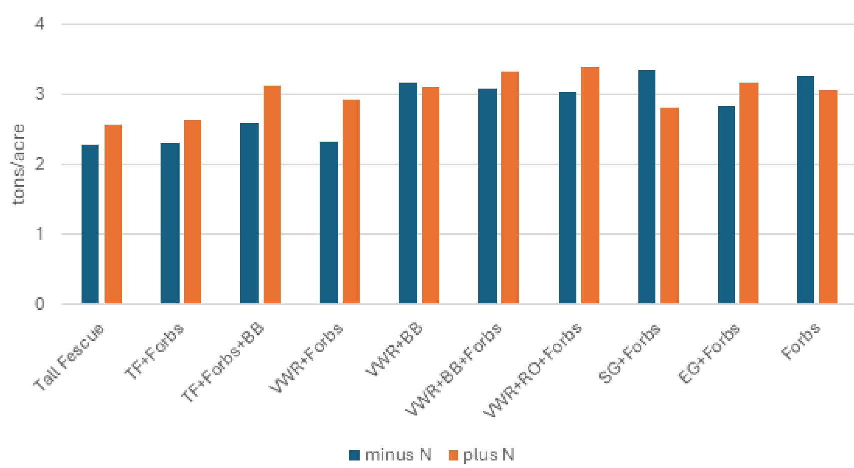

Figure 7. Average forage yields from collections made during the July harvest for years 1, 2 and 3 comparing yields in areas with spring applied nitrogen and without nitrogen fertilizer.

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

Forage yields of native warm-season grasses are well documented; as a reference, results are included from a demonstration conducted in Pettis County, Missouri, that showcases forage yield, collected as pounds of dry matter per acre, from harvests conducted during the summers of 2022 and 2023 (Figure 9).

There is little forage yield information available for native cool-season grasses or for these grasses mixed with native forbs/legumes. However, yields from these treatments were equal to or greater than tall fescue yields regardless of nitrogen treatment.

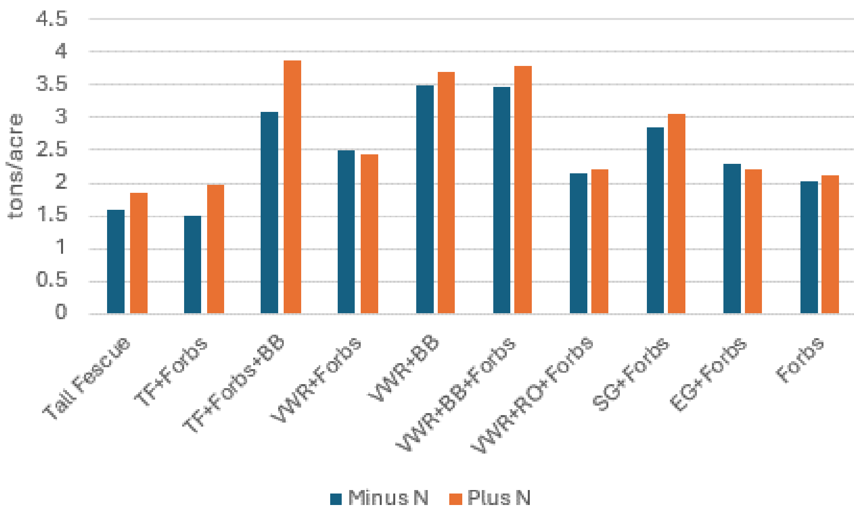

Figure 8. Average forage yields from collections made during the fall harvests of 2010 and 2011, comparing areas that received a nitrogen fertilizer application to areas that did not receive one.

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

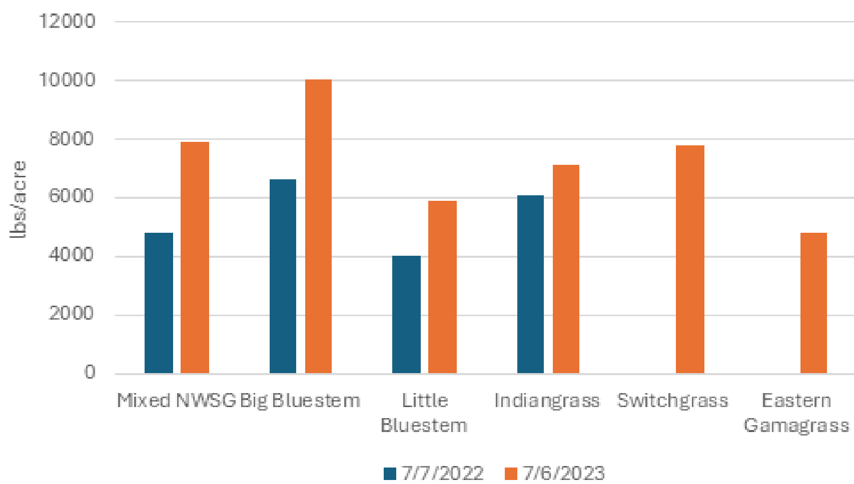

Figure 9. Dry matter, in pounds per acre, collected from native warm-season grass (NWSG) plots at State Fair Community College in Sedalia, Missouri, during 2022 and 2023. Harvests were conducted during the late summer of each year.

Fall harvest from summer regrowth was much greater for the native grasses and forbs/legumes than for tall fescue, as depicted in Figure 10. Tall fescue produces much of its annual growth during the spring and will go dormant during hot and dry periods of the summer.

The native cool-season grasses Virginia wildrye (VWR) and river oats (RO) continued to produce forage after the summer harvest. Like tall fescue, other nonnative cool-season grasses used as a forage, such as Timothy and orchardgrass, often have little summer/fall regrowth. Forbs/legumes continued to regrow after the summer harvest (Figure 11). Figure 12 depicts the regrowth of the forbs and legumes that occurred after the summer harvest.

During any given year, forage yields are determined by many factors, including management practices and environmental conditions. For instance, a lack of moisture can lead to dry conditions that, over an extended period, can lead to drought. In 2011 (Year 4), rainfall during the summer and fall was below the 20-year average (Figure 13).

Tall fescue yield decreased by more than 50% during 2011 compared to the yield during 2010 (Year 3). Forb/legume yields decreased by only 30% during this same period. When forbs/legumes were mixed with tall fescue or VWR, the reduction in total forage yield was greatly lessened.

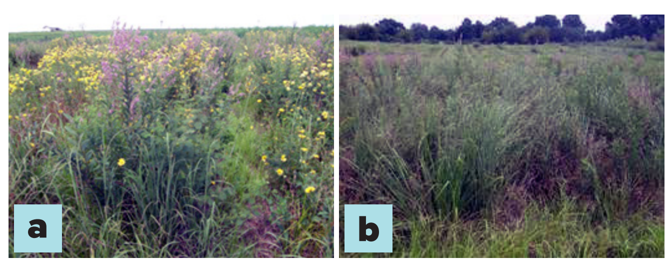

Figure 10. Three years after establishment, mixtures of native warm-season (a) and cool-season (b) grasses with forbs and legumes produced greater amounts of forage tonnage as compared with tall fescue.

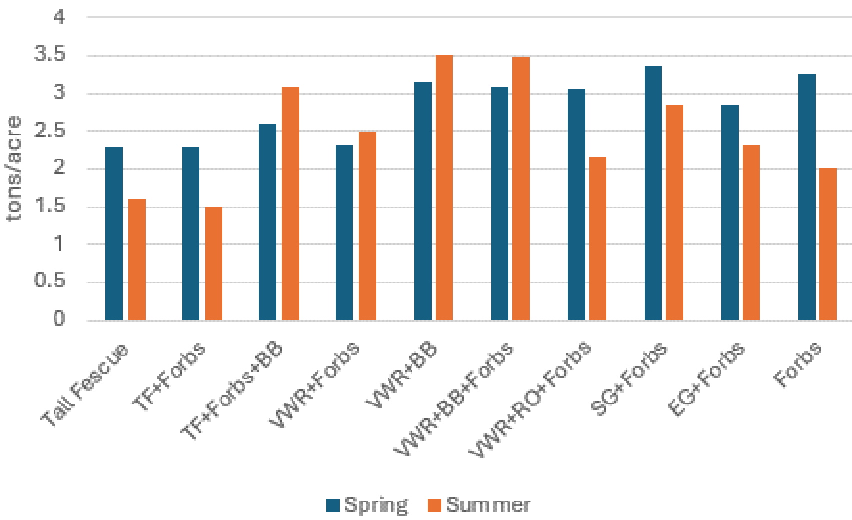

Figure 11. A comparison of average forage yield from collections made in July (Years 1 to 3) and the regrowth in September (Years 2 and 3) harvests without nitrogen.

Figure 12. Native forbs and mixtures of native cool-season (a) and warm-season (b) grasses continued to regrow during the summer and fall.

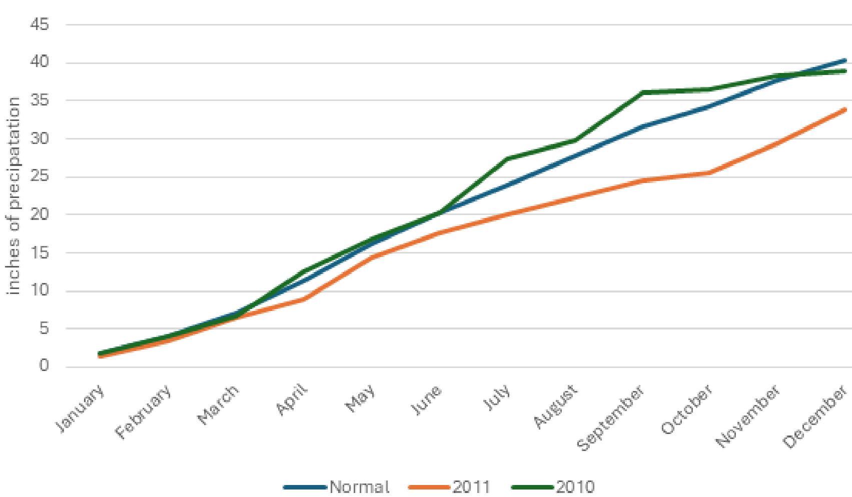

Figure 13. Precipitation amounts collected during 2010 (Year 3) and 2011 (Year 4) as compared to the 20-year average. Note the decrease in rainfall that occurred during 2011 as compared to 2010 and the deviation of rainfall from normal amounts.

The forage yield reduction for native warm-season grasses was about 40% during this period, demonstrating that stands of native warm-season grasses established with mixtures of forbs/legumes are much more drought tolerant than cool-season grasses (Figure 14). From these results, big bluestem appeared to be the least drought tolerant of the native warm-season grasses used in this case study.

Forage quality

Several forage quality metrics were collected to determine the nutritional value of each of these treatments. Samples were collected during the summer and fall of each year of the case study and were sent to Servi-Tech for forage quality measurements as determined by NIR.

Crude protein

Results from these analyses indicated that the forage crude protein levels during the summer collection were greatest with the forb/legume treatment or when the forbs/legumes were established as mixtures with the native warm-season and cool-season grasses (Figure 15).

Forage-quality crude protein for VWR and RO mixed with forbs/legumes was similar to the monoculture of tall fescue treatment or when mixed with forbs/legumes, whereas the native warm-season grass crude protein tended to be slightly less than that of tall fescue. A slight increase in

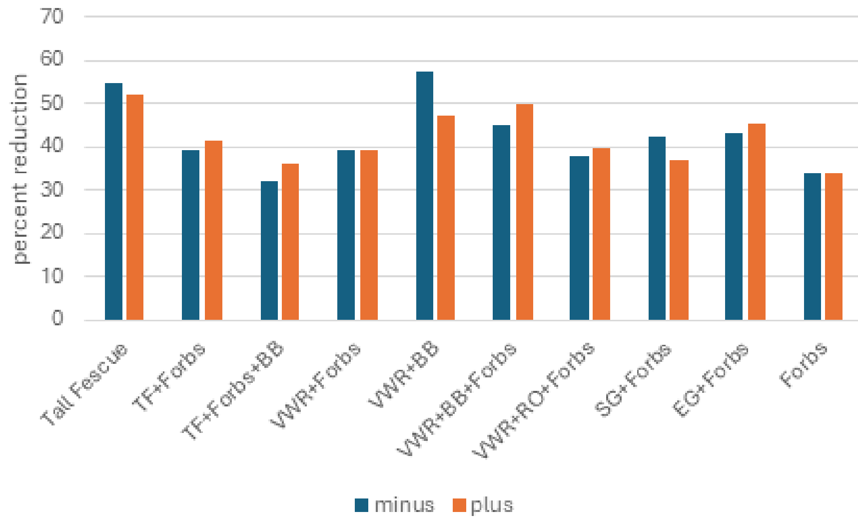

Figure 14. The percent reduction in forage yields for each of the treatments from 2010 (Year 3) and 2011 (Year 4) due to the drought conditions during Year 4.

Legend: BB = big bluestem, EG = eastern gamagrass, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

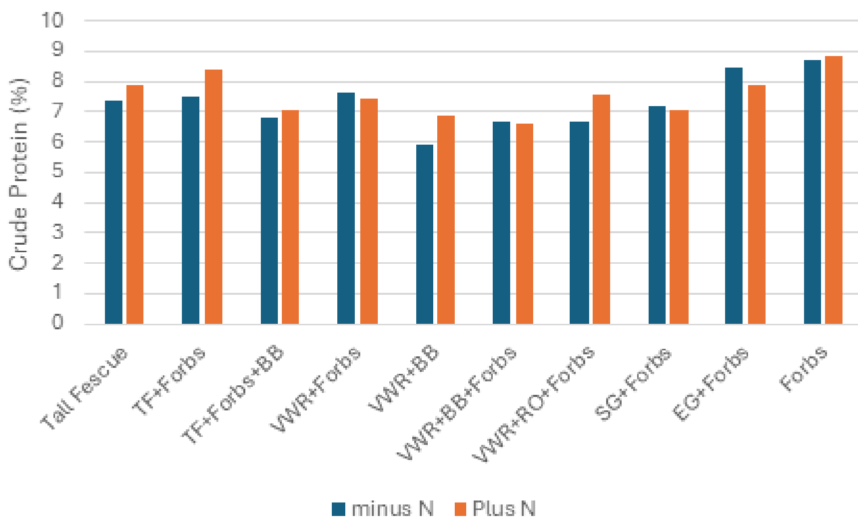

Figure 15. Crude protein across all years (2008 to 2011) from the July harvest.

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

crude protein value was noted in the native cool-season grasses that had nitrogen fertilizer applied; however, this increase was not found with the forb/legume treatment or with most of the treatments with native warm-season grasses. This result reinforces the recommendation for not applying nitrogen to stands of native warm-season grasses and forbs/legumes. These stands can still maintain forage yield and quality without a nitrogen application, unlike cool-season grasses, which greatly benefit from this additional fertilizer application.

Fall forage crude protein levels were greater in the tall fescue and forb/legume treatment than in the treatments with native warm-season grasses (Figure 16). The crude protein levels of VWR and RO with forbs/legumes were slightly lower than those of tall fescue mixed with forbs/legumes. As in the summer harvest, nitrogen fertilizer increased the crude protein values in the tall fescue and cool-season native grass treatments.

Total digestible nutrients

Total digestible nutrients (TDN) are an indicator of the energy that a forage possesses for livestock. At the summer harvest, when forbs and legumes were mixed with either tall fescue, VWR or native warm-season grasses, the level of TDN was greatly improved (Figure 17).

VWR mixed with forbs/legumes had the highest TDN of the treatments examined during this case study. This indicates that VWR mixed with forbs/legumes may have fewer stems that can impact digestion than the other forage treatments have. Nitrogen applications increased the TDN levels in the tall fescue treatments, but when tall fescue was mixed with forbs/legumes, little impact was observed. Nitrogen applications could increase the amount of stemmy growth on the plants and encourage

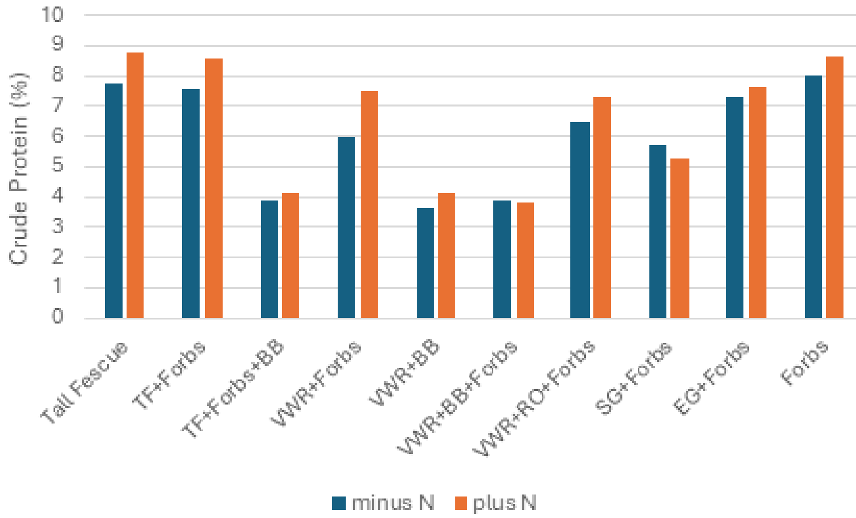

Figure 16. Percent crude protein from regrowth harvested in the fall following a July harvest in years 2010 and 2011.

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

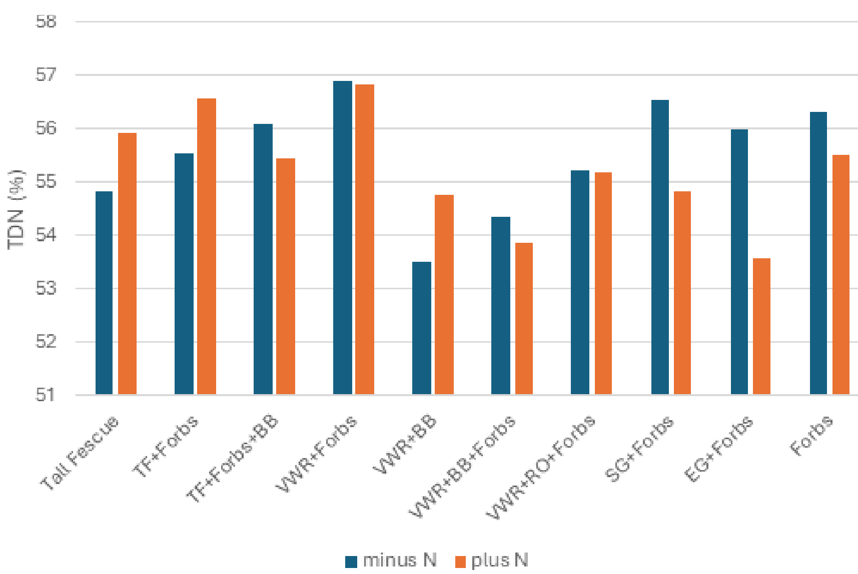

Figure 17. Total digestible nutrients (TDN) from a July harvest across all years (2008 to 2011).

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

less available leaf material, which would result in a lower level of TDN.

TDN values within the treatments of cool-season grasses and forbs/legumes were greater within the fall harvest than the summer harvest and were similar to the level found within the native warm-season grasses (Figure 18). The higher TDN found with the cool-season grasses and forb/legume treatments could have been due to a shift in growth that favored an increase in leaf biomass over stem biomass; stem formation in cool-season grasses is triggered by vernalization, a period of prolonged cold temperatures during winter that initiates reproductive growth. After the stems are harvested from these plants during the summer, new stems are not produced until the next year's growing season.

Relative feed value

A relative feed value (RFV) was used to compare forage quality between treatments. RFV takes into consideration several measures of forage quality that are important for livestock producers. It is an index that ranks hay based on a calculation of digestible dry matter and dry matter intake. Acid and neutral detergent fiber values are the basis for this calculation. For example, mature alfalfa hay might have an RFV of 100, and the RFV of most grass hays falls below 100. Legumes and legume-grass mixes, on the other hand, have an RFV greater than 100. RFV does not take protein level into consideration. An RFV below 80 will generally fall short of the energy requirements of most livestock.

The RFV of the summer harvest followed a trend similar to that of crude protein, with forbs/legumes having a greater RFV than tall fescue or the native cool- and warm-season grasses. Nitrogen fertilizer decreased RFV in most treatments (Figure 19). The fall RFV was lower in mixes of native warm-season grass and forbs/legumes than in tall fescue or mixes of native cool-season grass and forbs/legumes. As with the summer harvest, forbs also had the greatest RFV in the fall harvest. By fall, there was no effect from the spring nitrogen fertilizer treatment (Figure 20).

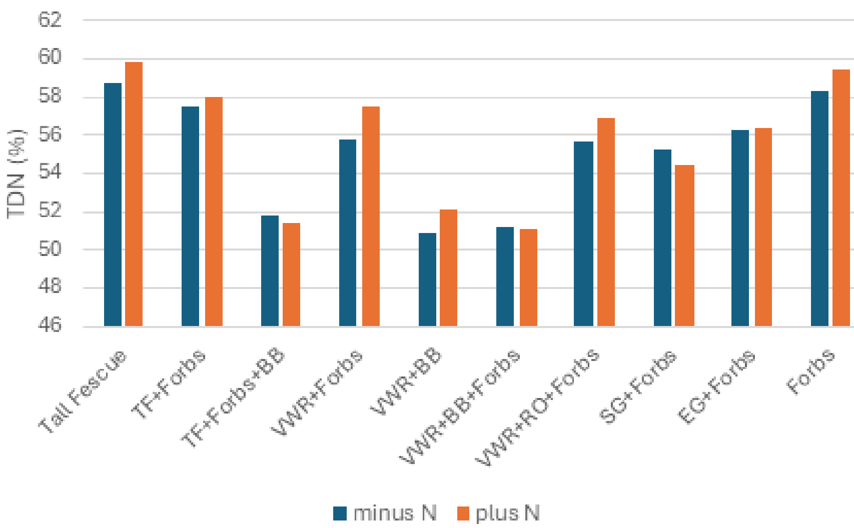

Figure 18. Total digestible nutrients (TDN) from regrowth harvested in the fall following a July harvest in years 2010 and 2011.

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

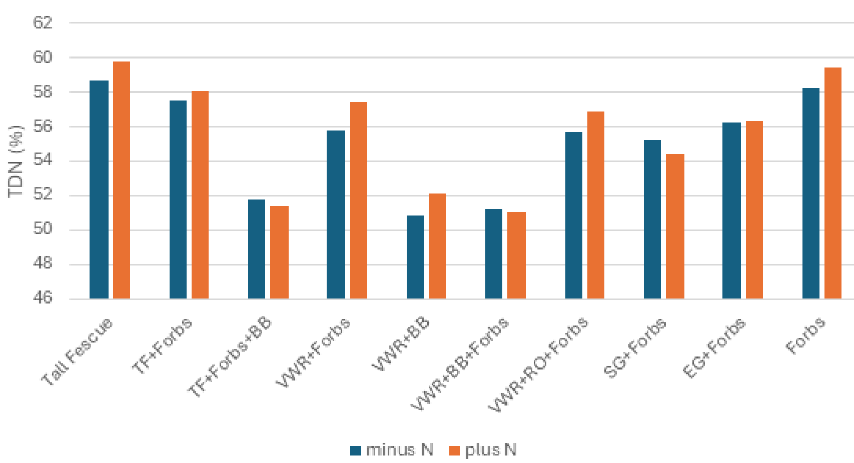

Figure 19. Relative feed value from the July harvest across all years.

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

Benefits of native grasses, forbs and legumes for wildlife habitat

Forage producers can manage these native cool- and warm-season grasses and mixtures for several management objectives, including maximum yield and quality and wildlife habitat benefits. Having these grasses and forb/legume mixtures as a component of the overall forage system will address both objectives; however, we highlight two management scenarios below as examples for maximizing forage production and for enhanced wildlife benefits.

Forage production

To maximize forage production, native cool- and warm-season grasses should be planted at 7 pounds PLS per acre and, depending on the species, harvested during the late spring (early to mid-June) and then again in late summer (by the end of August).

However, seeding rates for these grasses are dependent on the method of planting as well as the intended use of the grass. Seeding rates also depend on the species to be established. Increasing the seeding rate may compensate for poor seed placement by inadequate seeding equipment or poor seedbed preparation. It is important to seek technical assistance from USDA NRCS and MU Extension for specific recommendations. If forage quality is an objective, native cool- and warm-season grasses can be mixed with

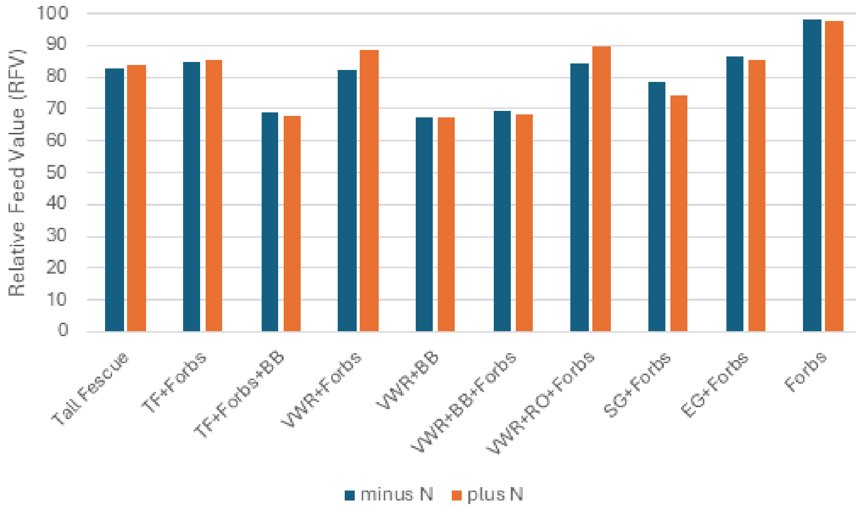

Figure 20. Relative feed value (RFV) from the fall harvest across two years, 2010 (Year 3) and 2011 (Year 4).

Legend: BB = big bluestem, EG = eastern gamagrass, N = nitrogen, RO = river oats, SG = switchgrass, TF = tall fescue, VWR = Virginia wildrye.

native forbs and legumes, at 3 pounds PLS per acre, which can also improve forage production of native cool-season grasses. A spring application of nitrogen fertilizer does not seem to impact native cool- or warm-season grass yield and can decrease native forb/legume quality.

Forage production and enhanced wildlife habitat

If forage yield, quality and wildlife habitat are objectives, one option is to establish native cool- and warm-season grasses together with native forbs and legumes. These mixtures provide the food and cover required by a diversity of wildlife, including ground-nesting birds. Hay harvests should be delayed until mid-July to give ground-nesting birds time to nest and produce young. Under normal livestock stocking rates, nests should not be negatively impacted. However, it is important to avoid high-intensity stocking rates until mid-July.

Harvesting at a height of 6 to 8 inches leaves enough regrowth for the vegetation to provide wildlife habitat throughout the fall and winter months. This management regimen will maximize forage quality and annual forage yield.

Another management option is to establish native cool- and warm-season grasses with forbs and legumes in separate fields. This option may provide the grower the ability to use these areas more efficiently for grazing and haying, while enhancing habitats for pollinators and wildlife. In the native warm-season grass fields, livestock could be removed by Sept. 1, allowing the forbs and legumes to regrow throughout the fall; providing nectar and pollen for butterflies, bees and other pollinators; and providing food sources — seeds and browse — available for wildlife during this time of year. Not harvesting these mixtures during the fall also allows for residual cover to be available throughout the winter and provides nesting habitat for ground-nesting birds the next spring.

Full seeding rates that are recommended for establishing native cool-season and warm-season grasses will also provide wildlife benefits, particularly if disturbance regimens such as livestock grazing at appropriate intensities are conducted. These seeding rates will also be consistent with recommendations provided by the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) and the Missouri Department of Conservation. However, if grazing is not used, then an option exists to establish native grasses at half the normal rate, 3.5 pounds PLS per acre, and plant one-and-a-half times the normal rate of forbs and legumes, which would be at 4.5 pounds PLS per acre. This option also provides year-round habitat for wildlife and pollinators.

Consider conducting a prescribed fire every two to three years in the spring to stimulate the growth forbs, legumes and native warm-season grasses and to keep plant succession at early stages, which is beneficial for nesting and brood-rearing cover for grassland birds (Figure 21). Burn about one-third of the area each year, rotating the burn area annually. It is extremely important to seek technical help from resource professionals with the Missouri Department of Conservation, USDA NRCS or Missouri Pheasants and Quail Forever before conducting a prescribed fire.

Figure 21. Prescribed fire can maintain these areas for forage and wildlife habitat

Summary and conclusion

Having forage production systems suited for multiple uses is crucial to success in evolving markets and satisfying increasing demand for Missouri agricultural products. One of the main objectives of this case study was to determine whether mixtures of native cool- and warm-season grasses grown with native forbs and legumes could produce as much quality livestock forage as a monoculture stand of nonnative grass such as tall fescue. A second objective was to demonstrate the habitat values that these native grasses mixed with native forbs and legumes provide for wildlife and pollinator species.

Native cool- and warm-season grasses and forb and legumes produced an abundance of forage in the early summer and fall that was equal to or exceeded tall fescue production. Native forbs and legumes mixed with native cool-season grasses had a surprisingly good forage yield with acceptable quality during the summer and fall. After the initial year of establishment, native warm-season grasses produced greater amounts of forage than tall fescue and, if mixed with native forbs and legumes, produced amounts equal to if not greater than tall fescue. Native grasses and forbs and legumes were also more drought tolerant than tall fescue. Mixing tall fescue with native forbs and legumes improved forage quality and provided benefits during drought conditions, but the native warm-season grass mixtures provided these benefits of drought resilience to a much greater degree. Nitrogen application does not impact native forb and legume yield and can negatively impact forage quality. A spring application of nitrogen fertilizer did not improve the yields of native warm-season grasses.

Results from this case study demonstrate that native cool-season grasses and native forbs are a viable replacement for tall fescue in a forage production system managed for the objective of enhancing wildlife habitat. The success of this approach is attributed to the inherent clump-like growth characteristics of these native species, which contrast favorably with the dense, turflike growth habit of tall fescue, thus providing superior cover and structure for wildlife. Adding native forbs and legumes to both native cool- and warm-season grasses greatly improves the habitat for numerous wildlife species as well as for pollinators during the summer. With proper management, these warm-season grasses and mixtures can provide food sources and cover for pollinators and wildlife throughout the fall and winter. In addition, the residual cover provided by these native grasses enhances potential nesting habitat that can be used the next spring by species such as bobwhite quail and grassland birds.

Additional resources

- MDC/MU Native Grass Extension Project[4]
- MU Extension publication G672, Native Warm-Grass Planning Budget[5]
- Grazing With Wildlife Management, Missouri Department of Conservation[6]
- USDA Natural Resource Conservation Service: Missouri[7]

Web addresses

1. extension.missouri.edu/publications/g9422
2. extension.missouri.edu/publications/g9423
3. extension.missouri.edu/publications/g9424
4. extension.missouri.edu/programs/native-grass-project
5. extension.missouri.edu/publications/g672
6. mdc.mo.gov/grazing-wildlife-management
7. nrcs.usda.gov/nrcs/missouri

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