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SUMMARY OF THE ECONOMIC AND PRODUCTION PERFORMANCE OF NATIVE GRASSES AS FORAGE IN THE FESCUE BELT

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Acknowledgements: This project was supported by Pheasants Forever and Natural Resource Conservation Service. This research is also supported by U.S. Department of Agriculture, Cooperative State Research, Education, and Extension Service through Tennessee Hatch Project TEN00442.

IN BRIEF

Tall fescue has many desirable qualities for cattle production, which is why this forage is grazed on a large portion of the United States, commonly referred to as the Fescue Belt. However, tall fescue has physiological characteristics that can cause problems for cattle producers during summer. Furthermore, this forage provides little protection and cover for wildlife, particularly northern bobwhite quail. Utilizing native warm-season grasses (NWSGs) for grazing during summer is one possible way to provide both timely summer forage and a quality habitat for quail. This report summarizes studies on cattle performance and economics of grazing NWSGs in the Fescue Belt as well as how NWSGs can enhance the quail habitat. However, more research is needed on implementing a tall fescue and NWSG grazing system for cow-calf and stocker production, while considering the impact of these forages on northern bobwhite quail habitat and populations.

THE "SUMMER SLUMP"

Tall fescue (Schedonorus arundinaceus (Schreb.) Dumort) is a cool-season grass (CSG) that is adaptable, easy to establish, and persistent under adverse conditions (Stuedemann and Hoveland 1988; Wolf et al. 1979), which is why it is grown on more than 37 million acres in the United States (Bussard and Aiken 2012). In the Fescue Belt[1], cattle production is centered on forage-based, cow-calf and stocker production (McBride and Mathews 2011) with producers primarily relying on tall fescue for pasture and hay. While tall fescue has strong growth in April and May as well as in the fall (October-November), physiological characteristics of tall fescue can cause problems for cattle producers during summer (Volenec and Nelson 2007).

Most tall fescue planted prior to 1980 is infected with a microscopic fungus, often referred to as an endophyte (Roberts and Andrae 2004). During summer, cattle grazing endophyte-infected tall fescue can be impacted by fescue toxicity. Symptoms in cattle include elevated body temperature, reduced conception rates, reduced average daily gain, and failure to shed winter coat (Looper et al. 2010; Roberts and Andrae 2004). Fescue toxicity is estimated to impact 26% of all beef cows that calved in 2011 (Bussard and Aiken 2012), consequentially decreasing about nine million calves adjusted weaning weights by 49 lb/head on average (Caldwell et al. 2013). Estimated losses to the beef cattle industry due to fescue toxicosis are over one billion dollars annually (Hoveland 1993; Strickland et al. 2011) or around $160 per cow per year (Kallenbach 2015). Thus, grazing and forage management is a common problem confronted by Fescue Belt producers that can have major implications for animal performance and profitability.

In a continuous grazing system, options producers have to address diminished summer tall fescue growth, commonly referred to as the "summer slump," are to provide cattle with supplemental feedstuffs, reduce stocking rate, interseeding legumes, or obtain more grazing land (Kallenbach 2015). Another possible solution to this issue is to rotate cattle to warm-season grasses (WSGs) during summer months (Burns et al. 1984; Burns and Fisher 2013; Kallenbach et al. 2012; Moore et al. 2004). WSGs break dormancy in late-March and early-April, grow vigorously from mid-May through mid-summer, with fall dormancy typically occurring in early-October. Incorporating WSGs in forage operations can increase grazing days and help improve tall fescue pasture by allowing it to rest during the summer (Moore et al. 2004).

This report summarizes results from studies on animal performance, profitability, and potential wildlife benefits from grazing WSGs, particularly native WSGs (NWSGs), in the Fescue Belt. Summarizing these findings is important for guiding impactful and relevant future research. This document will be helpful for Extension educators and agency field staff in informing producers on the benefits of utilizing WSGs in the Fescue Belt.

1 Fescue Belt includes portions of 15 states: Alabama, Arkansas, Georgia, Illinois, Indiana, Kentucky, Mississippi, Missouri, North Carolina, Ohio, Oklahoma, Tennessee, South Carolina, Virginia, and West Virginia (Bussard and Aiken 2012).

WARM-SEASON GRASSES IN THE FESCUE BELT

The most commonly grazed WSGs in this region are bermudagrass (BG) (Cynodon dactylon L.), which is a non-native perennial WSG (Burn et al. 1984; Burns and Fisher 2013) and annual WSGs (AWSGs) such as crabgrass (Digitaria sanguinalis) (Tracy et al. 2010; Zechiel 2017). Another WSG option for the Fescue Belt is NWSGs, but producers have not widely adopted them in this region. NWSGs commonly used are switchgrass (SG) (Panicum virgatum L.), big bluestem (BB) (Andropogon gerardi Vitman), eastern gamagrass (EG) (Tripsacum dactyloides), and indiangrass (IG) (Sorghastrum nutans L.) (Keyser et al. 2011).

Implementing a grazing management plan that balances yield and nutritive value is imperative to fully utilize the potential of WSGs. If WSG pastures are overgrazed, areas will be destroyed, and if it is under-utilized, pastures will go to seed, decreasing nutritional value and palatability of the forage (Harper et al. 2007; Tracy et al. 2010; Keyser et al. 2011b; Zechiel 2017). Studies have recommended not grazing NWSG pastures below approximately 12 inches (or 30 cm), while most AWSGs and BG should not be grazed below approximately 3 inches (or 8 cm) (Backus et al. 2017; Burns et al. 1984; Keyser et al. 2011b; Burns and Fisher 2013; Tracy et al. 2010; Zechiel 2017). It is important to note that the grazing management strategy that maximizes animal performance by balancing forage yield and quality can change from year to year based on weather and other environmental factors (Burns and Fisher 2013; Zechiel 2017). Therefore, inconsistences in animal performance studies might be connected to varying environmental factors over locations and time.

ANIMAL PERFORMANCE ON WARM-SEASON GRASSES

A few studies have investigated stocker and cow-calf performance when moved off of endophyte-infected tall fescue in the summer to a WSG (Aldrich et al. 1990; Forcherio et al. 1992; Kallenbach et al. 2012; McLaren et al. 1983; Scaglia et al. 2008). Aldrich et al. (1990) showed that animals grazing an AWSG (sorghum x sudangrass [Sorghum spp.]) had a higher average daily gain (ADG) than animals that remained on endophyte-infected tall fescue during the summer. However, Forcherio et al. (1992) found no difference in steer performance when grazing endophyte-infected tall fescue and Caucasian bluestem (Bothriochloa bladhii (Retz) S.T. Blake), and Kallenbach et al. (2012) reported steers grazing BG and endophyte-infected tall fescue performed similarly during the summer. Kallenbach et al. (2012) noted that above average rainfall in two of the three years of the experiment might have negated the advantages of grazing BG. Similarly, McLaren et al. (1983) reported no difference in total gain per acre between tall fescue and a BG- tall fescue system for steers, an outcome that could be attributed in part to very modest summer gains on the BG (i.e., 0.60 lb per day) for the summer grazing season. Moreover, Scaglia et al. (2008) discovered no difference in cow or calf bodyweight gains when grazing SG and endophyte-infected tall fescue during the summer. However, their SG stands had established poorly and, as a consequence, weeds accounted for about 45% of the stand in two of their three replicates. It seems apparent that where forage quality is low on WSG in summer, improvements in production outcomes with integrated CSG-WSG systems are not substantial; although, during dry summers, the benefits of including WSG are likely to be much greater.

In the Fescue Belt, there is an expanding literature that compares beef cattle performance from grazing various WSG forages. Burns et al. (1984) compared steer performance when grazing SG to the sequential grazing of tall fescue and BG (starting June 1st) in North Carolina. They found the ADG for steers grazing SG during summer was 66% higher than steers grazing the sequence of tall fescue

and BG. They noted that steers grazing SG yielded 287 lb/acre before the BG pasture was available to graze. Burns et al. (1984) concluded that there were advantages to both SG and BG and that either could be an effective summer forage in this region.

In a follow up study, Burns and Fisher (2013) compared ADG and total beef yield of steers grazing EG, SG, BB, and a sequence of tall fescue and BG in North Carolina. Steer performance was measured from April to September for all the forages, but steers on the tall fescue and BG treatment were grazed on tall fescue in April and May and BG from June to September. Steers grazing EG gained 1.91 lb/day with a total beef yield of 671 lb/acre, steers grazing BB gained 2.38 lb/day with a total beef yield of 653 lb/acre, steers grazing SG gained 2.0 lb/day with a total beef yield of 749 lb/acre, and steers grazing the tall fescue and BG combination gained 1.60 lb/day with total beef yield of 513 lb/acre. Burns and Fisher (2013) reported that total beef yield did not differ among the NWSGs. However, gains were higher from grazing NWSGs than tall fescue and BG over the same time period.

Tracy et al. (2010) evaluated rotating a cow-calf herd from a CSG mixture to various AWSGs and NWSGs during the summer months in Illinois. They reported no differences in cow-calf performance across the WSG forages, despite the AWSGs having higher nutritional value than the NWSGs. However, they did not graze the NWSG until July each summer, a point by which plant maturity was well-advanced and forage quality diminished. While animal performance from grazing NWSGs was not compared to grazing the CSG mixture in the summer, both of these WSGs options produced 61% more forage in the summer months than the CSG mixture.

Zechiel (2017) also compared weight gain for steers grazing SG, EG, BB and IG mixture (BB/IG), BG, and crabgrass in Tennessee. This study reported ADG of BB/IG (1.36 lb/day) was higher than the other forages, but the total grazing days were the greatest for EG and SG. Total gains were reported as 231, 166, 179, 246, and 281 lb/acre for BB/IG, BG, crabgrass, EG, and SG; respectively. Similar to Burns and Fisher's (2013) findings, gains were statistically higher for all the NWSGs than BG and crabgrass.

Some research also exists that exclusively compares grazing NWSGs in this region. Keyser et al. (2016) compared heifer performance when grazing SG and BB/IG in Tennessee. They found the ADG from grazing BB/IG (2.76 lb/day) was higher than the ADG from grazing SG (2.27 lb/day), but no difference in total gains between these forages. Furthermore, Backus et al. (2017) studied steer performance on SG, BB/IG, and EG at two location in Tennessee. They reported an ADG ranging between 1.85 to 2.71 lb/day for the first 30 days of the summer (May and June). For the full grazing season, 90-day grazing period (May to August), the ADGs were 1.06 to 2.11 lb/day with total beef gains ranging between 229 to 435 lb/acre. The results showed that ADGs were higher in the first 30 days of grazing when the forage quality is higher, but steers were able to continue gaining weight over the next 60 days.

As for meat quality, little information exists on the how grazing WSGs impact performance in the feedlot or carcass quality. Kurve et al. (2016) compared the carcass quality of steers that grazed BG and several NWSGs in Mississippi. The study found no differences in the grade (choice or above), marbling score, carcass weight, and dressing percentage across the WSGs. They concluded that grazing NWSGs could be an effective forage system for stockers without conceding carcass and meat quality.

PROFITABILITY OF GRAZING WARM-SEASON GRASSES

While these studies have suggested that WSGs could be an effective complement forage to tall fescue, these forages can be costly. Both NWSGs and BG can be difficult to establish, and no grazing or hay production should be expected during the establishment year while the root system is developing (Burns et al. 1984; Burns and Fisher 2013). In the second year, most perennial WSGs have not reached full yield potential and should be utilized lightly in grazing and hay production (Burns et al. 1984; Burns and Fisher 2013). This means a producer has to invest one to two years of capital into developing this pasture with limited production. On the other hand, AWSGs are planted annually around April or May with grazing occurring in the following month. The annual planting of AWSGs can be an expensive and labor-intensive forage option (Tracy et al. 2010). In our review of literature, we found no studies that compared the profitability of grazing WSGs relative to CSGs. However, there are a few studies that have investigated if revenue gains from grazing WSGs are greater than the cost.

Lowe et al. (2015) used the data from Backus et al. (2017) to assess the profitability of grazing beef steers on NWSGs in Tennessee and found that grazing steers on NWSGs would have positive net returns above the grazing cost. These returns ranged from a low of $99 per acre to a high of $345 per acre, depending on NWSG and grazing management. Similarly, Lowe et al. (2016) used data from Keyser et al. (2016) to analyze the economics of grazing bred heifers on NWSG. Costs for bred heifers grazing SG and a BB/IG were $0.38 and $0.65/head per day, respectively. For a producer to achieve comparable gains of these forage on harvested feeds were over $1.89/head per day. Keyser et al. (2016) reported cost of gain for these two native forages at $0.31 per pound (SG) and $0.40 per pound (BB/IG).

Tracy et al. (2010) estimated the cost of production for grazing AWSGs compared to NWSGs. Even with an investment cost of establishing the NWSGs, the initial savings of an AWSG system were offset by management costs of machinery and fertilizer associated with repeated annual establishment. They concluded that NWSGs had a lower cost of production in the long-run than AWSGs.

WILDLIFE BENEFITS FROM WARM-SEASON GRASSES

Across Fescue Belt region, the northern bobwhite population has been declining for more than four decades (Sauer et al. 2013). Burger et al. (1999) reported the decline in quail population in the southeastern United States has reduced the economic impact of quail hunting by $13 million since 1980. Part of these losses were absorbed by landowners who would lease their farm for hunting rights. Harper et al. (2009) reported that the average hunting lease in Tennessee was around $1,500 per hunter annually in 1999 dollars. Thus, the decline in the quail population has likely decreased supplemental income for producers during the winter months.

Several factors have contributed to this decline. Heard et al. (2000) attributed the decline in population to agricultural land use changes in the last few decades. They state many of the pastures and hayfields have been planted in non-native perennial grasses such as tall fescue and BG. These forages provide little protection and displace quality cover for wildlife (Barnes et al. 1995; Heard et al. 2000). This is because BG and tall fescue are shorter, denser, and more uniform than NWSGs, which negatively impacts nesting and food resources for grassland birds (Barnes et al. 1995; Heard et al. 2000).

Along with increasing summer forage production for grazing, NWSGs have the potential to benefit wildlife populations, particularly the northern bobwhite quail (Harper et al. 2015; Ryan and Marks 2005). Ryan and Marks (2005) state that bird populations can increase tenfold when 5% of BG and tall fescue hayfields are converted into NWSGs. As bunch grasses, NWSGs structure allows birds to move more efficiently than in BG and tall fescue (Ryan and Marks 2005). Replacing these non-native perennial grasses with NWSGs could increase grassland-dependent bird populations such as quail by providing protected cover for nesting and brood rearing (Ryan and Marks 2005).

However, studies have shown that stocking rate and grazing length are important components to managing NWSGs for wildlife habitat (Harper et al. 2015; Hickman et al. 2004). Harper et al. (2015) examined changing grassland wildlife habitat quality for northern bobwhite in response to grazing NWSGs in Tennessee. They concluded that grazing NWSGs all summer while maintaining a plant height of about 16 inches (or 40 cm) would maximize benefits for northern bobwhite, which is within the range of heights suggested for maximizing forage quality and cattle weight gains (Backus et al. 2017; Keyser et al. 2011b).

RESEARCH NEEDED

Overall, these studies indicate NWSGs can provide equal if not better animal performance than BG and AWSGs in the Fescue Belt while potentially improving wildlife habitat for northern bobwhite. However, these findings are observed from many independent studies. Future research should focus on identifying WSG species to incorporate in tall fescue cow-calf grazing systems. The objective would be to determine the percentage of tall fescue pasture converted to WSGs, species of WSGs, and grazing management of WSG that maximizes beef production and profits while considering the implications for wildlife habitat.

Most cow-calf producers using a defined calving season in the Fescue Belt follow a spring-calving season, beginning in January and ending around mid-March (Campbell et al. 2013). Cows are typically bred in late spring-early summer (April-June) and calves are weaned in the fall (September and October). The timing of nutritional needs for this calving season closely matches the growth cycle of WSGs (Bagley et al. 1987). Growth and development of WSG peaks at the time when spring-calving cows require their highest nutritional intake to produce milk for growing calves, maintain body condition, and successfully rebreed. Thus, cow-calf operations might be more productive and profitable in the Fescue Belt, if WSG is incorporated into these grazing systems. Furthermore, grazing a WSG in the summer will allow for stockpiling of the tall fescue pasture to extend grazing seasons and reduce reliance on conserved forages and/or purchased feeds. Furthermore, stockpiling can contribute to backgrounding weaned calves during the fall growth period. This could enable producers to acquire cheap gains on weaned calves before selling, thus improving returns to the operation.

A few studies in this region have explored cow-calf performance in grazing systems that combine tall fescue with a variety of WSGs (Scaglia et al. 2008; Tracy et al. 2010). However, these studies do not consider the impact on profitability and wildlife habitat. Also, these studies do not follow the animals all the way to finishing. The existing studies are good starting points for future research, but several vital questions remain to be answered. For example,

1. How do tall fescue-only systems compare to integrated tall fescue-WSG systems when a NWSG with a high rate of gain is used for the WSG component?;
2. What percentage of tall fescue pasture should be converted to NWSGs?;

3. What NWSG species or mixtures should be utilized?; and
4. How does grazing WSGs impact subsequent feedlot performance and carcass quality?

These are not simple questions to answer. There will likely be tradeoffs between desired outcomes. For example, the optimal percentage, species or mixture, and grazing management strategy that maximizes production might not maximize wildlife habitat. Results from such research could have important implications for total pounds of beef produced, producers' profits, and enhanced wildlife habitat.

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