Integrating bermudagrass into tall fescue-based pasture systems for stocker cattle

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ABSTRACT: The daily BW gain of stocker steers grazing tall fescue [Lolium arundinaceum (Schreb.) S.J. Darbysh. = Schedonorus arundinaceus (Schreb.) Dumort.]-based pastures typically declines during summer. To avoid these declines, in part to mitigate the effects of tall fescue toxicosis, it is commonly advised to move cattle to warm-season forage during this period. A 3-yr (2006, 2007, and 2008) grazing study was conducted to evaluate the effect of replacing 25% of the area of a tall fescue/clover (81% endophyte-infected) pasture system with “Ozark” bermudagrass [Cynodon dactylon (L.) Pers.] overseeded with clover (Trifolium spp.) to provide summer grazing for stocker steers (TF+BERM). The TF+BERM treatment was compared with a grazing system in which tall fescue/clover (TF) pastures were the only type of forage available for grazing. Our objective was to determine if replacement of 25% of the land area in a fescue system with bermudagrass would increase annual beef production compared with a system based solely on tall fescue. The study was conducted at the Southwest Research and Education Center of the University of Missouri near Mt. Vernon. Each treatment was rotationally stocked with 5 steers (248 ± 19.3 kg) on 1.7 ha. Fertilizer applications were applied at rates recommended for each respective forage species. Total forage production, BW gain per hectare, and season-long ADG of steers was greater (P < 0.06) for TF+BERM than for TF in 2006, but none of these measures differed (P > 0.19) in 2007 or 2008. In vitro true digestibility of pastures was greater (P = 0.01) for TF (84.4%, SEM = 0.64%) compared with TF+BERM (80.6%, SEM = 0.79%), even in summer. The decreased in vitro true digestibility of the bermudagrass pastures likely negated any benefit that animals in TF+BERM had in avoiding the ergot-like alkaloids associated with endophyte-infected tall fescue. Renovating 25% of the pasture system to bermudagrass provided some benefit to the system in years when summertime precipitation was limited (2006) but provided no value in wetter years (2007 and 2008). Although renovating endophyte-infected tall fescue pastures to a warm-season forage is a widely used practice to mitigate tall fescue toxicosis, the benefits of this practice are limited if forage quality of the warm season component is poor.

Key words: bermudagrass, grazing, pasture system, tall fescue

INTRODUCTION

Most forage systems for stocker cattle in the southern areas of the Midwest region of the United States are based on endophyte-infected [Neotyphodium coenophialum (Morgan-Jones and W. Gams) Glenn, C.W. Bacon and Hanlin] tall fescue [Lolium arundinaceum (Schreb.) S.J. Darbysh. = Schedonorus arundinaceus (Schreb.) Dumort.] interseeded with medium red (Trifolium pratense L.) and white clover (Trifolium repens L.; Cherney and Kallenbach, 2007). The tall fescue component typically comprises approximately 75% of the forage on a DM basis and heavily influences pasture production and quality. A mutualistic relationship between the endophyte and host plant makes tall fescue the most persistent and widely used forage in southern areas of the Midwest (Buckner and Bush, 1979; Sleper and West, 1996; Roberts and Andrae, 2004). However, endophyte-infected tall fescue produces forage containing ergot alkaloids, and because of this, stocker cattle BW gains are generally less than might otherwise be...
expected, especially during summer (Tucker et al., 1989; Roberts and Andrae, 2004).

This study compared a tall fescue/clover-based system (TF) with a tall fescue/bermudagrass system (TF+BERM) for stocker calves. The TF+BERM system was characterized by having 25% of the grazing area in “Ozark” bermudagrass [Cynodon dactylon (L.) Pers.] and 75% of the area in the same tall fescue/clover forage as TF. Bermudagrass was used as a component because of its ability to produce enough forage to support relatively large stocking rates in summer (Burns et al., 1984). The hypothesis was that replacing 25% of the pasture area of an endophyte-infected tall fescue-based forage system with bermudagrass would increase annual forage production and improve season-long steer BW gains. Our objective was to determine if replacement of 25% of the land area in a TF+BERM system with bermudagrass would increase annual beef production compared with a system based solely on tall fescue/clover.

**MATERIALS AND METHODS**

The animal management protocol was reviewed and approved by the University of Missouri Animal Care and Use Committee.

A 3-yr grazing study was conducted at the Southwest Missouri Agricultural Research and Education Center near Mount Vernon (37°04′55″ N, 93°53′21″ W). The soil at this location was a mixture of Keeno cherty silt loam, 2 to 9% slope (loamy-skeletal, siliceous, mesic Mollic Fragiudalf); Hoberg silt loam, 2 to 5% slope (fine-loamy, siliceous, mesic Mollic Fragiudalf); and Gerald silt loam, 0 to 2% slope (fine, mixed, mesic Umbritic Fragiaqualf).

Forage establishment was initiated 3 yr before the grazing study. Soil samples were collected in the summer of 2002 from the entire area under experimentation. On the basis of the soil sample results, lime, P, and K were applied at rates recommended by the University of Missouri Soil Testing Laboratory (Brown and Rodriguez, 1983). Existing vegetation was sprayed with glyphosate at 1.7 kg/ha of acid equivalent in the fall of 2002, and then moldboard plowed, disked, and planted to a small grain in February of 2003. Small-grain forage was grazed or hayed in the spring and summer of 2003, and then the field was sprayed again with 1.7 kg/ha of acid equivalent of glyphosate in late August of 2003. In early September of 2003, “Kentucky 31” tall fescue was no-till drilled into the entire area at 28 kg/ha of pure live seed. The amount of endophyte infection of the tall fescue seed was 84%; endophyte infection status was documented to be 81% in June 2006 by collecting 25 tall fescue tillers from pastures and assaying tillers with the immunoblot test described by Hiatt and Hill (1997). In the spring of 2004, 25% (0.42 ha) of the pastures designated to be TF+BERM were renovated to “Ozark” bermudagrass. The area to be renovated to bermudagrass was moldboard plowed, disked 2 times, and cultipacked before being sprigged at 2.61 kL/ha on June 4, 2004. Diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] was applied just after sprigging at 1.9 kg/ha of active ingredient to limit weed growth during bermudagrass establishment. During the establishment year, 67 kg/ha of N as NH₄NO₃ was applied on June 17 and August 17 to facilitate establishment. Pastures designated to TF had no additional renovation.

**Treatment and Experimental Design**

Treatments consisted of 2 different forage systems, each replicated 4 times. One treatment was a typical endophyte-infected tall fescue pasture with an estimated 20% component of medium-red and white clover. The other treatment was identical to the first except that 25% of the pasture area was renovated to “Ozark” bermudagrass. Incidentally, 25% was deemed appropriate because bermudagrass in southern portions of the Midwest is more suitable as complementary forage rather than as a solitary forage system because of its seasonal growth pattern. Each of the 8 (2 treatments × 4 replications) individual 1.7-ha systems was subdivided into 8 paddocks of equal area (Figure 1). Within TF+BERM, the 2 bermudagrass paddocks were further divided into 2 additional paddocks one-half the area of the other paddocks (Figure 1).

**Pasture and Forage Management**

In all years (2006, 2007, and 2008) of the grazing study, medium-red (5.5 kg/ha) and white clover (0.6 kg/ha) were overseeded in early March to all paddocks (including those with bermudagrass) in each treatment. Also each year, the bermudagrass was fertilized with 84 kg/ha of N (as urea) on May 1, June 14, and July 18 (+2 d) for an annual total of 252 kg/ha of N. Bermudagrass residue was burned during the last 2 wk of February all years. Following current University of Missouri guidelines, tall fescue in both treatments was not fertilized with N in spring. Nitrogen fertilization of tall fescue intended for grazing at this time of year is generally not feasible because of the inability to efficiently utilize the excess forage produced. In addition, N fertilization at this time of year makes it difficult to maintain the legume component of the pasture. Furthermore, toxicity issues have been reported to be exacerbated over the summer months with N fertilization at this time (Roberts and Andrae, 2004). To minimize the potential for tall fescue toxicosis in this study, all of the tall fescue/clover pastures received only 56 kg/ha of N in mid-August to stimulate fall growth.

**Forage Mass Determinations**

During the grazing season, forage mass was determined weekly from each paddock by taking 50 rising plate meter (RPM) readings. The RPM (Model F200, Farmworks, Feilding, New Zealand) was calibrated just
before the start of grazing and every 25 ± 3 d thereafter by clipping 0.82 × 4.6 m strips (n = 10 for a paddock) from 2 selected paddocks within each of the 8 units. The strips were cut to a 2-cm height with a flail-type harvester. The paddocks selected for calibration were the most recently stocked (poststocking) and the next-to-be-stocked (prestocking) paddock within each unit. In addition, a subsample [300 g (±50 g) of fresh mass]] from the strips harvested in each unit was weighed fresh and again after drying for more than 96 h in a forced-air oven at 50°C to determine DM.

The forage mass values of the poststocked and prestocked paddocks along with their corresponding RPM measurements were then used, along with Julian date, coded dummy variables for species (10 for tall fescue paddocks, 20 for bermudagrass), and pre- or poststocked forage yield (10 for samples collected before stocking, 20 for samples collected after stocking), in stepwise regression to estimate forage yield for each paddock. Stepwise regression equations were predicted using the PROC REG statement (SAS Inst. Inc., Cary, NC), with significance for variables to enter and stay in the model set at 0.20. Model $R^2$ ranged from 0.84 to 0.86, depending on year. After prestocked and poststocked forage yields were calculated, growth rate for each stocking period was determined by averaging the growth rates of the unoccupied paddocks within each treatment. Forage growth while animals were stocked in an individual paddock was then added to the prestocked yield to determine the amount of forage available for grazing.

**Steer and Grazing Management**

Angus cross steers and intact bulls (*Bos taurus*) were acquired from a central Missouri sale barn 5 to 7 wk before grazing each year. The calves were received at the Beef Research and Teaching Facility near Columbia, MO, placed into a confined drylot, and offered a typical receiving diet. Approximately 1 wk after arrival, the calves were vaccinated with 7-way blackleg with haemophilus (Ultrabac 7/Somubac, Pfizer, Exton, PA) and bovine rhinotracheitis-virus diarrhea-parainfluenza-3-respiratory syncytial virus modified live virus vaccine with *Mannheimia haemolytica* toxoid (Pyramid 4+ Presponse SQ, Fort Dodge Animal Health, Fort Dodge, IA) and were given an ear identification tag, and bulls were castrated. The calves were transported to the Southwest Missouri Agricultural Research and Education Center Research near Mt. Vernon approximately 3 wk after the purchase of the animals. Immediately before or after transport, all steers were given a second round of vaccinations, dewormed with moxidectin (Cydectin, Pfizer, New York, NY) or ivermectin (Ivomec, Merial, Duluth, GA), and implanted with zeranol (Ralgro, Intervet/Schering-Plough Animal Health, Kennilworth, NJ). In late May, the steers were given fly tags impregnated with pyrethroid and organo-phosphate insecticide. The steers were reimplemented with zeranol in late June. Tilmicosin (Micotil, Elanco, Greenfield, IN) or florfenicol (Nuflor, Intervet/Schering-Plough Animal Health) was administered under the advisement of a veterinarian following label recommendations to any animals displaying symptoms of respiratory ailments. Steers were weighed on 2 consecutive days at the beginning of the experiment and reweighed every 28 ± 7 d thereafter until removal from pasture, when they were again weighed on 2 consecutive days. Cattle were allowed ad libitum access to water and trace mineral salt blocks for the duration of the experiment.

Five 248 ± 19.3-kg crossbred beef steers were assigned to each unit as tester animals, giving a stocking rate of 3 steers/ha. Grazing began on April 5, 2006, April 4, 2007, and April 2, 2008. The steers were rotationally stocked within each unit. Animals were moved to a new paddock within each unit when the residual forage where the animals were grazing was 5 to 7 cm in height. In spring, hay was harvested from individual paddocks within each treatment when forage growth rates exceeded expected animal intake. Hay was fed back to steers when pasture growth was limiting during summer. In TF+BERM, bermudagrass paddocks were preferentially stocked if forage was available for grazing. For example, within TF+BERM, if a bermudagr-
rass and a tall fescue/clover paddock were both ready to be grazed, the Bermudagrass paddock was stocked and the tall fescue/clover paddock was grazed at a later time or allowed to accumulate growth until hay was made. Steers did not graze Bermudagrass paddocks after approximately September 20 each year to ensure plant carbohydrate accumulation for winter survival. All steers for both treatments were removed from the study by individual pasture throughout the month of November (except for a single pasture in yr 1 and 3, from which steers were removed in mid-October). The criterion for steer removal from pasture was based on available forage so as to not restrict forage intake.

Forage Nutritive Value Determinations

Forage nutritive value samples were collected each time steers entered a paddock in the rotation. These samples were taken by clipping hand-sized samples of forage to a 2-cm height from 25 to 30 locations in the paddock. Samples were frozen at the time of collection, and then freeze-dried upon return of the researcher to the laboratory. After freeze-drying, samples were ground in a cyclone mill to pass a 1-mm screen. The ground samples were evaluated for CP, in vitro true digestibility (IVTD), and ergovaline using a near-infrared reflectance spectrophotometer (Foss Model 5000 scanning monochromator, Foss NIRSystems, Silver Spring, MD) driven by Infrasoft International software (Infrasoft International, Port Matilda, PA). The spectrophotometer was calibrated for each component by regression of chemically derived data against spectral data in a modified partial least squares regression (Westerhaus et al., 2004; Table 1). The calibration for CP (n = 87) was determined by thermal conductivity detection with a Leco FP-428 N analyzer (Leco Corp., St. Joseph, MI), and calibration of IVTD (n = 87) was determined by a 48-h in vitro digestion, followed by an NDF solution wash (Spanghero et al., 2003). Rumen fluid collected from a cannulated cow on a forage-based diet was used for the in vitro digestion calibration samples. Calibration standards for ergovaline (n = 150) were attained by following the procedures outlined by Hill et al. (1993).

### Statistical Analyses

Forage production, nutritive value, and ergovaline concentrations were analyzed as a randomized complete block with 2 treatments and 4 replicates, as described by Steel and Torrie (1980). The model used included year and block as the main plots, forage treatment as subplots, and all possible interactions. Year and interactions with year were considered random effects, and all others were considered fixed effects. Repeated-measures ANOVA procedures were used to test the effects of treatments. The PROC MIXED procedure (SAS Inst. Inc.) was used, assuming first-order autoregressive correlation among the repeated measures. Animal performance data (ADG, BW gain/ha) were also analyzed as a randomized complete block using the model described above. The experimental unit for all measurements of animal performance was a group of 5 steers on each of the 8 pastures (2 forage treatments × 4 replications).

### RESULTS AND DISCUSSION

#### Forage Production

There was a year × treatment interaction ($P < 0.01$) for total forage produced, so data were analyzed by year. The TF+BERM produced more total forage ($P = 0.04$) than TF in 2006, but total forage produced in 2007 and 2008 did not differ ($P = 0.38$ and $P = 0.89$, respectively) between treatments (Table 2). Although only 25% of the total pasture area was dedicated to Bermudagrass in TF+BERM, the contribution of Bermudagrass paddocks accounted for 31 to 42% of the total forage produced, and accounted for 47 to 56% of the grazing days annually (Table 2). The reason for the larger than anticipated contribution of the Bermudagrass paddocks to grazing days can be attributed to 2 factors. First, during the 3 yr of study, the Bermudagrass paddocks were ready for grazing in TF+BERM, then those paddocks were stocked and any excess forage was harvested for hay from the tall fescue/clover paddocks.

Table 1. Calibration statistics for near-infrared spectroscopic determination of CP, in vitro true digestibility (IVTD), and ergovaline concentrations of rotationally stocked tall fescue/clover and Bermudagrass pastures

<table>
<thead>
<tr>
<th>Constituent</th>
<th>n</th>
<th>$R^2$</th>
<th>Mean</th>
<th>$SEC^1$</th>
<th>$SECV^2$</th>
<th>1-VR$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP, %</td>
<td>87</td>
<td>0.98</td>
<td>16.3</td>
<td>0.49</td>
<td>0.7</td>
<td>0.96</td>
</tr>
<tr>
<td>IVTD, %</td>
<td>87</td>
<td>0.97</td>
<td>81.7</td>
<td>1.42</td>
<td>1.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Ergovaline, μ/kg</td>
<td>150</td>
<td>0.87</td>
<td>233</td>
<td>53</td>
<td>69</td>
<td>0.77</td>
</tr>
</tbody>
</table>

$^1$SEC = SE of calibration, calculated in modified partial least squares regression.

$^2$SECV = SE of cross-validation, calculated in modified partial least squares regression.

$^3$1-VR = 1 minus the variance ratio, calculated in cross-validation in modified partial least squares regression.
There was a year effect \((P < 0.01)\) for hay (excess forage) harvested but no year × treatment interaction \((P = 0.96)\). Pooled over 3 yr, hay harvested was greater for TF+BERM \((P = 0.02)\), with 1,910 kg/ha \(\text{SEM} = 218\) kg/ha compared with 1,570 kg/ha \(\text{SEM} = 184\) kg/ha for TF. Hay fed back to the steers was different between treatments only in 2006, when steers in TF required 220 kg/animal \(\text{SEM} = 29\) kg/animal, compared with 22 kg/animal \(\text{SEM} = 22\) kg/animal) for steers in TF+BERM. The reason for the relatively large SEM values for hay fed is that hay was fed only during 2006 and that only 1 small round bale (113 kg) was fed in 1 replication of TF+BERM during 2008.

Net hay production (hay harvested minus hay fed) was 1,890 kg/ha \(\text{SEM} = 230\) kg/ha) for TF+BERM and was 1,350 kg/ha \(\text{SEM} = 258\) kg/ha) for TF. Assuming the 5 steers in each treatment weighed 320 kg each and were offered hay at 3% of BW daily, the net hay produced for the 1.7-ha system would supply feed for an additional 67 d for steers in TF+BERM and for 48 d for steers in TF each year.

**Forage Nutritive Value of Pastures**

There was a year effect \((P = 0.01)\) but no year × treatment interaction \((P = 0.08)\) for CP. With all years pooled, the seasonal trends of forage CP are given in Figure 2. Crude protein concentrations were typically equal or greater for TF+BERM \((P = 0.02)\), with 1,910 kg/ha \(\text{SEM} = 218\) kg/ha) compared with 1,570 kg/ha \(\text{SEM} = 184\) kg/ha) for TF. Hay fed back to the steers was different between treatments only in 2006, when steers in TF required 220 kg/animal \(\text{SEM} = 29\) kg/animal), compared with 22 kg/animal \(\text{SEM} = 22\) kg/animal) for steers in TF+BERM. The reason for the relatively large SEM values for hay fed is that hay was fed only during 2006 and that only 1 small round bale (113 kg) was fed in 1 replication of TF+BERM during 2008.

![Figure 2. Crude protein of forage as steers entered a different paddock over the course of the grazing season. TF was a typical tall fescue/clover system, whereas TF+BERM had 75% of the area in tall fescue/clover and 25% in “Ozark” bermudagrass/clover. Steers were rotationally stocked from early April to approximately mid-November. Data are combined over 3 yr. Bars equal 2 × SEM to give 95% confidence intervals. Nonoverlapping bars indicate a significant difference at the 0.05 level.](image-url)
Bermudagrass, even well-managed bermudagrass, as was the case in this study, is often less than expected. Kloppenburg et al. (1995) reported that bermudagrass pastures in New Mexico had an in vitro OM digestibility of approximately 8 percentage units less than did pastures of native rangeland grasses. Further, Fisher et al. (1991), who examined the masticates of beef steers grazing several forage species, including tall fescue and bermudagrass, found that masticates from animals grazing tall fescue averaged 78% IVDMD, compared with 64% for bermudagrass pastures.

Ergovaline concentrations in TF increased as the leaf sheath and stem component of the sample increased in the spring (Figure 4). The concentration of ergovaline in tall fescue samples decreased though mid-August, followed by a seasonal increase to more than 450 μg/kg in autumn. When steers were stocked onto tall fescue paddocks within TF+BERM, ergovaline concentrations were not different from the coinciding samples from TF (P = 0.88). The increase in ergovaline during the autumn was most likely not due to the presence of leaf sheaths, but was likely the result of N fertilization (Rottinghaus et al., 1991) and seasonal changes in ergovaline production (Rogers et al., 2011).

**Steer BW Gain**

There was no year effect (P > 0.10), and no year × treatment interaction (P ≥ 0.10) for season-long ADG or BW gain/ha. When pooled over years, season-long ADG of steers in TF was 0.61 kg/d, whereas that of steers in TF+BERM was 0.59 kg/d (P = 0.78). Patterns of BW gain per hectare were similar to ADG responses because stocking rate was equal and the number of days grazing for each treatment was similar (405 vs. 380 kg/ha for TF and TF+BERM, respectively, P = 0.61). However, because the P-value for the year × treatment interaction for season-long ADG was 0.10, Figure 5 includes season-long ADG values by year. Season-long steer ADG between treatments was not different in 2007 (P = 0.61) and 2008 (P = 0.24). However, there was a difference between the treatments (P = 0.02) in 2006. Precipitation (Figure 6) was typical in 2006, and tall fescue growth slowed enough in midsummer to warrant hay feeding (ad libitum). This partially explains the difference (P = 0.02) for steer ADG for TF compared with TF+BERM in 2006. In the other 2 yr, precipitation from June through September was more than the 30-yr mean, which allowed for adequate tall fescue production throughout the summer, thus partially negating the advantage of having bermudagrass in the system. With precipitation patterns similar for 2007 and 2008, it may actually have been detrimental to have bermudagrass in the system because steers were reintroduced to ergovaline from tall fescue in autumn (Stuedemann et al., 1985).

Average daily gain by period of year is also given in Figure 5. Whereas year did not affect ADG (P > 0.11), the year × treatment interaction (P < 0.06) within periods was sometimes significant, so data are presented by year. Steer ADG in the spring was 0.45 and 0.31 kg greater during 2006 and 2007, respectively (P = 0.03, both years), for steers in TF+BERM than for steers in TF. In the spring of 2008, steer ADG was not different (P = 0.93). During summer, steer ADG was typically about two-thirds of that in spring, but treatments were not different for any of the 3 yr (P > 0.46). In autumn, there were no differences between treatments in any year (P > 0.13). However, this might be misleading because in each of the first 2 yr, 5 to 7 of the steers (out of 20/treatment, blocks combined) in TF+BERM had negative ADG responses (as much as −1.3 kg/d), whereas none of the steers in TF exhibit...
stituted this response. Individual steers with negative ADG in autumn exhibited typical visual symptoms (longer hair coats, unthrifty appearance, less time grazing) of livestock being introduced to toxic tall fescue for the first time, although no physiological data were collected from them.

Because forage IVTD was often greater in TF (Figure 3), these steers should have gained BW at a greater rate than steers in TF+BERM. However, this was not the case. Endophyte infection of the tall fescue likely influenced forage intake of the steers in TF (Peters et al., 1992; Stewart et al., 2008) and this likely negated any improvement of forage IVTD. However, the uneven performance of steers in TF+BERM when moved to tall fescue paddocks in the autumn might be attributed to the reintroduction of ergovaline in the diet. Stuedemann et al. (1985) stocked steers on tall fescue pasture with 1% endophyte infection from April 4 to May 16, and then moved one-half of the animals onto tall fescue with 95% infection by a toxic, wild-type endophyte (“Kentucky 31”). Steers moved to 95% infected tall fescue pastures lost an average of 0.11 kg of BW/d in the following 2 wk, whereas the group of steers that remained on the 1% infected pastures continued to gain 1.4 kg of BW/d during the same 2-wk period (Stuedemann et al., 1985). A similar effect may have taken place with steers in this study when moved from bermudagrass to endophyte-infected tall fescue in autumn. Perhaps one way that producers could maximize the benefits of adding bermudagrass would be to remove the steers from the system in mid to late summer. The fall growth of infected tall fescue could then be stock-piled for another class (or new group) of animals in late winter because ergovaline declines during the winter months (Kallenbach et al. 2003).

Other studies have shown that moving stocker steers from endophyte-infected tall fescue to other forage species in summer improved ADG. For instance, Aldrich et al. (1990) discovered that moving animals grazing endophyte-infected tall fescue to sorghum × sudangrass (Sorghum spp.) pastures in summer improved ADG by approximately 0.15 kg compared with animals that remained on endophyte-infected tall fescue. Similarly, Forcherio et al. (1992) compared grazing systems when steers grazed infected tall fescue pasture in spring and then were moved to Caucasian bluestem [Bothriochloa bladhii (Retz.) S.T. Blake] pastures in early summer. The ADG of steers in this system was not different from that of steers stocked on endophyte-free tall fescue pasture for the entire grazing season (Forcherio et al., 1992). On the other hand, Scaglia et al. (2008) converted 20% of a tall fescue/clover-based forage system to switchgrass (Panicum virgatum L.) for summer grazing by cow-calf pairs. Neither cow nor calf BW gain was
improved for this system compared with a 100% tall fescue/clover-based system.

In conclusion, the hypothesis that replacing 25% of the pasture area of an endophyte-infected tall fescue-based forage system with bermudagrass would increase annual forage production and improve season-long steer BW gains was rejected. In only 1 of 3 yr did annual forage production and ADG increase, although in a year when weather conditions were closer to the 30-yr mean than in the other 2 yr. The decreased IVTD of the bermudagrass pastures limited animal BW gains such that steers grazing toxic, endophyte-infected tall fescue/clover pastures performed equally. Perhaps using a cultivar of bermudagrass with greater IVTD concentrations, providing greater amounts of pregrazing herbage for steers when grazing bermudagrass (thus allowing animals greater selectivity), or reducing the temporal stocking rate of the bermudagrass pastures would have given different results. Even though moving animals to nontoxic pastures is a widely used practice to mitigate tall fescue toxicosis, the benefits of this practice are limited unless the forage quality of the warm-season component is almost equal to or better than that of the endophyte-infected tall fescue it replaces.

LITERATURE CITED


