Using Orchardgrass and Endophyte-Free Tall Fescue Versus Endophyte-Infested Tall Fescue Overseeded on Bermudagrass for Cow Herds - 2000 and 2001

Wayne K. Coblentz[1], *Kenneth P. Coffey*[1], *D. A. Scarbrough*[1], *Timothy Smith*[2], *Kenneth Harrison*[2], *Brad McGinley*[2], *Donald Hubbell*[2], *and Jason Martin*[2]

Story in Brief

A trial was initiated in January 2000 to evaluate endophyte-free tall fescue (*Festuca arundinacea* Schreb.) or orchardgrass (*Dactylis glomerata* L.) overseeded into dormant common bermudagrass [*Cynodon dactylon* (L.) Pers.] sods for spring-calving cows. Two management systems were evaluated in an effort to help these cool-season grasses persist; these included rotations to new paddocks twice weekly (HM) or twice monthly (LM). Generally, orchardgrass and endophyte-free tall fescue persisted well, but cow and calf performance was only marginally better in these pastures than with a more typical mixture of endophyte-infested tall fescue and bermudagrass. Cow and calf performance on endophyte-infested tall fescue pastures in 2000 and 2001 did not usually differ ($P > 0.1$) from all orchardgrass and endophyte-free tall fescue grazing systems. Continued monitoring of these pastures will be necessary to assess the long-term benefits of these grazing systems with traditionally less-persistent forages.

Introduction

Many cow-calf enterprises in the Ozarks are maintained on pasture systems that are mixtures of endophyte-infested tall fescue and common bermudagrass. The association of the fungus *Neotyphodium coenophialum* with tall fescue has a positive effect on plant persistence, but the negative effects of the toxins produced by this fungus can have a detrimental effect on livestock performance. Other perennial cool-season grasses, such as endophyte-free tall fescue and orchardgrass, have generally persisted poorly when subjected to the same types of management as endophyte-infested tall fescue. A trial was initiated to evaluate the effectiveness of overseeding endophyte-free tall fescue or orchardgrass into dormant common bermudagrass sods for spring-calving cows. Two management systems (HM, rotation to new paddocks twice weekly and LM, twice monthly) were used in an effort to help these cool season grasses persist. Our objective was to compare these forage management systems with a typical mixture of endophyte-infested tall fescue and common bermudagrass managed on a LM rotation schedule. This report includes data from the initial two years of the study. Our intention is to evaluate these systems for at least three years prior to making a final summary.

Experimental Procedures

Pasture Establishment and Maintenance. Nine 10-acre mixed-species pastures with a base sod of common bermudagrass were sprayed (Roundup Ultra®, Monsanto Company, St. Louis, MO 63167) in the spring of 1998 to eliminate annual and perennial cool-season grasses. In the late summer of 1998, cattle were used to remove summer growth of forage that was primarily bermudagrass. Cattle were used to remove available forage because many of the pastures were not suitable for haying.

In September and early October 1998, thirteen 10-acre pastures (including the nine pastures sprayed in the spring) were fertilized to soil test recommendations of the Arkansas Cooperative Extension Service, and >Benchmark= orchardgrass and endophyte-free >Kentucky 31' tall fescue were overseeded into five and four of these pastures, respectively. The remaining four pastures had mixtures of endophyte-infested tall fescue and bermudagrass that had been established previously, and these were retained as controls. In April 1999, three independent observers evaluated each overseeded pasture for continuous row coverage by cool-season seedlings. During the 1999 growing season, pastures were grazed lightly to control forage growth. All pastures were fertilized with urea (46-0-0) at a rate of 60 lb N/acre on September 9-10, 1999. Similar applications were made in both 2000 and 2001 in mid February, early June, and early September. Soil tests were obtained each year in August and any needed P and K was applied based on soil test recommendations each September.

All 13 pastures were evaluated initially (November 1999; prior to initiating the trial) for basal cover and species composition by the modified step-point method (Owensby, 1973). These procedures were repeated in June and November of each subsequent year to assess the effects of grazing on the species composition and basal cover of experimental pastures. The trial was initiated on January 11, 2000.

Grazing Management. Each 10-acre pasture was subdivided into either eight (1.25-acre) or two (5-acre) paddocks using electric fencing to supplement existing permanent fences. Orchardgrass and endophyte-free tall fescue mixtures with bermudagrass were managed with either a twice weekly rotation to a fresh 1.25-acre paddock (HM) or a twice-monthly rotation to new 5-acre paddock (LM). Endophyte-infested tall fescue pastures were managed on a LM rotation schedule. There were two replications of the orchardgrass pastures managed with the LM system, and three replications of the HM system. There were two replicates of both the LM and HM systems for the endophyte-free tall fescue pastures. Pastures were evaluated monthly for forage availability using a rising-plate disk meter. In order to protect the non-toxic forages from trampling and overgrazing when forage was limiting, cattle were fed bermudagrass hay on single 1.25-acre paddocks in the HM system and on an area of comparable size constructed with electric wire in the LM system.

Livestock. Sixty-five spring-calving cows were stratified by weight, age, and breeding and assigned to one of the thirteen pastures

[1] Department of Animal Science, Fayetteville

[2] Livestock and Forestry Substation, Batesville

(five per pasture) on January 11, 2000. Initially, at least one cow per pasture had a Hereford sire and Brahman x Angus dam; the balance of the cows were purebred Angus. Cows and calves were not supplemented other than with hay when forage was limiting, but a commercial mineral mix was offered free choice throughout the trial. From mid-May through mid-July of each year, one Gelbvieh bull was assigned to each pasture. Cows were weighed and evaluated for body condition on a monthly basis. Calves were weighed monthly and weaned in early October. Actual and 205-d adjusted weaning weights were obtained and analyzed as response variables. Milk production was evaluated by the weigh-suckle-weigh method in May and July of each year.

Cows initially assigned to each pasture remained on their assigned pasture continuously throughout the trial in order to assess the cumulative effects of each grazing system on animal performance. Cows were checked for pregnancy by rectal palpation in January of each year, and any open cows were replaced with pregnant first-calf heifers. Similarly, any cows without calves at the end of the calving season (May 1) were replaced with a primiparous cow and her calf.

In an effort to control the flush of forage growth that occurs in the spring, extra thin cows were placed on these pastures in order to improve their body condition. This technique was used because all pastures were not suitable for harvesting extra forage as hay. Extra cows were assigned to a specific 10-acre pasture and remained there as long as forage availability permitted. Within each pasture, cows were co-mingled and managed with the same rotation schedule as the five permanently assigned cows. Additional grazing days for these extra cows were tabulated for each pasture and analyzed as a response variable.

Statistics. Forage species composition and basal cover data were analyzed as a repeated measures design with grazing systems as the whole-plot term and evaluation date (November 1999, June 2000, November 2000, June 2001, and November 2001) as the repeated measures term. Forage availability was analyzed with a similar design; within year, grazing systems served as whole plots and month was the repeated measures term. Since this report is preliminary, all animal performance data are analyzed by year as a completely randomized design with unequal replication. Since open cows were replaced with primiparous cows each spring, cow weight was used as a covariate for the 2001 animal performance data. Significance is declared at the $P = 0.1$ level of confidence unless otherwise indicated.

Results and Discussion

Establishment. Visual evaluation of continuous row coverage by cool-season seedlings in April 1999 indicated that there were no differences ($P = 0.81$) between orchardgrass and endophyte-free pastures. The overall mean for both forages was 68.4%, indicating that establishment was relatively good. In sites where establishment was poor, the bermudagrass sod was often particularly vigorous and competitive, and the cattle did not effectively remove the entire existing bermudagrass canopy prior to seeding.

Species Composition and Basal Cover. The percentage of the desired cool-season grass within experimental pastures was affected by evaluation date ($P < 0.001$) and the interaction of grazing system and evaluation date ($P = 0.057$). The percentage of endophyte-infested tall fescue did not change ($P \geq 0.19$) over the five evaluation dates (Table 1), and the overall mean for the five dates was 51.8%. Percentages of both orchardgrass and endophyte-free tall fescue varied ($P < 0.1$) among evaluation dates, regardless of rotation frequency. Through June 2001, percentages of both forages were generally higher in June than on November evaluation dates; however, there were no differences ($P \geq 0.17$) in percent composition for these forages between the June and November 2001 evaluation dates. On November 2001, HM and LM endophyte-free tall fescue and HM orchardgrass comprised more than 50% of the sward, indicating that our overseeded forages had persisted throughout two grazing seasons. Orchardgrass managed as LM made up less of the sward (31.9%), but this did not differ ($P > 0.1$) from the percentage observed at the start of the trial (36.9%).

The percentage of bermudagrass in our experimental pastures (Table 2) was not affected by grazing system ($P = 0.715$) or the interaction of grazing system and evaluation date ($P = 0.187$), but was affected by evaluation date ($P = 0.002$). More ($P \leq 0.048$) bermudagrass was observed on November evaluation dates than on June dates, but the overall range was relatively small (29.3 to 37.7%). There was no difference ($P = 0.775$) in the percentage of bermudagrass in November 2001 and at the beginning of the trial. The percentage of total basal cover (Table 2) was affected by evaluation date only ($P < 0.001$), and was lower ($P \leq 0.001$) in November 2000 and June 2001 than on the other three evaluation dates.

Forage Availability. In both 2000 and 2001, sampling date affected ($P < 0.001$) forage availability, but grazing system only exhibited an effect ($P = 0.092$) in 2000. The associated interaction of these main effects was not significant ($P \geq 0.726$) either year. The addition of extra cows in the spring was an effective technique for controlling the flush of spring growth. Available forage DM ranged from 1974 to 5068 lb/acre in 2000, but remained less than 2600 lb/acre until the July sampling date, which was after extra cows were removed. In 2001, available forage DM ranged from 2589 to 3462 lb/acre between April and October, but increased to more than 4000 lb/acre in early November, which was after calves were weaned. In 2000, grazing system had no effect ($P = 0.163$) on the animal grazing days accumulated by extra cows in the spring; the overall mean was 354 animal days per 10-acre pasture. In 2001, extra cows grazing orchardgrass pastures (HM or LM) accumulated more ($P < 0.1$) additional animal grazing days than did extra cows grazing LM endophyte-free tall fescue pastures or endophyte-infested tall fescue pastures (Table 3).

Cow Performance 2000. There were no differences among grazing treatments for cow weight (overall mean = 1,212 lb) or body condition score (overall mean = 6.2) at the initiation of the trial ($P \geq 0.32$). By weaning, grazing system had affected both body condition score and cow weight ($P \leq 0.011$). Cows grazing pastures overseeded with both orchardgrass and endophyte-free tall fescue gained between 65 and 175 lb and 1.1 to 1.2 body condition scores between January and October. There were no differences between these grazing systems ($P \geq 0.14$) for either of these response variables. In contrast, cows grazing pastures with endophyte-infested tall fescue lost 87 lb during this same time period, and this response differed ($P < 0.029$) from the cow performance on all other grazing systems. There were no differences ($P \geq 0.24$) among grazing systems for May or July milk production (overall means = 13.1 and 8.6 lb/day, respectively). Pregnancy rate, as determined by rectal palpation in January 2001, was not affected ($P = 0.35$) by grazing system (overall mean = 77%).

Cow Performance 2001. Cow weights (Table 4) were affected by grazing system at calving ($P = 0.079$) and weaning ($P = 0.035$), but not at breeding ($P = 0.84$). Grazing system did not affect ($P \geq 0.11$) body condition score at any of these time periods (overall means = 6.7, 7.2, and 7.1, respectively). Milk production (Table 4) in May was not affected by grazing system ($P = 0.56$), but was in July ($P = 0.001$). Milk production in July was highest ($P < 0.1$) for cows grazing overseeded HM orchardgrass pastures. The next highest production was observed in cows grazing endophyte-infested tall fescue, which exceeded (P < 0.1) the milk production level on all remaining grazing systems. Pregnancy rate was good on all grazing systems (overall mean = 94%), and did not differ across treatments (P = 0.70).

Calf Performance 2000 and 2001. Generally, calves performed well during both years on all grazing systems. Grazing system affected (P ≤ 0.098) calf performance measured as actual and 205-d adjusted weaning weights in both years (Table 5). In 2000, the numerically greatest weaning weights were observed in LM endophyte-free tall fescue pastures, but this performance did not differ (P > 0.1) from that of calves grazing LM orchardgrass pastures. In 2001, the numerically greatest weaning weights were observed for calves grazing HM orchardgrass pastures, but performance was similar (P > 0.1) on LM orchardgrass pastures. In both years, calf performance on endophyte-infested pastures was either numerically poorest, or did not differ (P > 0.1) from the grazing system where performance was numerically poorest. Overall, this suggests that dilution of endophyte-infested tall fescue with bermudagrass may have reduced the effects of toxins produced by the endophyte and limited the differences in performance observed between calves grazing endophyte-infested pastures and those with non-toxic perennial cool-season grasses.

Implications

The management systems used in this study were effective at maintaining orchardgrass and endophyte-free tall fescue in these pastures. Generally, cow and calf performance were only marginally better with these forages in the pasture than with a more typical mixture of endophyte-infested tall fescue and bermudagrass. Continued monitoring of these systems is necessary to assess long-term benefits of these grazing systems with traditionally less-persistent forages.

Literature Cited

Owensby, C. E. 1973. J. Range Manage. 26:302-303.

Table 1. Percentage of desired cool-season grasses within the sward at Batesville, AR, from November 1999 through 2001[1]

	Evaluation date					
Treatment[2]	Nov 1999	June 2000	Nov 2000	June 2001	Nov 2001	SE
OG - HM	36.9[b]	52.1[a]	32.9[b]	50.4[a]	52.9[a]	3.6
OG - LM	36.3[b]	48.6[a]	34.4[b]	40.7[ab]	31.9[b]	4.4
FF - HM	45.1[b]	63.5[a]	55.4[ab]	60.3[a]	64.1[a]	4.4
FF - LM	52.3[c]	68.8[b]	59.1b[c]	72.5[a]	67.2[ab]	4.4
IF - LM	49.0	52.6	54.6	54.2	48.6	3.1

[a,b,c] Means in a row without common superscripts differ (P < 0.1).

[1] Data were determined by the modified step-point method (Owensby, 1973). The grazing system x evaluation date interaction affected species composition at P = 0.057.

[2] Abbreviations: OG, orchardgrass; FF, endophyte-free tall fescue; IF, endophyte-infested tall fescue; HM, cattle rotated to fresh paddocks twice-weekly; and LM, cattle rotated to fresh paddocks twice-monthly.

Table 2. Percentages of bermudagrass and basal cover in pastures at Batesville, AR[1]

Evaluation date	Bermudagrass, %	Basal Cover, %
November 1999	36.9[a]	44.5[a]
June 2000	31.6[b]	45.4[a]
November 2000	37.7[a]	36.3[b]
June 2001	29.2[b]	36.8[b]
November 2001	36.3[a]	47.7[a]
SE	1.6	1.5

[a,b] Means in a column without common superscripts differ (P < 0.1).

[1] The main effect of evaluation date affected (P = 0.002) both percentage of bermudagrass and basal cover, but other effects and interactions did not (P > 0.1). Data were determined by the modified step-point method (Owensby, 1973).

Table 3. Extra grazing days accumulated by additional cows to control spring forage growth during 2000 and 2001 at Batesville, AR

Treatment[1]	2000	2001
OG - HM	371	159[a]
OG - LM	454	153[a]
FF - HM	311	108[ab]
FF - LM	231	70[b]
IF - LM	375	84[b]
SE	50	18

[a,b] Means in a column without common superscripts differ (P < 0.1).

[1] Abbreviations: OG, orchardgrass; FF, endophyte-free tall fescue; IF, endophyte-infested tall fescue; HM, cattle rotated to fresh paddocks twice-weekly; and LM, cattle rotated to fresh paddocks twice-monthly.

Table 4. Cow performance in 2001 in overseeded pastures at Batesville, AR

	------------- Cow weight, lb ------------			-- Milk production, lb/d --	
Treatment[1]	Calving	Breeding	Weaning	May	July
OG - HM	1,404[ab]	1,217	1,357[a]	11.2	11.7[a]
OG - LM	1,409[ab]	1,289	1,437[a]	11.7	2.6[b]
FF - HM	1,431[a]	1,132	1,445[a]	7.9	4.0[b]
FF - LM	1,408[ab]	1,324	1,206[b]	10.6	0.6[b]
IF - LM	1,366[b]	1,114	1,232[b]	5.5	8.8[a]
SE	14	51	50	2.8	1.3

[a, b] Means in a column without common superscripts differ ($P < 0.1$).
[1] Abbreviations: OG, orchardgrass; FF, endophyte-free tall fescue; IF, endophyte-infested tall fescue; HM, cattle rotated to fresh paddocks twice-weekly; and LM, cattle rotated to fresh paddocks twice-monthly.

Table 5. Calf performance (weaning weights) at Batesville, AR, in 2000 and 2001

	-------2000------		------2001------	
Treatment[1]	Actual, lb	205-d Adjusted, lb	Actual, lb	205-d Adjusted, lb
OG - HM	540[b]	536[b]	622[a]	600[a]
OG - LM	554[ab]	565[ab]	567[ab]	546[b]
FF - HM	538[b]	520[bc]	495[c]	485[c]
FF - LM	589[a]	591[a]	514[bc]	514[bc]
IF - LM	527[b]	498[c]	517[bc]	505[bc]
SE	16	15	19	15

[a,b,c] Means in a column without common superscripts differ ($P < 0.1$).
[1] Abbreviations: OG, orchardgrass; FF, endophyte-free tall fescue; IF, endophyte-infested tall fescue; HM, cattle rotated to fresh paddocks twice-weekly; and LM, cattle rotated to fresh paddocks twice-monthly.