Comparison of Novel Endophyte Tall Fescues to Kentucky-31and Cool-Season Annuals

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SUMMARY

One hundred twenty-eight steer calves were assigned to one of 16 two-acre pasture. Pastures were planted to the following grasses: 1) Kentucky 31 tall fescue infected with native endophyte, 2) Jesup tall fescue infected with AR 542 endophyte (**Jesup AR542**), and 3) HiMag tall fescue infected with Number 11 endophyte (**HM11**), or 4) Soft Red Winter Wheat (Delta King 9027) and cereal rye (Wintergrazer70) planted at a rate of 60 lb/acre of each per acre into a clean-tilled seed bed on September 7, 2003. Pastures were stocked with 1.5 calves per acre in the fall and 2.5 calves per acre in the spring. For fall grazing, Calves assigned to fescue pasture began grazing on September 16, while calves assigned to small grain pastures began grazing on November 11. Calves were removed from fescue pastures on December 23 and small grain pastures on January 23. Spring grazing was initiated on March 17. Calves were removed from pastures when forage allowance and quality began limiting growth on May 12 for cattle grazing small grains and July 8 for calves grazing fescue. In the fall, calves grazing Kentucky-31 gained 50.5 lbs less/calf compared to HM11, Jesup AR542, and small grains. During the spring and summer, Gain per steer did not differ (P = 0.51) between small grains and Kentucky-31 averaging 108.5 lbs per steer, while gain per steer did not differ between HM11 and Jesup AR542 (P = 0.86) averaging 228 lbs per steer. Grazing HM11 or Jesup AR542 produced 824 lbs of gain per acre while grazing small grains or Kentucky-31 tall fescue yielded only 477 lbs of gain per acre. Grazing either HM11 or Jesup AR542 has the potential to improve production and profitability of the stocker cattle enterprise.

INTRODUCTION

Stocker cattle on novel-endophyte HM11 fescue

For stocker cattle producers to remain profitable forage programs must be developed that promote high rates of gain economically. Small grain pastures (such as wheat, rye, or ryegrass) have been used for many years by stocker cattle producers in the High Plains region and the wheat belt of Oklahoma and Kansas.

Grazing small grains has been profitable because the high quality forage produces high animal gains at a time of the year that other high quality forages are not available and the supply of calves sold in the fall is higher than demand causing low cattle prices at this time of year. Thus, purchasing calves in the fall for small grain pastures has historically been the most profitable livestock enterprise available in the areas that it is practiced. Cool-season annuals do produce high quality forage in the fall and early spring but stocker cattle grazing Kentucky-31 tall fescue, the most widely grown introduced forage in the United States, exhibit reduced growth rates and elevated body temperatures which are signs of fescue toxicosis caused by ergot alkaloids produced by fungal endophytes in the forage. These fungal ergot alkaloids enable the tall fescue to be highly persistent in harsh conditions. Endophytes have been discovered that do not produce or produce very little ergot alkaloids, these 'novel' edophytes have been promoted to combine the advantages of plant persistence with the increased animal performance of fescues not containing the endophytes. The development and use of stress-tolerant tall fescue infected with novel endophytes have been suggested as the next major advance for livestock production. The follow study has been designed to compare performance of stocker cattle grazing small grain pasture or Kentucky-31 tall fescue to two tall fescue varieties infected with novel endophytes.

EXPERIMENTAL PROCEDURES

Cattle receiving procedures

In September of 2003, 48 bulls and steer (body weight = 450 to 500 lb) calves were received at the Batesville Livestock & Forestry Research Center located northwest of Batesville, AR. Upon arrival, the cattle were individually weighed and the cattle were processed by treating with clorsulon (Curatrem; Merial, Inc.), vaccinated with a 7-way Clostridial antigen, and infectious bovine rhinotracheitis, bovine viral diarrhea, parainfluenza-3, and bovine respiratory syncytial virus (MLV), bulls were castrated with a Calicrate Bander (St. Francis, KS), and horns tipped as necessary.

Castrated bulls were injected with a perfringes C + D with tetanus toxiod vaccine. The cattle were maintained in 2 acre bermudagrass based pastures for 28 days. Calves recieved 2.2 lb/day of supplement containing required minerals and monensin (Rumensin 80; Elanco Animal Health; Indianapolis, IN), and had free choice access warm-season grass hay. Cattle were re-vaccinated on day 14.

After receiving, calves were assigned to one of 16 two-acre pasture. Pastures were planted to the following grasses: 1) Kentucky 31 tall fescue

infected with native endophyte, 2) Jesup tall fescue infected with AR 542 endophyte (**Jesup AR542**; MaxQ; Pennington Seed Inc), and 3) HiMag tall fescue infected with Number 11 endophyte (**HM11**; University of Arkansas, Fayetteville), or 4) Soft Red Winter Wheat (Delta King 9027) and cereal rye (Wintergrazer70) planted at a rate of 60 lb/acre of each per acre into a clean-tilled seed bed on September 7, 2003. Calves were assigned to treatment by apparent breed, castration, and body weight. Calves were removed from feed and water the evening before grazing was started for 16 hr before weights were recorded. The next morning at between 8:00 and 10:00 am, the cattle were weighed and sorted into their 16 assigned groups then placed on pasture. The stocking rate was 1.5 steers/acre (3 calves per pasture). Calves assigned to fescue pasture began grazing on September 16, while calves assigned to small grain pastures began grazing on November 11. While grazing, the cattle were weighed every 28 days after a 16-hr removal of feed and water. Calves were removed from fescue pastures on December 23 and small grain pastures on January 23 when forage allowance became limiting to calf growth.

In January of 2004, 80 calves were received and randomly assigned to pasture as described above. Five calves per pasture (2.5 calves per acre) began grazing on March 17. Calves were removed from pastures when forage allowance and quality began limiting growth on May 12 for cattle grazing small grains and July 8 for calves grazing fescue.

Dependent variables were analyzed by analysis of variance for a completely random design with pasture serving as the experimental unit using PROC GLM (SAS Inst., Inc.; Cary, NC). Least-square means were be separated using least-significant difference option in PROC GLM (SAS Inst., Inc.).

RESULTS AND DISCUSSION


Calves on Ky 31 infected fescue

Body weight and performance of calves grazing small grains and fescue pastures are shown in Table 1. In the fall, Calves grazing small grains tended ($P = 0.09$) to be heavier than calves grazing fescue because of the later grazing initiation date (November 11 vs September 16).

When grazing of fescue pastures was terminated on day-98 of grazing, the average body weight of cattle that had grazed HM11 and Jesup AR542 was 8.9% heavier ($P < 0.01$) than cattle that had grazed Kentucky 31. When calves were removed from small grain pastures on day-72 of grazing the average body weight was not different ($P > 0.23$) from calves grazing HM11 or Jesup AR542, but calves grazing small grains were 12% heavier than cattle that grazed Kentucky-31. The overall average daily gain of cattle grazing HM11 and Jesup AR542 was 42% faster ($P < 0.01$) than for cattle grazing Kentucky 31. Calves

grazing small grains gained 38% faster than calves grazing HM11 or Jesup AR 542 and 96% faster than calves grazing Kentucky-31. Total gain per steer did not differ ($P > 0.83$) among HM11, Jesup AR542 and small grains, averaging 169 lb/steer. Compared to Kentucky-31 calves grazing HM11, Jesup AR542, and small grains gained 50 lbs more/calf during the fall/winter grazing period.

In the spring, there was no difference ($P = 0.95$) in body weight at the initiation of grazing on March 17 (Table 1). Steers grazing small grains were only able to graze 56 days (May 12) compared to 113 days (July 8) for calves grazing fescue. Average daily gain for calves grazing small grains, HM11, and Jesup AR542 were not different ($P > 0.23$), but were 97% greater ($P < 0.01$) than gains of calves grazing Kentucky-31. Body weight at the termination of grazing did not differ between calves grazing Kentucky-31 and small grains ($P = 0.57$) and were 17.8% less ($P < 0.01$) than body weight of calves grazing HM11 and Jesup AR542. Gain per steer did not differ ($P = 0.51$) between small grains and Kentucky-31 averaging 108.5 lbs per steer, while gain per steer did not differ between HM11 and Jesup AR542 ($P = 0.86$) averaging 228.8.

Gain per acre including both the fall/winter and spring/summer-grazing periods did not differ ($P = 0.49$) between small grains and Kentucky-31, which produced only 58% of the gain ($P < 0.01$) produced by HM11 and Jesup AR542. The novel endophyte fescues produced 824.5 pounds of gain per acre, this was possible only because animal performance was held at a high level (1.72 and 2.02 lbs/day for the fall and spring grazing period, respectively) for a long period of time (total grazing season of 211 days). Calves grazing wheat and rye pastures during a three-year study from the fall of 1999 to the spring of 2002 had performance that was slightly higher than calves grazing small grains in the current study (average daily gain of 2.59 lb/day and 606 lbs of gain per acre). Depending on annual forages for a stocker grazing enterprise can be risky because of possible problems that can occur with stand establishment caused by either drought (delaying emergence until a rainfall event does occur or too much rain (causing a crust to form on soil surface preventing emergence). In other research conducted at Batesville, calves grazing Kentucky-31 tall fescue gained 51 lbs/calf less in the fall and 73 lbs/calf less in the spring than small grain calves.

Differences in the comparison of novel endophyte to native endophyte fescue in the present study are similar to differences reported in research from surrounding states. In Georgia, calves grazing Jesup AR542 gained 0.57 lb/d more in the fall and 0.95 lb/day more in the spring than calves grazing Jesup infected with the native endophyte. An economic analysis of replacing Kentucky-31 tall fescue with novel endophyte tall fescue found that a stocker cattle enterprise required 3 to 7 yr to cover establishment costs and produce a positive return on the investment, depending primarily on the effect of the native endophyte on performance of cattle and the discounts received by cattle due to reduced quality caused by fescue toxicosis.

IMPLICATIONS

Calves on novel endophyte MaxQ fescue

Profitability of a stocker enterprise is determined by both high animal performance and production per acre. In this study, novel endophyte tall fescues produced higher animal performance than native endophyte tall fescue, and higher gain per acre than either small grains or native endophyte tall fescue. These novel endophyte tall fescues offer potential benefits related to decreased risk of stand establishment of annual forage crops and high animal performance.

Table 1. Effects of forage type on steer BW and performance for fall 2003 and spring 2004.

Item	Forage[a]				SE[b]
	Kentucky 31	Jesup AR542	HM11	Wheat Rye	
Season	Fall				
Grazing Initiation	16-Sept	16-Sept	16-Sept	11-Nov	
Grazing Termination	23-Dec	23-Dec	23-Dec	23-Jan	
Grazing Days	98	98	98	72	
Body Weight, lbs					
Initial Weight	435	436	433	450	4.8
Final Weight	554[x]	605[y]	602[y]	621[y]	11.3
Average daily gain, lb	1.21[x]	1.72[y]	1.72[y]	2.37[z]	0.11
Total Gain per Steer, lb	118.6[x]	168.1[y]	168.5[y]	170.8[y]	9.19
Season	Spring				
Grazing Initiation	17-Mar	17-Mar	17-Mar	17-Mar	
Grazing Termination	8-July	8-July	8-July	12-May	
Grazing Days	113	113	113	56	
Body Weight, lbs					
Initial Weight	451	454	449	451	5.6
Final Weight	564[x]	684[y]	677[y]	555[x]	11.92
Average daily gain, lb	1.00[x]	2.03[y]	2.02[y]	1.86[y]	0.10
Total Gain per Steer, lb	113.2[x]	229.9[y]	227.7[y]	104.4[x]	9.20
Body weight gain/acre, lb	461[x]	827[y]	822[y]	493[x]	32.3

[a] Kentucky-31 = Kentucky 31 infected with the endemic (or native) endophyte, Jesup AR542 = Jesup tall fescue infected with the AR542 endophyte (MaxQ; Pennington Seed Inc.; Madison, GA), and HM11 = HiMag tall fescue infected with the Number 11 endophyte (University of Arkansas, Fayetteville), and Wheat-Rye was planted at a rate of 60 lb/acre of Soft Red Winter Wheat (Delta King 9027) and 60 lbs of Rye (Wintergrazer70) into a clean-tilled seed bed on September 7, 2003.

[b] Standard Error of the mean.

[x,y,z] Least-square means with uncommon superscripts differ ($P \leq 0.05$).