EFFECTS OF FESCUE ENDOPHYTE AND INTERSEEDED CLOVER ON STEER PERFORMANCE ON KENTUCKY 31 TALL FESCUE

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Story in Brief

A total of 173 Angus, Brahman x Angus, and Simmental x Brahman-Angus steers (7 to 12 months old) were used in a 3-year study on the effects of fescue endophyte and clover on performance of stocker cattle grazing Kentucky 31 Tall Fescue. Steers of all breeds gained faster on interseeded clover and low endophyte pastures than on high endophyte fescue. However, the effect of the endophyte was not the same for all breeds. Brahman x Angus steers gained faster than Angus on all three pasture treatments, but Brahman x Angus steers had a greater advantage over Angus on high endophyte pasture (.62 lb/day), than on interseeded clover (.48 lb/day) or low endophyte fescue (.19 lb/day). Gains of Simmental x Brahman-Angus steers were similar to gains of Angus steers. The endophyte caused increases in body temperature only in late May, although the effect was not the same for all breeds. Temperatures of Brahman x Angus steers were not increased by grazing endophyte infected fescue but Angus and Simmental x Brahman-Angus had increased temperatures. Higher body temperatures were also seen with steers grazed on interseeded clover-fescue pastures although temperatures were not as elevated as on endophyte infected fescue alone. This study shows that interseeding clover with endophyte infected tall fescue can help overcome the detrimental effects of the endophyte on cattle gains. Breeds of cattle apparently differ in their ability to tolerate the toxic effects of the endophyte.

(Key Words: Fescue, Endophyte, Grazing, Clover.)

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Materials and Methods

A total of 173 Angus, Brahman x Angus and Simmental x Brahman-Angus, 7- to 12-month old steers were used to study effects of grazing tall fescue on weight gains and rectal temperature. The study was initiated in the fall of 1985 at the Kerr Center, Inc. near Poteau in Eastern Oklahoma. All steers originated from the cow herd at the Kerr Center. The three pasture treatments were: (1) high endophyte (76% infected); (2) high endophyte (74% infected) interseeded with clover, and (3) low endophyte (.7% infected).

Three pastures of each forage treatment (total of nine pastures) were randomly arranged in a wagon wheel design around a set of working and weighing facilities. Pasture sizes varied from 11 to 14 acres. The soil is Neff silt loam. Endophyte infection rate was determined from seed samples taken throughout the pastures in early June of 1985, 1986, and 1988. Seed samples were analyzed by the Fescue Toxicity Diagnostic Center, Auburn University, Auburn, AL.

The entire area had an old established stand of Kentucky 31 tall fescue. Low endophyte pastures were established by spraying three times with Paraquat beginning in the spring of 1984 to prevent seed production, followed with moldboard plowing, and seeding with one year old Kentucky 31 tall fescue testing 0% live endophyte. Soil pH, P, and K were maintained according to soil test recommendations. The interseeded clover treatment received no N fertilizer, but both the high and low endophyte treatments received 246 lb N fertilizer per acre each September. The interseeded clover pastures were overseeded each September with Redland red clover, Regal ladino clover, and Yuchi arrowleaf clover. Red clover became the dominant clover.

All steers were implanted with Ralgro each year at the beginning of grazing study and again at the March weighing. Average beginning steer weights were 484, 497, and 541 lb for 1985-87, respectively. Grazing began about November 6 and ended about May 20 for a 196-day period. Weights were taken after overnight withdrawal from feed and water at 42-day intervals except for the final period which lasted 28 days. Supplemental bermudagrass hay was fed when snow and ice occurred although only an average of 99 lb/steer was fed each year. Stocking rates were adjusted by adding or removing extra steers in order to equalize forage availability between pastures and also to better utilize the spring growth. Only data from steers maintained on the pastures throughout the season were used for analysis.

Rectal temperatures were taken with an electronic digital thermometer on the final weigh date the first year and at every weigh date during years 2 and 3. Weighing was completed before 10:00 a.m. and the order in which

pasture groups were weighed was arranged to minimize bias because of the natural rise in body temperature during the day.

Results and Discussion

Average daily gains for each weighing period are shown in Table 1. Steers of all three breeds gained faster for the total grazing period on low endophyte and interseeded pastures than for high endophyte pastures ($P<.01$). However, the effect of pasture treatments was not the same for all steer breeds, and daily gains are shown for each breed and pasture treatment combination. The interaction between treatment and steer breed for daily gain was significant for the total grazing period and for the 2nd, 4th and 5th grazing periods. A breed x treatment interaction means that all breeds did not respond the same to the different pasture treatments. Brahman x Angus steers gained faster ($P<.05$) than Angus on all three pasture treatments but Brahman x Angus steers exhibited a greater advantage over Angus steers on the high endophyte pasture (.62 lb/day) than on interseeded (.48 lb/day) or

Table 1. Daily gains (lb) for Angus (AN), Brahman x Angus (BA) or Simmental x Brahman-Angus (SxBA) steers grazing high endophyte (HE), low endophyte (LE) or high endophyte fescue interseeded with clover (IS)[a].

		Grazing period ending date[b]					
Treatment	Breed	18Dec	29Jan	12Mar	23Apr	20May	Total
HE	AN	1.96^{cd}	.95^{c}	.66^{c}	1.32^{c}	.73^{c}	1.14^{c}
HE	BA	2.46^{e}	1.39^{ef}	1.08^{ef}	2.09^{d}	1.89^{ef}	1.76^{de}
HE	SxBA	1.62^{c}	.90^{c}	.86^{cd}	1.45^{c}	1.21^{d}	1.21^{c}
IS	AN	2.42^{e}	1.43^{ef}	1.23^{ef}	2.22^{d}	1.68^{de}	1.78^{e}
IS	BA	2.88^{f}	1.66^{f}	1.50^{f}	2.63^{e}	2.72^{h}	2.26^{g}
IS	SxBA	1.71^{c}	.86^{c}	1.28^{ef}	2.26^{c}	2.11^{fg}	1.61^{d}
LE	AN	2.90^{f}	1.25^{def}	.81^{d}	2.09^{d}	2.46^{fg}	1.87^{e}
LE	BA	3.01^{f}	1.47^{de}	1.10^{e}	2.11^{d}	2.81^{h}	2.04^{f}
LE	SxBA	2.06^{d}	.99^{cd}	.79^{d}	2.22^{d}	2.44^{gh}	1.65^{d}
Significance[i]							
Treatment		*	NS	*	**	**	**
Breed		**	**	**	**	**	**
Treatment x Breed		NS	*	NS	**	*	**

[a] 3-year means.

[b] Grazing periods were 42 days except the last, which was 28 days.

c,d,e,f,g,h Means in a column with different superscripts differ ($P<.05$).

[i] *,** Indicate significance at the .05 and .01 probability levels, respectively, NS = not significant.

low endophyte pastures (.17 lb/day). Compared to Angus steers, daily gains of Simmental x Brahman-Angus steers for the total grazing period tended to be greater on the high endophyte pastures (.07 lb/day) but were less ($P<.05$) on interseeded and low endophyte pastures (-.17 and -.22 lb/day, respectively).

In general, steers grazing low endophyte and interseeded clover pastures gained faster in each intermediate period than high endophyte steers. The greatest differences were observed during the periods from mid March to late May ($P<.01$). Smaller differences in favor of low endophyte and interseeded clover treatments compared to high endophyte were seen during the November to mid December and mid January to mid March periods ($P<.05$). Pasture treatment differences were not different during the mid December to late January period. These observations strongly suggest that season and(or) temperature influenced the effects of endophyte toxins in these tall fescue pastures. The relative gain advantage for Brahman x Angus compared to Angus and Simmental x Brahman-Angus steers was greater on high endophyte and interseeded clover pastures than on low endophyte pastures.

Body temperatures for the different pasture treatments and cattle breeds are shown in Table 2. No differences in body temperature were detected at mid December to late April weigh dates ($P>.30$). However, on May 20, presence of the endophyte caused significant increases in body temperature for Angus and Simmental x Brahman-Angus steers.

Table 2. Rectal temperatures (F) on May 20 for Angus (AN), Brahman x Angus (BA) and Simmental x Brahman-Angus (SxBA) steers grazing high endophyte (HE), low endophyte (LE) or high endophyte fescue interseeded with clover (IS)[a].

	Breed		
	AN	BA	SxBA
Treatment			
HE	104.2[e]	102.7[c]	103.3[d]
IS	103.6[d]	102.8[c]	102.7[c]
LE	102.0[b]	102.5[bc]	102.4[bc]

Significance[e]	
Treatment	P<.01
Breed	P<.01
Treatment x Breed	P<.01

[a]3-year means.
[b,c,d]Means on a line or column with different superscripts differ (P<.05).
[e]*,**Indicate significance at the .05 and .01 probability levels, respectively, NS = not significant.

Temperatures of Angus and Simmental x Brahman-Angus steers were higher ($P < .05$) from high endophyte pastures than for low endophyte pastures with interseeded clover steers intermediate. Rectal temperatures of Brahman x Angus steers were not affected by pasture treatment. A number of Angus and Simmental x Brahman-Angus steers exhibited rectal temperatures above 106°F with the highest being 107.3°F for one Simmental x Brahman-Angus steer in 1987.

Although elevated body temperatures occurred only at final weigh date on May 20, reduced steer gains caused by the high endophyte occurred on 4 of 5 weigh dates. Thus, while elevated body temperature is a symptom of fescue toxicosis, gains can be reduced by the endophyte without body temperature being affected. Highest gains were seen with interseeded clover steers although their body temperatures were intermediate between high and low endophyte.

It appears that elevated body temperatures occur only when environmental temperatures begin to exceed 80°F in May and that the effect of the endophyte is in restricting the body's ability to control body temperature. That is to say that these cattle did not have a true fever, but rather could not control their body temperature when the environmental temperature was high. Research at other universities has also shown the effect of the fescue endophyte to be temperature dependent.

It is important to note that the Brahman x Angus steers did not have elevated body temperatures which were characteristic in the Angus and Simmental x Brahman-Angus steers in May. This suggests that the heat tolerance and(or) characteristics of Brahman cattle may somehow permit these cattle to overcome the detrimental effects of the endophyte toxins.

Stocking rates were determined following visual appraisals of quantity of forage available. High endophyte pastures had the highest stocking rates and still had excess forage in the spring. The presence of excess forage in spring for the high endophyte pasture should not, however, necessarily be interpreted as meaning that high endophyte fescue produced more forage than low endophyte fescue. A number of studies have shown that the presence of endophyte in fescue reduces forage intake. Further, the degree of intake depression is greater when cattle are exposed to warmer temperatures.

An excellent stand of red clover was maintained in the interseeded clover pastures, and while individual steer gains were similar to those on the low endophyte, stocking rates were less on interseeded clover until mid April. This is because nitrogen fertilization could not be used in the fall with clover present in the pastures. Mean stocking rates were .82, .67 and .74 steers per acre for the high endophyte, interseeded clover, and low endophyte, respectively. This would give an estimated 232, 252, and 277 lb/acre gain for the high endophyte, interseeded clover, and low endophyte, respectively.

Grazing was terminated each year about May 20 because: (1) the cattle from high endophyte gained poorly during the last weigh period and were visibly affected by fescue toxicosis, (2) many of the other cattle were weighing over 880 lb and were ready for the feedlot, and (3) growth rate and quality of the pastures were deteriorating. No visible evidence of stand deterioration was noted in the low endophyte pastures throughout and at the end of the study.

In conclusion, Brahman x Angus steers gained faster on high endophyte and interseeded clover pastures than the Angus steers, and the advantage of Brahman x Angus steers was less on low endophyte pasture. Steer gains were similar on interseeded clover and low endophyte. Thus, the clover had a very positive effect in reducing the effect of the endophyte. Elevated body temperature did not occur in the Brahman x Angus steers, but did occur in Angus and Simmental x Brahman-Angus steers only in May, indicating that environmental temperature influenced body temperature. Reduced steer gains from high endophyte, however, occurred throughout much of the grazing season without elevated body temperatures. Therefore indicating that the endophyte affects physiological processes other than temperature control. Also, the other processes appear to be influenced by breed type.