Research Update: Beef Cattle Management Considerations for Grazing Tall Fescue

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Introduction

It has been reported that 8 million beef cattle graze an estimated 35 million acres of endophyte-infected tall fescue in the United States with the majority of tall fescue being produced in the Midwest and southeastern regions of the United States. In the presence of the endophytic fungus, ergot alkaloids are present that when consumed by beef cattle results in decreased animal performance as measured in reduced weight gains, lower body condition scores, decreased conception rates, rough hair coats and the inability to regulate body temperatures. It has been estimated that this loss in animal performance accounts for a $600 million annual loss to beef producers. Recently, novel endophyte varieties of tall fescue have been identified that reportedly have the same agronomic advantages without causing the depression in animal performance exhibited by older varieties.

Research projects investigating methods to improve beef cattle performance and reduce the negative effects in animal production associated with grazing endophyte infected tall fescue have recently been conducted by the faculty and staff of the Department of Animal Sciences at the University of Illinois in an effort to provide producers with research based recommendations for profitable beef production. This paper will serve as an overview of recent beef cattle research conducted at the University of Illinois' Dixon Springs Agricultural Center addressing the performance of animals grazing tall fescue.

Study 1

Grazing novel endophyte-infected tall fescue following grazing endophyte-infected tall fescue as a means to minimize fescue toxicosis in beef calves

Introduction

In each of 2 years, 36 fall-born, Simmental x Angus calves (Yr. 1: steers, body weight (BW) = 401 ± 62 lbs; Yr. 2: heifers, BW = 530 ± 35 lbs) were stratified by BW and randomly allotted into 6 groups. Groups were randomly assigned 1 of 3 treatments; 1) Endophyte-infected (E+) (May 2 – September 18, 2012 or May 1 – August 30, 2013), 2) Novel endophyte (NE) (May 2 – September 18, 2012 or May 1 – August 30, 2013), and 3) E+ (May 2 – July 10, 2012 or May 1 – July 1, 2013; period 1) followed by NE (July 11 – September 18 2012 or July 2 – August 30, 2013; period 2; E+/NE). Groups were grazed on 10 ac pastures that were subdivided into six 1.33 ac paddocks, and were rotated every 5 days. Put-and-take cattle were used to maintain similar forage availability. Calf BW, body condition score (BCS;1 = emaciated, 9 = obese), and hair coat score (HCS; 1 = sleek, short; 5 = long, dull) were taken at the initiation, mid-point between periods, and the conclusion of study. Resting respiration rate was taken at the mid-point of each period via visual estimation. Period 1 data were analyzed using a contrast of NE vs. E+ and E+/NE, as both treatments were grazed on E+ pastures during this time.

Results

There were no differences in initial BW, BCS, or HCS between treatments. At the end of period 1, cattle grazed on NE had greater BW than those grazed on E+, as they experienced greater average daily gain (ADG). Cattle grazed on NE during period 1 also had greater improvement in HCS, while BCS tended to be greater at the end of the period. There was no difference in respiration rate during period 1. Final BW was not different between cattle grazed on NE and E+/NE during period 2, with both treatments being heavier than those grazed on E+ continuously. This is due to the fact that cattle switched from E+ to NE pastures during period 2 exhibited compensatory ADG, resulting in no difference in overall ADG between NE and E+/NE treatments for the duration of the study. There also were no differences in final BCS or HCS between cattle grazed on NE and E+/NE, with both treatments having greater BCS and HCS improvement than cattle grazed on E+. Period 2 respiration rate was greatest for E+, lowest for cattle grazed on NE, and intermediate for E+/NE. There were substantial differences in the two years in which this study was conducted. The first year,

2012, was characterized by extreme drought and high temperatures. The second year, 2013, was characterized by significantly more rainfall and milder temperatures. Differences in environmental stress and the difference in initial calf BW may explain the significant effects of year that were observed.

Implications

Cattle grazed on novel endophyte-infected fescue during late summer after grazing endophyte-infected fescue experienced compensatory gains and had similar overall performance relative to those grazed on novel endophyte-infected fescue continuously. Partial pasture renovation with novel endophyte-infected fescue may be an effective strategy to mitigate the effects of fescue toxicosis while reducing the cost of pasture renovation to the beef operation.

Study 2

Differences in forage quality when comparing novel and endophyte-infected tall fescue over the grazing season

Introduction

Objectives were to compare forage characteristics and in situ digestibility of novel and endophyte-infected tall fescue over the growing season. Tall fescue is widely used for grazing beef cattle predominantly in the Southeastern United States. Endophyte-infected tall fescue (KY-31) possesses many positive agronomic qualities, but can depress cattle growth due to ergot alkaloid-producing endophytes. Novel endophyte-infected tall fescue (MaxQ) combines the agronomic advantages of KY-31 with improved cattle performance. However, comparison of forage quality between MaxQ and KY-31 is lacking. We hypothesized MaxQ would have greater in situ digestibility than KY-31, in part due to decreased ADF and NDF concentrations when compared to KY-31. Samples were taken at 10 d intervals over 70 d, beginning May 28. Clipped samples were collected from randomly selected locations in 4 different paddocks per cultivar at each time point. Forages were analyzed for DM, NDF, and ADF. Composite samples were incubated in ruminally fistulated steers (n = 2) for 12 and 24 h to determine in situ DM disappearance (DMD) and NDF disappearance (NDFD). Data were analyzed using the MIXED procedures in SAS (SAS Inst. Inc., Cary, NC) with repeated measures. There were interactions of cultivar by d collected for ADF ($P = 0.03$) and NDF ($P < 0.01$). On d 20, 30, 50, and 60 of collection, paddocks of KY-31 had 2.5 to 7.8 percentage units greater NDF than paddocks of MaxQ. Similarly, on d 20, 30, 50, 60, and 70 of collection, paddocks of KY-31 had 3.0 to 6.2 percentage units greater ADF than paddocks of MaxQ.

Results

There were no interactions ($P \geq 0.16$) of cultivar, incubation time, or week sampled for DMD. As expected, the 24-h in situ DMD was greater ($P < 0.01$) than the 12-h in situ DMD. Over the course of the growing season, DMD of both MaxQ and KY-31 decreased ($P < 0.01$). There was an interaction ($P = 0.05$) of incubation time and sampling d on NDFD. From d 10 through d 40, 24-h NDF digestibility was greater than 12-h NDF digestibility; however, from d 50 through d 70, there was no difference in 12 versus 24-h in situ NDF digestibility.

Implications

Although forage quality differed over the growing season, lack of difference in in situ DMD and NDFD between MaxQ and KY-31 suggest that improved forage quality is not the mechanism for increased performance of cattle grazing MaxQ compared to those grazing KY-31.

Study 3

Evaluation of KY-31 and Jesup MaxQ tall fescue for fetal development, growth, and reproductive performance in beef cattle

Introduction

Eighty fall calving Angus crossbred cows were grazed in 8 groups on either endophyte-infected KY-31 tall fescue (E+) or novel endophyte (NE; Jesup MaxQ) from May 28, 2014 through the end of calving on October 8, 2014. Cow body weights, body condition scores, hair coat scores, and serum for prolactin concentration analysis were taken on days 0, 1, 63, 64, 97, and 98. Respiration rates were taken on days 5-8, 68-72, and 102-105 of the study. Calves were weighed, tagged, and vaccinated immediately upon located them after birth. Milk production was measured utilizing a weigh-suckle-weigh (WSW) procedure at approximately 60 days postpartum.

Results

There were no significant differences (P ≥ 0.10) in calf birth weight, Julian calving date, body weight at WSW, milk production, AI conception rates or overall conception between cow treatments. Prolactin concentrations were higher (P < 0.05) for cows grazing novel endophyte tall fescue with interactions of time, treatment, and time x treatment. Cow respiration rates tended to be lower (P< 0.10) with a time x treatment interaction. Cows grazing novel endophyte tall fescue tended to have lower respiration rates than cows that grazed the Ky-31.

There was a tendency for calf body weight (P=0.10) and body condition score (P=0.06) of calves to differ by dam treatment. Calves born to cows that grazed novel endophyte tall fescue tended to be heavier and have a higher body condition score than calves born to cows that grazed endophyte tall fescue. Dam treatment and time x dam treatment did not differ (P≥0.14) for respiration rates, hair coat scores, and prolactin concentrations of calves.

There were no differences (P ≥ 0.10) in the feedlot performance or carcass characteristics (HCW, backfat, loin eye are, marbling, yield grade or KPH) of the Charolais/Angus crossbred progeny.

Implications

The nutritive value of tall fescue in the fall, whether E+ or NE, is at one of the highest level of the year and, in many cases, will meet the nutritional requirements of mature, non-lactating beef cows at this time of year. Research results indicate there is no reduction in conception rates for fall bred beef cows grazing E+ as opposed to the reduction in conception rates seen in spring bred herds. There does appear to be a benefit of reduced RR in cows grazing NE. There was a tendency for calves born to cows that grazed E+ during gestation to perform better when grazing E+ tall fescue than calves born to cows that grazed NE during gestation. This data suggests that we may be altering fetal development during gestation resulting in offspring that are more adapted to certain environmental conditions.

Study 4

Effects of eprinomectin on heifers grazing endophyte-infected tall fescue

Introduction

Angus-cross heifers were stratified by BW and were assigned to 1 of 2 treatments: 1) Control (Saline Solution; n = 99) or 2) LongRange (n = 100). Heifers were injected with 1 mL/50 kg BW of either LongRange or Saline. Two weeks prior to treatments, all heifers were given oral fenbendezole (SafeGuard; 2.5 mg/lb) to remove internal parasites. Throughout the trial, heifers grazed endophyte-infected fescue pastures as 1 group and were rotated among pastures as determined by forage availability.

Forage samples were collected for proximate analysis and forage heights were measured on d 1, 17, 31, 45, 59, 73, 87, and 116.

Results

LongRange increased weight gains from 55 d to 291 d post-treatment, improved ADG throughout the entire study, and increased BCS from 112 d to 291 d post-treatment. Respiration rates were numerically decreased for heifers given LongRange, with no significant differences observed. Furthermore, at 111 d post-treatment, heifers injected with LongRange had a decreased fecal egg count compared to Control heifers. However, there was no effect of LongRange on heifer serum prolactin concentrations. At the final pregnancy check, a greater percentage of heifers given LongRange were confirmed pregnant compared to Control heifers.

Implications

Treating heifers with sustained released eprinomectin resulted in increased body weight gain and improved conception rates in growing beef heifers grazing endophyte-infected tall fescue summer pastures and placed in a fall calving herd. This improvement was experienced even in the absence of internal parasites. Previously reported research suggests that compounds in the avermectin family may improve performance of cattle grazing endophyte-infected tall fescue. While no differences were seen in serum prolactin concentrations between treatments, heifer development

was enhanced with eprinomectin treatment which may account for the improvement in conception rates. The numerical reduction in respiration rates may indicate an improvement in the heifer's ability to maintain a lower body temperature while grazing E+ tall fescue. There is a savings in time associated with a sustained release drug administration compared to other formulations requiring several injections over time. Further research is needed to determine the mechanisms responsible for the improvement in performance.

Fescue Tolerance Testing

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Fescue toxicosis is characterized by clinical symptoms such as vasoconstriction, immunosuppression, and poor thermoregulation. Fescue toxins bind to membrane receptors of cells that control constriction of blood through capillaries responsible for heat dissipation. When cattle consume toxic tall fescue, they lose ability to move blood to their skin where heat can be lost to the environment. As they lose this ability they become more prone to heat stress. In the winter, this lack of blood flow leads to other clinical symptoms, such as fescue foot and loss of tail switch, that occur from restricted blood flow.

Fescue toxicosis is also characterized by poor performance, such as low rate of gain, low weaning weight, low conception rate, and low milk production. This lack of production costs beef producers between $180 and $200 million each year in Missouri alone; it costs livestock producers in the eastern US well over $1 billion annually.

Two approaches to reducing the impact of fescue toxicosis is 1) to replace toxic fescue with a nontoxic grass, or 2) manage the toxic grass with a series of effective practices. One of the newest management practices is the selection of animals that are tolerant to toxic tall fescue.

Cows were grazed on toxic tall fescue and calf weaning weight was measured. DNA was sampled from the cows and analyzed to determine if any genetic similarity could be found between the dam's DNA and weaning weight of the dam's calf. A genetic pattern was identified that was predictive of weaning weight. The genetic pattern of the dam that correlated to its calf's weaning weight were genes that play a role in regulating cell membrane receptors.

Research to date has measured a difference of 112 Lbs in weaning weight loss due to a susceptible dam grazing toxic tall fescue compared to nontoxic forage. Selecting for fescue tolerance results in approximately 56 Lbs greater weaning weight. It is possible to select for cows that are more tolerant to toxic tall fescue. As with any single trait marker, single trait selection is not wise. It is possible that the best producing cows in a herd or fescue intolerant. Consequently, consideration of using T-Snip testing should be as part of the selection criteria for a herd.