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Herbage Quality, Biomass, and Animal Performance of Cattle Grazing

Part II: Animal Performance

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Introduction

Although there are several well-adapted forages for Virginia's climate, early spring, mid-summer, and late fall are often low in forage productivity. Any forage crop that stretches the grazing season by providing additional feed in early spring, mid-summer, and late fall – when the productivity of the typical cool-season forages is low – will provide the livestock producer with lower feed costs and boost animal performance.

Materials and Method

For a detailed protocol on pasture establishment and management, refer to *Herbage Quality, Biomass, and Animal Performance of Cattle Grazing – Part I: Forage Biomass, Botanical Composition, and Nutritive Values*, Virginia Cooperative Extension publication 418-151. Three Angus crossbred steers (average body weight 614 pounds) were assigned to each treatment replicate, with a stocking rate of 1.1 steers per acre. Pastures were managed under rotational stocking, with each pasture subdivided into six paddocks (1.1 acres per paddock). Animal movement from paddock to paddock was determined by available forage (based on residual height and/or forage biomass). All animals were treated for internal parasites, and trace mineral salt (98 percent sodium chloride, 0.20 percent zinc, 0.20 percent manganese, 0.50 percent iron, 0.045 percent copper, 0.002 percent iodine, and 0.007 percent cobalt; from Cargill Inc., Minneapolis) was available by free choice to all animals. During the 2004 and 2005 grazing seasons, two or three of the sub-paddocks were mowed for hay during the month of June. In 2005, due to excessive forage growth driven by the nitrogen application and the ample moisture, additional (to the one annual mowing) hay was removed from three of six Lakota paddocks in all replications. The three paddocks had a sufficient amount of forage to supply feed for at least 10 days per paddock.

In 2003, grazing began in July; grazing began in May for the 2004 and 2005 grazing seasons. Each year, animals were weighed and blocked by age and weight prior to assignment to field treatments. A front and back fence of single-strand, electrified polywire was used to allocate seven to eight days of pasture forage at a time on all treatments throughout the trial. As animals were rotated, a portable 60-gallon trough was used to provide water in every paddock. Animals were weighed at the beginning and end of the grazing season, and full weights were taken every 28 days. A new group of young/growing animals was used each experimental year. Data were analyzed as a randomized complete block design (SAS 1982). The effect of treatment, field block, date, year, and all two- and three-way interactions were tested.

Animal Performance

In 2003, the cumulative weight gain of steers on Kentucky 31 endophyte-free tall fescue (KY31 E-) was more than that of steers on Lakota prairie grass, Kentucky 31 endophyte-infected tall fescue (KY31 E+), or Quantum (figure 1A). Overall, the cumulative weight gains of steers on Lakota prairie grass, Quantum, KY31 E+, and KY31 E- were less in 2004 than in 2003 or 2005. In 2004, steers on Lakota prairie grass gained

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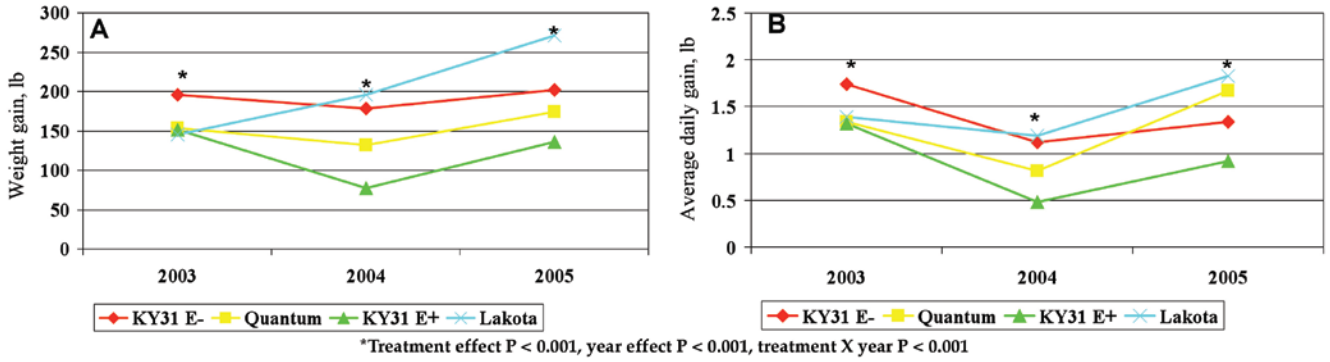
more weight than steers on the other treatments. Steers on Lakota prairie grass also gained the most in 2005, followed by steers on KY31 E- (figure 1A). The smallest gain by steers was observed in those grazing on KY31 E+.

Similar results were observed for average daily weight gain (figure 1B). From July through October of 2003, steers on KY31 E- gained the most, while no difference in cumulative weight gains was observed among steers grazing on KY31 E+, Lakota, and Quantum (figure 2A). In July, the average daily gains of steers grazing KY31 E- and Quantum were similar (2.42 pounds and 1.78 pounds, respectively), while for steers on KY31 E+ and Lakota, the average daily gains were less than that of steers on KY31 E-. In August, there was no difference in average daily gains among steers grazing the different forage types. In September, the average daily gains of steers on KY31 E+ and KY31 E- (1.94 pounds and 1.54 pounds, respectively) were more than the gains for those on Lakota and Quantum (1.28 pounds and 1.21 pounds, respectively). In October, however, the average daily gain of steers on Quantum was more than the gain of steers that grazed on KY31 E+. This difference in average daily gain was more than 50 percent (2.2 pounds for Quantum and 1.08 pounds for KY31 E+). Average daily gains of steers on KY31 E- and Lakota were similar (figure 2B).

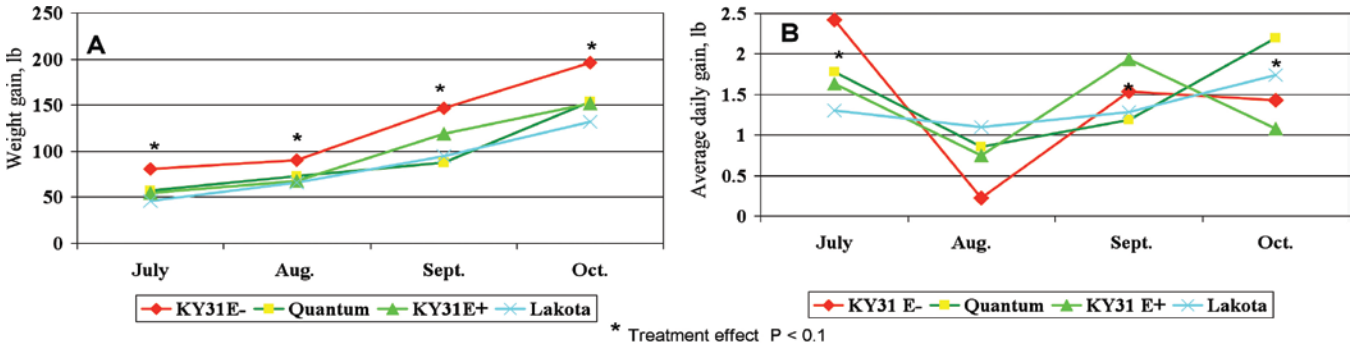
In 2004, initial gains of steers on KY31 E- and Quantum were more than those on KY31 E+ but similar to steers on Lakota. The cumulative weight gain of steers on Lakota increased more than that of steers on the rest of the treatments. In October, the cumulative weight gain of steers on Lakota was more than that of steers on KY31 E-, Quantum, or KY31 E+. The total cumulative weight gains were 196 pounds for Lakota, 178 pounds for KY31 E-, 132 pounds for Quantum, and 79 pounds for KY31 E+ (figure 3A). Steers grazing Lakota prairie grass gained 18 pounds more than steers grazing on KY31 E-, 64 pounds more than steers grazing on Quantum, and 117 pounds more than steers grazing on KY31 E+. In May and June, there was no difference in average daily gain among treatments. However, from July through October, the average daily gain of steers grazing on Lakota was more than that of steers

Figure 1. Accumulated weight gain (A) and average daily gain (B) of steers grazing Lakota prairie grass, Kentucky 31 endophyte free (KY31 E-) tall fescue, Kentucky 31 endophyte infected (KY31 E+) tall fescue, and Quantum 542 tall fescue, averaged over treatments and months.



*Treatment effect P < 0.001, year effect P < 0.001, treatment X year P < 0.001

Figure 2. Accumulated weight gain (A) and average daily gain (B) of steers grazing Lakota prairie grass, Kentucky 31 endophyte free (KY31 E-) tall fescue, Kentucky 31 endophyte infected (KY31 E+) tall fescue and Quantum 542 tall fescue for the **2003** grazing season.



* Treatment effect P < 0.1

on Quantum and KY31 E+ but similar to steers on KY31 E-. Overall, the average daily gain of steers on Lakota was slightly more than that of steers on the fescue treatments (figure 3B).

From June through October of 2005, steers grazing on Lakota gained more weight than steers grazing on the other three treatments. The slight drop in cumulative weight gain in October by steers on Lakota was a reflection of low available forage, driven by the lack of moisture in September. In September, the cumulative weight gain of steers was 293 pounds for Lakota, 205 pounds for KY31 E-, 178 pounds for Quantum, and 130 pounds for KY31 E+. The difference in cumulative weight gain of steers on Lakota versus KY31 E- was 88 pounds, versus Quantum was 114 pounds, and versus KY31 E+ was 163 pounds (figure 4A).

Although the actual cumulative weight gain of steers on all treatments in 2005 was more than in 2004, the trend was similar. As in 2004, the average weight gain of steers on Lakota in 2005 was more than the weight gain of steers on the fescue treatments. The sharp decline in average daily gain (figure 4B) of steers on Lakota at the end of the grazing season is the reflection of the decline in biomass yield. Generally, in two of the three experimental years, the steers' cumulative weight gain and average daily gain were higher for those on Lakota than for those on the fescue treatments. The difference in cumulative weight gain – as well as the average daily gain – between Lakota and the fescues was more pronounced in mid-summer than in early spring or fall. This difference was more pronounced for animals grazing on KY31 E+ than for those grazing on Quantum or KY31 E-. Steers on KY31 E+ gained the least weight and showed the classic endophyte-toxic effect of the grass. The effect of KY31 E+ on animal performance was well documented by Boland (2005) in the study she conducted to investigate the effect of the three fescue types and Lakota on the grazing behavior of steers.

Figure 3. Accumulated weight gain (A) and average daily gain (B) of steers grazing Lakota prairie grass, Kentucky 31 endophyte free (KY31 E-) tall fescue, Kentucky 31 endophyte infected (KY31 E+) tall fescue and Quantum 542 tall fescue for the **2004** grazing season.

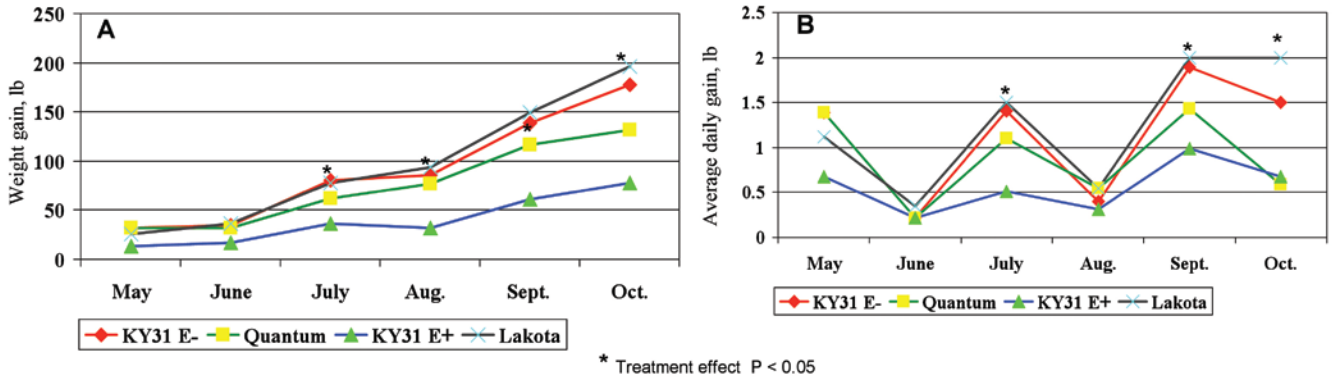
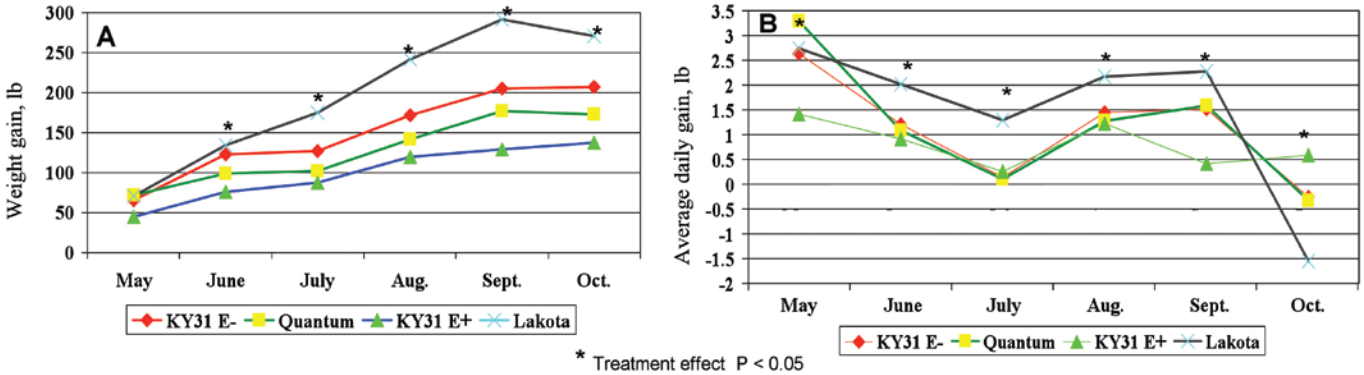


Figure 4. Accumulated weight gain (A) and average daily gain (B) of steers grazing Lakota prairie grass, Kentucky 31 endophyte free (KY31 E-) tall fescue, Kentucky 31 endophyte infected tall (KY31 E+) fescue and Quantum 542 tall fescue for the **2005** grazing season.



Conclusion and Recommendations

The biomass yield of KY31 E+ was often more than that of Lakota and KY31 E- but similar to Quantum (see *Herbage Quality, Biomass, and Annual Performance of Cattle Grazing – Part I: Forage Biomass, Botanical Composition, and Nutritive Values*, Virginia Cooperative Extension publication 418-151). By the third year of establishment, the stand of KY31 E- and Lakota prairie grass was much thinner than the Quantum and KY31 E+. In two of the three years, steers grazing on Lakota prairie grass outperformed (in both cumulative weight gain and average daily gain) the steers on the fescue treatments. The difference between Lakota and KY31 E+ was most evident. There was no difference in animal performance between Quantum and KY31 E-, but animals on both treatments gained more weight than steers on KY31 E+. Animal performance in this study – as well as in a parallel behavioral study (Boland 2005) – showed that steers grazing on KY31 E+ exhibited the negative effects of the endophytic fungus associated with KY31 E+.

Based on our three-year experiment, we conclude that steers grazing on properly managed Lakota can outperform steers on all of the fescues tested. Among the fescue treatments, steers grazing on KY31 E- performed well; however, stand persistence was less than that of Quantum and KY31 E+. Although the biomass of KY31 E+ was the most of all the treatments, animal performance was compromised by the presence of the fungal endophyte. Quantum (equipped with the novel endophyte) yielded similar results to KY31 E- and KY31 E+ during most months but exhibited better animal performance than KY31 E+, making it a possible alternative to KY31 E+ for livestock producers.

References

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