Comparison of Cereal Rye/Annual Ryegrass and Tall Fescue Stocker Grazing Systems in the Southern Great Plains of USA

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Abstract

Use of cool-season perennial grass may decrease cost of production, and improve returns to producers. The objective of this study is to compare the performance of stocker grazing on two systems: cool-season annuals rye/ryegrass vs experimental cool-season perennial tall fescue (*Festuca arundinacea* Schreb. 'AGRFA 144'). Paddocks of annual grass mixture ['Oklon' or 'Maton II' cereal rye (*Secale cereale* L.) and 'Marshall' ryegrass (*Lolium multiflorum* Lam.)] were planted in early September 2005, 2006, and 2007 whereas tall fescue was planted in late September 2005 with four replicates. Beef steers (*Bos* spp.) with average body weight of 245 kg were used. Animals were weighed every 28 days of each grazing season, and stocking rates were adjusted based on forage availability. At each grazing cycle, forage availability, forage quality, and animal performance as average daily gain (ADG) and total gain (TG) were measured. Forage availability and quality for both grasses were high in late winter through spring and decreased thereafter. Animals performed well in both systems with an ADG of 3.06 and 2.50 kg ha^{-1} d^{-1} and TG of 193 and 638 kg ha^{-1} for rye/ryegrass, and ADG of 3.18 and 3.06 kg ha^{-1} d^{-1} and TG of 181 and 405 kg ha^{-1} for tall fescue in 2005-06 and 2006-07, respectively. The difference of TG between two systems was due to higher number of grazing days in annual system compared to the perennial system. Considering stand life of perennial system, tall fescue system may be profitable over time by amortizing the establishment cost.

Media summary

A perennial tall fescue system provides similar quality and quantity of forage production with lesser animal gains compared to a conventional cereal rye/annual ryegrass system but has potential to be profitable over time.

Keywords

Animal gain, annual ryegrass, cereal rye, grazing, performance, tall fescue

Introduction

Livestock producers in the southern Great Plains of USA rely primarily on cool-season annual grasses for grazing during fall to spring (Kindiger and Conley 2002; Butler et al. 2006; Hopkins and Alison 2006). Winter wheat (*Triticum aestivum* L.) or cereal rye are sown annually as forage crops in the southern regions. However, due to higher energy and fertilizer prices, incipient concern is growing regarding the annual production cost of annual systems. In the southern Plains, planting of annual grasses requires land to be fallowed for prolonged periods of time, as a result, precipitation and wind cause a substantial loss of soils and nutrients (Kindiger and Conley 2002). In recent years, there is an increase interest from livestock producers and landowners to shift from annually sown cool-season forages to more permanent perennial cool-season grass systems (Hoveland et al. 1970; Hopkins and Alison 2006). Beef and dairy producers in the southern Plains would be interested in adopting a cool-season perennial grass system, provided that the expected net returns from such as system are greater than or equal to the net returns currently realized under the conventional annual system. Since perennial grasses do not have to be established each year, a potentially large economic benefit could be realized from the substantial reduction in annual production and maintenance costs that are normally encountered with an annual system. With production costs on the rise for annual grass systems, there is substantial need in the southern Plains to develop cool-season pasture systems that can be used as a prime source of high quality forage for livestock in the winter and spring months when warm-season perennial species like bermudagrass (*Cynodon dactylon* Pers.) and bahiagrass (*Paspalum notatum* Flügge) are dormant and unproductive. Such perennial grass systems are not only useful in maintaining a well established livestock industry by promoting economical high rates of gain (Beck et al. 2006), but would also be useful in reducing overgrazing on native rangelands, and would help in reduction of soil erosion from annually sown winter pastures. The objective of this study is to compare performance of a novel cool-season fescue grazing system relative to a conventional rye/ryegrass grazing system.

Methods

The experiment is being conducted at the Noble Foundation's Headquarter Farm located in south central Oklahoma (34°10' N, 97°10' W; 266 m), USA. Initially weeds were controlled in May each year prior to initiating the experiment by using glyphosate [*N*-(phosphonomethyl)-glycine; 0.28 kg a.i. ha^{-1}] and 2,4-D [2,4 dichlorophenoxyacetic acid], 1.1 kg a.i. ha^{-1}). Paddocks, each 0.8 ha in size, were prepared by clean tilling in June or July and fertilizing according to the soil test recommendation in September with fertilizer (18-46-0) at the rate of 55-330 kg ha^{-1}. Plots with nitrogen deficient were also fertilized with fertilizer (34-0-0) at the rate of 110-248 kg ha^{-1} following the soil test results. The experiment was laid out as a randomized complete block design with four replicates comparing two grazing systems: annual system, mixture of Oklon (2005) or Maton II (2006 and 2007) cereal rye plus Marshall ryegrass vs. perennial system, AGRFA 144 experimental tall fescue (Hopkins and Bouton 2007). Seeds of rye/ryegrass were planted using a Great Plains no-till drill in early September each year (2005-2007) at a rate of 112/22 kg of bulk seed ha^{-1}. Tall fescue was initially planted in late September of 2005 at a rate of 19 kg of bulk seed ha^{-1}, followed by two additional plantings with two replicates in late September of 2006 and 2007. Beef steers consisting of Angus and Angus × Brangus cross animals (average body weight of 245 kg) were used in this study. The stocking rates (animals ha^{-1}) were decided based on forage availability ranging 2.5 – 6.9 for rye system, and 2.5 – 3.7 for tall fescue system. Available forage was estimated initially and every four wk of grazing season by random sampling of ten 0.09 m^2 quadrate samples across each paddock. Four 1.2 × 1.2 m exclosures were built with in each paddock, and forage availability and quality were monitored before and after grazing periods by relocating exclosures at starting day of each grazing cycle. Animals were weighed every 28 days for the grazing cycle, and ADG and TG per ha were calculated. Subsamples of dry matter (DM) were used to analyze crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and in vitro true dry matter digestibility (IVTDMD) using near-infrared reflectance spectroscopy (NIRS) analysis. Data were analyzed by analysis of variance using PROC GLM (SAS Institute, 2002) and means were separated using Fisher's protected least significant difference (LSD) at P=0.05 level of significance.

Results and discussion

This is an on-going experiment and data only for the 2005-06 and 2006-07 seasons are reported in this paper. Data for tall fescue planted in 2006 and 2007 were also excluded. Dry and hot weather in 2005-06 shortened the length of grazing period for the rye/ryegrass system due to a delayed start. In 2005-06, a total of 77 days grazing for the annual rye/ryegrass and 56 days for the perennial tall fescue occurred, however in 2006-07, weather condition favored grass growth and the number of grazing days increased for both annual and perennial systems (193 vs 128, respectively). Forage production differed significantly ($P<0.0001$) between periods for each 28 days grazing cycle for both the rye/ryegrass and tall fescue systems, however, the total forage production for both systems were similar (Figure 1). For example, the cumulative forage productions in 2005-06 were 7100 kg DM ha^{-1} for rye/ryegrass and 7800 kg DM ha^{-1} for tall fescue; while for 2006-07, forage yield was 15800 vs 13800 kg DM ha^{-1}, respectively. This amount of forage production is higher than the production reported elsewhere (Schwartz and Semler 1998; Redfearn et al. 2002). Forage quality for both grasses was significantly higher ($P<0.0001$) at the beginning of grazing, and decreased with time. The ranges over the two years for CP and IVTDMD (g kg^{-1}) for rye/ryegrass were 85–299 and 651–978, respectively. In addition, ADF (172–440 g kg^{-1}) and NDF (319–621 g kg^{-1}) increased continuously with time. The forage quality values for rye/ryegrass are quite similar to those that were reported elsewhere (Schwartz and Semler 1998; Butler et al. 2006). Tall fescue had similar trends and values when compared to rye/ryegrass (CP, 101 – 256; IVTDMD, 686–916; ADF, 248–444 and NDF, 453–621 g kg^{-1}).

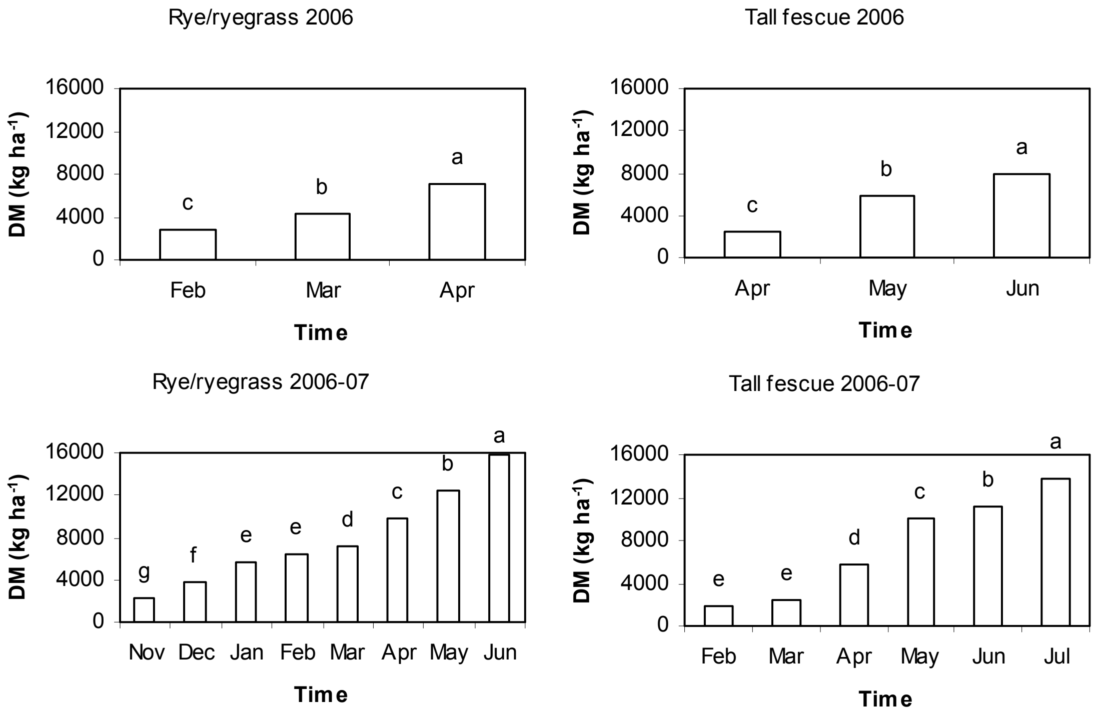

Figure 1. Cumulative dry matter (DM) production for rye/ryegrass and tall fescue systems at Ardmore, OK during 2005-06 and 2006-07 grazing seasons. Means followed by same letters between bars in each system do not differ significantly at P=0.05.

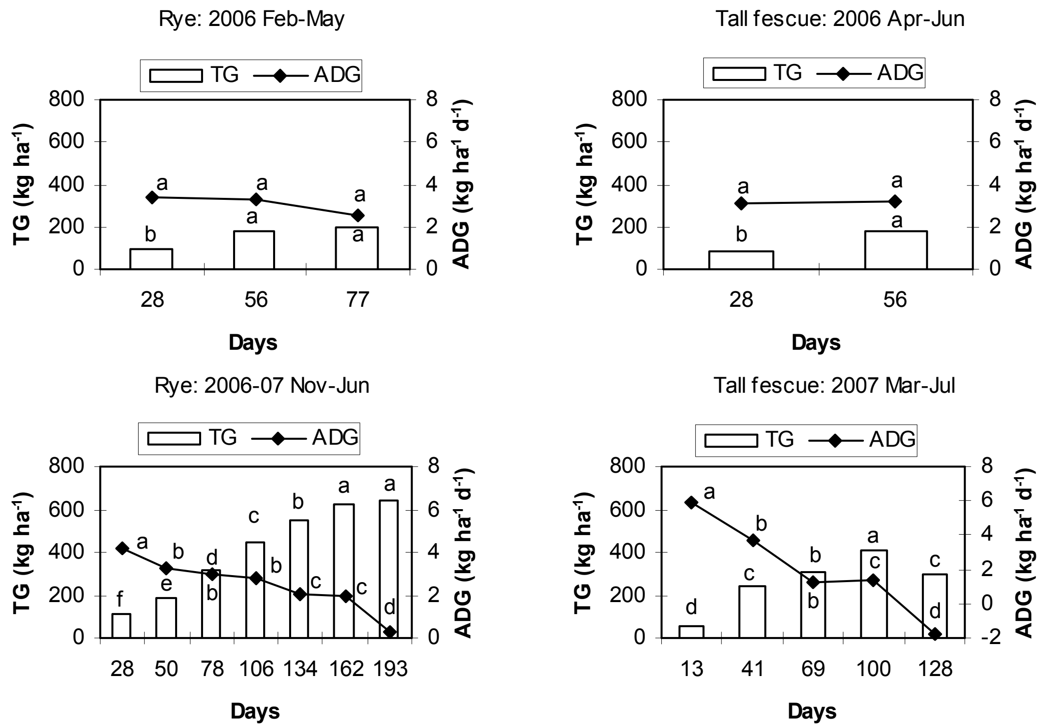

Figure 2. Total gain (TG) and average daily gain (ADG) for steers grazing rye/ryegrass and tall fescue systems at Ardmore, OK during 2005-06 and 2006-07 grazing seasons. Means followed by same letters between bars or within line in each system do not differ significantly at P=0.05.

Average daily gain were similar for both systems (3.06 kg ha^{-1} d^{-1} for Rye/ryegrass; 3.18 kg ha^{-1} d^{-1} for tall fescue system) in 2005-06, however, total gain was greater in the annual rye/ryegrass system (193 vs 181 kg ha^{-1}) due to greater number of grazing days (Figure 2). In 2006-07, number of grazing days, and TG were greater for the annual rye/ryegrass system compared to the tall fescue system (Figure 2). Average daily gain was similar for both systems in 2006-07 except the last grazing cycle. The negative ADG in tall fescue at the end of the season was due to excessive rainfall that interfered with animal grazing, and the lower forage quality during the summer, which resulting in lower TG for tall fescue system (Figure 2). Therefore, last cycle data for tall fescue were omitted in calculation of means. As a consequence, on an average over two years, it appears that, for rye/ryegrass and tall fescue, ADG and TG, especially ADG, are higher than values reported elsewhere in the southern USA (Bransby et al. 2002; Bouton 2005; Beck et al. 2006; Hopkins and Alison 2006). The higher animal performance in this present study could be attributed to greater forage quality and availability. Assuming that the stand life for perennial system is 10 years (Bauer et al. 1997), and by amortizing the establishment cost over this time frame, the perennial tall fescue system would become profitable in the second year in this study in southern Oklahoma, USA. Beck et al. (2006), in northwest Arkansas, estimated that perennial novel endophyte tall fescue system would reach economic advantage over an annual wheat/rye system in 1.8 years. In addition, reducing the time, labor, and equipment requirements each year may encourage producers to adopt this perennial system. Unseen environmental benefits, such as reduction in soil erosion and nutrient loss, and greater soil organic matter are also advantages in the perennial system (Kindiger and Conley 2002).

Conclusion

This study demonstrates that both cereal rye/annual ryegrass and perennial tall fescue systems had similar forage production and nutritive value. Cereal rye/annual ryegrass system provided with better animal gains compared to the perennial tall fescue system because of higher number of grazing days in the annual system. However, considering long stand life of perennial grasses, over time, this tall fescue system may have potential to provide greater net return compared to an annual system.

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