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Forage nutritive value and steer responses to grazing intensity and seed-head suppression of endophyte-free tall fescue in mixed pastures[1]

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ABSTRACT

A 2-yr grazing experiment was conducted with 8- to 10-mo old steers on pastures of endophyte-free tall fescue [Lolium arundinaceum (Schreb.) Darbysh.] in mixture with other grasses to assess the effect of seed-head suppression of fescue on steer performance and forage nutritive values. Treatments with and without seed-head suppression were each combined with either light or moderate grazing intensities for assignment to twelve 1.0-ha pastures of the grass mixtures. The experiment was conducted as a randomized complete block design with 3 replications. Steer ADG was measured, and CP and in vitro DM digestibility (IVDMD) of available forage, and leaf blade and sheaths of fescue tillers, were monitored. Averaged over grazing intensities, ADG was 16% greater ($P < 0.05$) with seed-head suppression; however, a lower ($P < 0.001$) mean stocking rate with seed-head suppression resulted in a tendency of greater ($P = 0.068$) BW gain per hectare without suppression. Crude protein of available forage was consistently greater ($P < 0.01$) with seed-head suppression across all dates, whereas IVDMD was consistently greater ($P < 0.01$) with seed-head suppression in the late grazing season. Crude protein in leaf blades and sheaths of vegetative tillers with seed-head suppression were consistently greater ($P < 0.01$) than vegetative tillers without seed-head suppression. The IVDMD of blades and sheaths was similar ($P > 0.18$) between suppressed and nonsuppressed vegetative tillers, and both had greater ($P < 0.05$) IVDMD than reproductive tillers over most dates. Results showed seed-head suppression of fescue to improve steer ADG by increasing CP in vegetative tissues and improving digestibility of available forage by alleviating lower-quality, reproductive tillers.

Key words: beef cattle, forage quality, plant growth regulation, seed-head suppression, tall fescue

INTRODUCTION

Tall fescue [*Lolium arundinaceum* (Schreb.) Darbysh.] is a cool-season perennial grass that is used as a forage on approximately 14 million ha in the humid east (Thompson et al., 2001). Tall fescue is persistent and productive, but cattle production and thriftiness is low (Hoveland et al., 1980) because of toxic ergot alkaloids produced by a fungal endophyte (*Neotyphodium coenophialum*) that infects most plants of tall fescue (Bacon et al., 1977). Cattle that consume endophyte-infected tall fescue can undergo a toxicosis that causes cattle to exhibit poor weight gain, rough hair coats during the summer months, elevated core body temperatures, and reduced serum prolactin concentra-

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tions (Schmidt and Osborn, 1993; Strickland et al., 1993).

Removal of fescue seed heads can be an effective strategy for reducing dosage of alkaloids by grazing animals because ergot alkaloid concentrations are greater in seeds than other plant parts (Rottinghaus et al., 1991) and cattle readily consume seed heads (Goff et al., 2012). Seed heads can be removed by mowing, but this is generally ineffective if done during seed maturation because cattle selectively graze seed heads over a short period during early seed development (Goff et al., 2012). Research demonstrated that the plant growth regulator mefluidide inhibits floral development of cool-season perennial grasses (Roberts and Moore, 1990; Moyer and Kelley, 1995) to maintain vegetative stands and improve nutritive value (Sheaffer and Marten, 1986), but mefluidide was not licensed for forages.

Aiken et al. (2012) reported that steer ADG increased and signs of fescue toxicosis were mitigated on chemically seed head–suppressed tall fescue that was grazed; however, it could not be concluded whether the increase in weight gain was due to alleviation of toxic seed heads or by enhancement of nutritive value by maintaining fescue in the vegetative stage of growth. A follow-up grazing experiment was designed to use endophyte-infected fescue to evaluate the interaction between seed-head suppression and grazing intensity on steer performance and pasture responses. However, these pastures were inadvertently planted with endophyte-free seed. Nonetheless, this provided pastures of endophyte-free fescue that removed the ergot alkaloid effect and provided an objective evaluation of steer and forage nutritive-value responses to chemical seed-head suppression and light and moderate grazing intensities.

MATERIALS AND METHODS

Experimental Site and Design

The study was conducted at the University of Kentucky C. Oran Little Research Center, near Versailles, Kentucky, on a McAfee silt loam (fine, mixed, active, mesic Mollic Hapludalf) and a Maury-Bluegrass silt loam (fine, mixed, active mixed, mesic Typic Paleudalf) complex. Twelve 1.0-ha pastures were sprayed twice with glyphosate (5 L/ha) and no-till planted with endophyte-free Kentucky 31 tall fescue on 19 March 2010 with 28 kg of pure live seed per hectare. Areas that exhibited poor emergence or losses of plants from intensive spot grazing were reseeded on 14 September 2011 at the same rate.

Pastures were blocked according to the average slope and soil type. Two grazing intensities (light and moderate) and 2 rates of herbicide application were arranged as a 2 × 2 factorial with 3 replications. Herbicide treatments consisted of Chaparral {Dow AgroSciences, Indianapolis, IN; 62.13% aminopyralid [4-amino-3,6-dichloro-2-pyridinecarboxylic acid] and 9.45% metsulfuron-methyl [methyl 2-[[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino] sulfonyl]benzoate]} applied at 0 or 140 g/ha (metsulfuron: 13.2 g/ha, aminopyralid: 87.0 g/ha) on 7 April 2011 and 19 March 2012. Control pastures received Milestone (DowAgrosciences LLC, Indianapolis, IN; 40.6% aminopyralid) at 220 g/ha (aminopyralid: 89.3 g/ha) on the same dates. All herbicides were applied with nonionic surfactant (0.25% vol/vol). Pastures were fertilized annually in mid-March with 78 kg of N/ha.

Steer Responses

Steers used in 2010 were primarily crossbred Angus with initial BW of 263 ± 19 kg, and those used in 2011 were predominately Hereford, Charolais, and Angus with initial BW of 314 ± 11 kg in 2011. Tester steers were blocked by BW in 2010 and by BW and breed type in 2011 for assignment to pastures such that mean BW were similar across pastures and breed types. On the day that grazing was initiated, all steers were dewormed using moxidectin (Cydectin; Fort Dodge Animal Health, Fort Dodge, IA) and received steroidal implants (Synovex; 200 mg of progesterone, 20 mg of estradiol; Fort Dodge Animal Health). Steers on pasture were provided free-choice trace minerals (zinc, 0.35% minimum; manganese, 0.2% minimum; iron, 0.2% minimum; copper, 0.03% minimum; selenium, 0.009% maximum; iodine, 0.007% minimum; cobalt, 0.005% minimum). Steers were maintained according to University of Kentucky Institutional Animal Care and Use Committee (IACUC) protocol #2011–0797.

Steers grazed the pastures for 74 d (5 May to 14 July) and 84 d (3 April to 26 June) for the 2011 and 2012 growing seasons, respectively. Three tester steers were used in each pasture, and put-and-take steers were used to provide light and moderate grazing intensities. Grazing intensities were established and monitored using a disk meter, similar in design to one described by Bransby et al. (1977), with the exception that the falling plate weighed 1.9 kg and had a diameter of 45 cm. Based on previous research (Aiken et al., 2012) and experience measuring forage mass with disk meters for seed head–suppressed and nonsuppressed pastures, mean disk meter heights (**DMH**) of 7 to 9 cm were targeted for the light grazing and 5 to 7 cm for the moderate intensity. Fifty DMH were randomly measured for each pasture at approximately 2-wk intervals. Stocking adjustments were made following the 2-wk measurements of DMH.

Steers were weighed following a 12- to 14-h fast at the start and end of each grazing season. Carcass-related traits of the tester steers were determined at the end of the grazing season using an Aloka SSD-500V (Hitachi Aloka Medical Ltd., Tokyo, Japan) ultrasound with a 3.5-MHz linear array transducer (UST 6049). Scans were taken between the 12th and 13th ribs to determine the longissimus dorsi area and backfat thickness, and over the rump region between the pin and hook bones to measure rump fat thickness at the distal terminal point of the superficial gluteus medius muscle. Images were