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Comparison of Virginia wildrye, annual ryegrass, and wheat for weaned beef steers grazing and confinement feeding

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ABSTRACT

Virginia wildrye (*Elymus virginicus* L.; VWR) was compared with Marshall annual ryegrass (*Lolium multiflorum*; ARG) and EK102 wheat (*Triticum aestivum*; WHT) as pasture and with ARG for confinement feeding. Replicated (n = 3) 2.17-ha pastures were continuously stocked with 4 British crossbred steers (initial BW = 233 ± 28.5 kg) per pasture during spring in 2 yr to evaluate ADG and forage nutritive value. Forage TDN ($P = 0.87$), NDF treated with amylase and sodium sulfite ($P = 0.83$), and ADF ($P = 0.17$) were comparable among species. No CP concentration differences ($P = 0.12$) were observed in 2015; however, CP concentration of VWR (10.1 ± 0.5) was greater ($P = 0.01$) than that of WHT (8.7 ± 0.5) in 2016. At d 0, ARG relative feed value concentration (133.8 ± 5.4) was greater ($P < 0.05$) than that of VWR (111.2 ± 5.4) or WHT (117.7 ± 5.4). At d 28 ($P = 0.08$) and d 56 ($P = 0.56$), relative feed value was not different among species. Steer ADG was greater on ARG (1.40 ± 0.05 kg/steer per day) than on WHT (1.20 ± 0.05 kg/steer per day; $P < 0.01$) or VWR (1.26 ± 0.05 kg/steer per day; $P = 0.03$). Penned steers had comparable ($P = 0.90$) daily DMI of ensiled ARG (7.99 ± 0.14 kg/d) and VWR (7.88 ± 0.14 kg/d) in 2015 but more ($P < 0.0001$) daily DMI of VWR (7.42 ± 0.14 kg/d) than of ARG (6.19 ± 0.14 kg/d) in 2016. Further research is needed to explore forage persistence and economics of VWR for grazing.

Key words: wildrye, annual ryegrass, wheat, native grass, grazing

INTRODUCTION

The perennial grass Virginia wildrye (*Elymus virginicus* L.; **VWR**) is a cool-season forage that is not widely used in forage systems for beef cattle production in the southeastern United States. The short-lived, perennial nature of VWR, often 5 or fewer growing seasons, and lack of known concerns regarding grazing-livestock toxicity may make it a reasonable alternative to more commonly adopted cool-season forages in the region. In comparison, tall fescue [*Lolium arundinaceum* (Schreb.)], a perennial grass occupying much of the cool-season pasture in the region, is a causative agent in fescue toxicosis when infected with the wild-type endophyte (*Neotyphodium coenophialum*). Annual grasses such as annual ryegrass (*Lolium multiflorum*; **ARG**) and wheat (*Triticum aestivum*; **WHT**) can be used to produce highly productive grazing livestock but must be established on an annual basis; instead, cool-season, perennial grasses may improve returns to stocker cattle producers via decreased annual establishment cost (Islam et al., 2011).

There is interest in use of VWR, considered a native forage species, from the standpoint of developing wildlife habitat in pasture systems. Nielsen and Kelly (2016) recognized the long-term ecosystem services of VWR as a perennial forage species to wildlife habitat restoration in riparian areas by providing ground cover throughout the year without the need for annual renovation. Sanderson et al. (2004a) noted that increased interest in native plant species for conservation and production is due to new federal policies. Rushing and Baldwin (2013) suggested a need in northeast Mississippi, the locale of the present investigation, for a native, cool-season grass for restoring and reclaiming grasslands while simultaneously providing forage with acceptable nutritive value for livestock. Virginia wildrye is reported to have CP values of 23, 19, and 7% in the vegetative, flower/boot, and fruit/head stages, respectively, as well as 80, 74, and 60% IVDMD values for these same stages, respectively (Bosworth et al., 1985). A comparison of VWR to other cool-season grasses in the northeastern United States including orchardgrass (*Dactylis glomerata* L.) showed comparable nutritive values (Sanderson et al., 2004b). In the southeastern United States, *Elymus* species were similar to domesticated, nonnative species including tall fescue for forage nutritive value attributes (Rushing and Baldwin, 2013). The objectives of these experiments were to compare steer growth performance and forage nutritive value of 3 cool-season forage grasses (VWR, ARG, and WHT) and to assess steer intake of VWR versus ARG as ensiled forage. The authors hypothesized that similar animal growth performance would be measured among the 3 forage species.

The author declares no conflict of interest.

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MATERIALS AND METHODS

Exp. 1: Grazing VWR vs. ARG or WHT Pastures

Pasture Establishment and Management. Three cool-season forage grasses (ARG, WHT, and VWR) were compared for forage nutritive value and steer growth performance for 2 yr at the North Mississippi Research and Extension Center Prairie Research Unit (**PRU**) at Prairie, Mississippi (latitude 33.7891°N; longitude 88.6585°W; elevation 100 m). This grazing experiment was a randomized complete block design. There were 9 total pastures: 3 pasture treatments with 3 replications each randomly arranged in 3 blocks. Soil type was Houston clay. The 2.17-ha pastures were clipped to 3-cm stubble height in mid-August each year. After volunteer grass seedlings emerged in late August, an application of glyphosate (1.5 L/ha of 41% vol/vol) was applied to eradicate the existing pasture species. Glyphosate was not applied to the VWR pastures after establishment. On September 17 to 19, 2014, and September 16 to 18, 2015, the VWR (2014 planting only), ARG, and WHT seed were no-till drilled at seeding rates of 16.8, 33.6, and 112.1 kg/ha, respectively. The ARG and WHT pastures were planted to the same forage species in both years. Nitrogen (27.2 kg of N/ha) was applied as ammonium nitrate 2 wk after seedling emergence from the soil in October each year. Soil samples collected at the research site to a 15.2-cm depth were submitted to the Mississippi State University Extension Service Soil Testing Laboratory (Mississippi State, MS), and these test results indicated that lime, P, and K applications were not necessary.

Cattle and Grazing Management. The cattle in this experiment were managed under protocol 14–050 approved by the Mississippi State University Institutional Animal Care and Use Committee. Weaned British crossbred steers (mean initial BW ± SE = 276 ± 10.4 kg) less than 1 yr of age were acquired from the resident Mississippi Agricultural and Forestry Experiment Station herd at PRU. Four steers per paddock were used each grazing season. Before each grazing season, calves were vaccinated for protection against respiratory disease complex with Pyramid 10 (Boehringer Ingelheim Vetmedica Inc., St. Joseph, MO), clostridial diseases with Vision 7 (Intervet Inc., Millsboro, DE), and *Mannheimia* diseases with Presponse SQ (Fort Dodge Laboratories Inc., Fort Dodge, IA). Cattle were also treated for internal and external parasites with EPRINEX pour-on (Merial, Duluth, GA) at a dosage rate according to the product label and applied an XP 820 insecticide fly tag (Y-Tex Corporation, Cody, WY) in one ear per steer at grazing initiation.

The cattle were grazed together on mixed sward cool-season grass pasture for 14 d before being stratified by BW and breed composition and then randomly assigned to experimental paddocks at the beginning of each grazing season. These steers remained on their original assigned experimental paddocks for the duration of the grazing season. In each paddock, cattle were supplied with access to fresh water and free-choice mineral supplement (Purina Wind & Rain Storm Fescue Hi Mag 5 CO AU2800 Medicated; Purina Animal Nutrition LLC, Shoreview, MN) containing 3.09 g/kg of chlortetracycline and not less than 13.5% Ca, 5.0% P, 18.0% salt (NaCl), 10.0% Mg, 0.1% K, 4,800 mg/kg of Mn, 4,800 mg/kg of Zn, 1,600 mg/kg of Cu, 80 mg/kg of I, 16 mg/kg of Co, and 27 mg/kg of Se. The mineral supplement was labeled to contain not less than 661,386.8 IU of vitamin A/kg, 66,138.7 IU of vitamin D/kg, and 661.4 IU of vitamin E/kg.

Spring grazing seasons were 56 d each. Grazing periods for the year were as follows: April 8 to June 3, 2015, and April 6 to June 1, 2016, with the calves grazing the pastures for the entire duration of these grazing periods. Grazing initiation was based on availability of at least 3,500 kg/ha forage mass in all paddocks. Continuous stocking management was used. Paddocks were restocked with new animals at the beginning of each grazing season.

Pasture Data Collection. Paddocks were measured every 28 d beginning d 0 through the end of each grazing season to monitor herbage mass using a double sampling technique (Burns et al., 1989). The sward height was measured using a falling plate disk meter with 50 contacts per paddock. In each paddock, the first disk meter contact site was selected by walking a randomly selected number of steps into the pasture from the gate. Thereafter, a fixed number of steps, estimated to cover 5 diagonal transects in a zigzag pattern in each paddock, were used to determine the rest of the contact sites so as to spatially cover the entire paddock. After taking disk measurements in each paddock, herbage from three 0.25-m^2 quadrats was harvested at 2.5 cm above the soil surface at sites selected to approximate the shortest, mean, and tallest disk meter readings recorded in the paddock to calibrate the indirect estimates (disk meter readings) with direct estimates (harvested herbage samples). The quadrat cuts from each paddock were weighed fresh and then pooled within grazing paddock within pasture replicate. From each pooled sample, a 1-kg subsample was taken, dried in a forced-air oven at 60°C for 72 h, and then weighed to determine DM concentration. A regression equation was developed for each sampling date, with direct measurements (DM weight of clipped samples) as the dependent variable and indirect estimates (disk readings) as the independent variable. Herbage mass was then estimated with the resulting regression equation using the mean of the 50 disk readings per paddock. Season average herbage mass was calculated as the mean of all herbage mass estimates taken within each season.

Subsamples of the pooled herbage samples from d 0, 28, and 56 of the grazing period were frozen at −20°C, lyophilized, ground through a 1-mm screen in a Wiley mill (Thomas Scientific, Swedesboro, NJ), and shipped to a commercial laboratory (Dairy One Forage Lab, Ithaca, NY) to be analyzed for nutritive value including DM, TDN (Cherney et al., 1997), NDF treated with amylase and sodium sulfite (**aNDF**), ADF (Van Soest et al., 1991), and