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Performance of stocker cattle grazing bales in winter and supplemented with wheat-based dried distillers grains plus solubles or barley grain in western Canada

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ABSTRACT

Backgrounding calves during winter months in western Canada requires additional supplementation due to the cold climatic conditions. The objectives of this study were to determine the effects of supplementing either wheat dried distillers grains plus solubles (DDGS) or barley grain in an alternative backgrounding program on steer performance and DMI when winter bale grazing in a 2-yr study. Each year, 54 crossbred steers (BW, 219.5 ± 5.3 kg) from a similar annual cohort were stratified by BW and randomly allocated to 1 of 3 replicated (n = 3) supplement treatments [3 kg/d of (1) 100% barley grain (BARL); (2) 100% wheat DDGS (WDDGS); or (3) 50% barley + 50% wheat DDGS (50:50)] during winter grazing of grass–legume bales [CP = 7.1, ADF = 44.6, TDN = 48.0 (% DM)]. Supplement strategy did not affect (P = 0.95) DMI of round bale hay. Crude protein intake was 25 and 67% greater (P = 0.01) for WDDGS steers compared with 50:50 and BARL steers, respectively. Total digestible nutrient intake was similar (P = 0.73; 6.4 kg/d) among supplement strategies. Steers fed WDDGS tended (P = 0.07) to have 5 and 11% greater ADG (0.97 kg/d), and 4 and 10% greater total gain (103 kg), than the 50:50 (99 kg) and BARL (94 kg) steers, respectively. The study results suggest a tendency for greater performance of beef steers supplemented with wheat DDGS compared with barley grain when managed in an extensive winter bale grazing system.

Key words: backgrounding, bale grazing, distillers dried grains with solubles, stocker cattle

INTRODUCTION

A typical beef stocker (backgrounding) program through winter months in western Canada involves drylot forage feeding supplemented with barley grain until target weight is reached (Perillat et al., 2003). Because winter feed represents 60% of total system production cost (Kaliel and Kotowich, 2002; Larson, 2010), there is interest in alternative extensive winter feeding systems that can reduce costs (Meyer et al., 2009; Kelln et al., 2011; Van De Kerckhove et al., 2011). In these alternative systems pen feeding is replaced by extensive swath grazing, crop residue grazing or bale grazing on crop stubble or dormant perennial pasture during the winter. Such systems are suitable for overwintering beef cows (McCartney et al., 2004; Kelln et al., 2011; Van De Kerckhove et al., 2011) but are less understood for stocker cattle (Kumar et al., 2012; McMillan et al., 2018).

Backgrounding stocker calves need extra maintenance energy and protein in the Canadian winter due to environmental conditions in addition to those required for live-weight gain (NASEM, 2016). According to Marston et al. (1998), Hahn (1999), and Tarr (2007), animals experiencing temperatures below −6 to −8°C require extra supplemental energy for temperature regulation. Typical winter weather conditions in western Canada are below this threshold temperature (Webster et al., 1970). Therefore supplementation of forage-based rations is essential to achieve optimal growth of stocker calves in winter (Adams, 1991; Moore et al., 1999; DelCurto et al., 1990, 2000). Supplementation price is a major contributor to feed cost volatility for producers and usually the most expensive addition to a forage-based diet.

The expansion of ethanol production for transportation fuel has resulted in increased production of wheat-based dried distillers grains plus solubles (**DDGS**) co-product (Nuez-Ortin and Yu, 2010). Dried distillers grains plus solubles may represent a viable source of supplement for beef cattle because it is nutritionally dense with high CP

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and energy primarily in the form of digestible fiber and fat (Schingoethe, 2006).

The study objectives were to evaluate DMI, nutrient intake, and performance of crossbred beef steers in an extensive winter bale grazing system supplemented with 100% wheat-based DDGS, 100% barley grain, or a 50:50 blend.

MATERIALS AND METHODS

Study Location and Management

A 2-yr backgrounding study was conducted at the Western Beef Development Center's Termuende Research Ranch near Lanigan, Saskatchewan, Canada (51°51′N, 105°02′W). A 5.4-ha dormant pasture study site was further subdivided into nine 0.6-ha replicate paddocks, where steers were managed in a bale grazing system during the winter period. Bale grazing is the practice of setting out bales in fall in a predetermined, equally spaced design on a field site, where cattle then graze the bales during winter months (Kelln et al., 2011). In each replicate (n = 3) paddock, smooth bromegrass (*Bromus inermis* L.) and alfalfa (*Medicago sativa* L.) round hay bales (average wt. 684 kg/bale) were placed during the fall, in 4 rows of 5 bales each (20 bales per paddock) placed on a grid with on-center bale spacing 12 m apart across the paddock width and 12 m down the paddock length. Steers grazed the bales in field paddocks, with access to newly allocated bale forage restricted for a 3-d period using a portable electric fence to control use and reduce wastage.

Treatments and Grazing Animal Management

Each yr, 54 spring-born cross-bred beef calves (219.5 ± 5.3 kg) were weaned in October and, before study start, fed a grass–legume hay for a 21-d adaptation period. The steers were stratified by BW and randomly allocated to 1 of 9 paddocks (6 steers per paddock). Each paddock was then randomly assigned to 1 of the 3 replicated (n = 3) supplement strategies during winter bale grazing: (1) 100% barley (**BARL**), (2) 100% wheat DDGS (**WDDGS**), or (3) 50% wheat DDGS + 50% barley (**50:50**). The supplementation levels were first formulated based on 100% barley grain (BARL) and then replaced with wheat DDGS at either 100% (1:1 substitution) or 50% for the WDDGS or 50:50 supplement diets, respectively. In yr 1, the wheat DDGS was obtained from Husky Energy Ltd. (Lloydminster, Saskatchewan, Canada), and in yr 2 the DDGS was received from Noramera Bioenergy Corporation (Weyburn, Saskatchewan, Canada). Supplement amounts were adjusted throughout the study to account for increasing nutrient requirements of the steers due to BW change, forage nutrient analysis, and temperature fluctuations in accordance with the NRC (2000) beef model for stocker cattle as predicted by the CowBytes Ration Balancer Program (Version 4, AAFRD, 1999). Water was delivered daily to water troughs and 2 portable windbreaks (10 × 16 m) per paddock were provided for shelter to each replicate group of 6 steers.

Throughout the duration of the study, all steers received an average of 3.0 kg of DM/steer daily of supplement or 1.1% of BW/steer daily. All supplements were fed daily in the morning between 0830 and 0930 h and top-dressed with 56 g/steer per day of a 2:1 (Ca:P) mineral (20% Ca, 10% P, 60 mg/kg Se, 70 mg/kg Co, 200 mg/kg I, 3,000 mg/kg Cu, 9,000 mg/kg Mn, 10,000 mg/kg Zn, 3,700 mg/kg Fe, 1,000 mg/kg F, 1,000,000 IU/kg vitamin A, 150,000 IU/kg vitamin D, 1,000 IU/kg vitamin E; FeedRite Ltd., Humboldt, Saskatchewan, Canada) and 56 g/steer of limestone (calcium carbonate, 38.0% Ca; FeedRite Ltd.) in portable bunks. All steers used in the study were cared for in accordance with the Canadian Council on Animal Care (2009) guidelines.

Composite grass–legume hay and supplement samples were obtained at the start of the study and every 14 d throughout the study. The hay samples were dried immediately after collection, in a forced-air oven for 72 h at 55°C. Subsequently, all hay and supplement samples were ground to pass through a 1-mm screen (Thomas-Wiley Laboratory Mill Model 4; Thomas Scientific, Swedesboro, NJ) and analyzed in duplicate for moisture, CP, ADF, NDF, OM, in vitro 48-h OM digestibility (**IVOMD**), calcium (Ca), and phosphorus (P). Dry matter was determined by drying samples at 100°C for 24 h (method 930.15; AOAC International, 2000) and ash determined by AOAC International (2000; method 942.05). Crude protein (N × 6.25) was analyzed by the Kjeldahl procedure (Method 984.12; AOAC International, 2000) using the 2400 Kjeltic Analyzer unit (Foss Tecator, Hoganas, Sweden). Neutral detergent fiber was analyzed using the ANKOM 200 fiber analyzer (ANKOM Technology, Fairport, NY). Sulfuric acid and heat were used to analyze ADF (method 973.18; AOAC International, 2000). In vitro 48-h OM digestibility was determined using the modified Tilley and Terry (1963) method developed by Goering and Van Soest (1970). Calcium and P were analyzed using the method described by Qian et al. (1994; method 927.02 and 965.17; AOAC International, 2000). Chemical composition of grass–legume hay and supplements are presented in Table 1.

Total digestible nutrient contents (% DM) were calculated for hay samples using the grass–legume Penn State equation (TDN = 114.420 − 1.492 × ADF) based on ADF and for supplement samples using the cereal grains Penn State equation (TDN = 92.2 − 1.12 × ADF) (Adams, 1995). The estimated intakes of NE_m and NE_g for steers in the current study were calculated using 2 different equations (Adams, 1995; Zinn and Shen, 1998) using chemical composition results. An equation developed by Zinn and Shen (1998) as outlined by McKinnon and Walker (2008) was used to estimate NE_m and NE_g based on ADG and estimated DMI. These calculated NE_m and NE_g values were then compared with NE_m and NE_g derived from the Ad-