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Effects of supplementing spring-calving beef cows grazing barley crop residue with canola meal and wheat-based dry distillers grains with solubles on performance, reproductive efficiency, and system cost

D. Damiran,*† H. A. Lardner,*† P. G. Jefferson,*† K. Larson,† and J. J. McKinnon*[1]
*Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 5A8; and †Western Beef Development Centre, Humboldt, Saskatchewan, Canada S0K 2A0

ABSTRACT

A 2-yr experiment was conducted to determine the effects of supplementing canola meal and wheat-based dry distillers grains with solubles (wDDGS) on the performance of wintering cows grazing barley straw-chaff. Each year, a 24-ha field was seeded with forage barley (Hordeum vulgare 'Ranger'). The mature crop was swathed and combined to collect straw-chaff crop residue (STCH; 5.7% CP, 51% TDN) in 22 ± 5 kg piles. The field was divided into six 4-ha paddocks. Each year, 60 pregnant Black Angus cows (yr 1: BW = 641.4 ± 10.6 kg, BCS = 2.7 ± 0.1, gestation d = 121 ± 2; yr 2: BW = 685.2 ± 9.1 kg, BCS = 2.6 ± 0.1, gestation d = 108 ± 2) were randomly allocated to 1 of 3 replicated (n = 2) supplement treatments: (1) 100% wDDGS (39.2% CP, 78.8% TDN, DM basis); (2) 50% wDDGS plus 50% canola meal (50:50); or (3) 100% canola meal (42.6% CP, 71.5% TDN, DM basis) while winter grazing (49 and 39 d for yr 1 and yr 2, respectively) on STCH piles. The supplementation rate was 0.41% of BW or 2.6 kg/d. Supplementation strategy did not influence (P > 0.05) STCH DMI (11.4 ± 0.55 kg/d), cow BW change (−3.0 ± 1.90 kg), final BCS (2.5 ± 0.02), and subsequent reproductive performance. The results indicate that approximately one quarter (24–28%) of the winter feeding period can be filled by grazing barley STCH residue with supplementation and that canola meal was equal to wDDGS as a supplement for beef cows consuming barley STCH residue.

Key words: barley straw-chaff residue, supplementation, wheat-based dried distillers grains with solubles, wintering grazing

INTRODUCTION

For beef producers in the northern Great Plains, meeting cow maintenance and gestation requirements economically during the winter months is a challenge. In response, beef producers have moved from conventional drylot wintering systems where cattle are housed in pens to the adoption of extensive wintering systems (Van De Kerckhove et al., 2011; Krause et al., 2013). Grazing pregnant beef cows on cereal crop residues through the winter months is an option to potentially reduce the costs of wintering beef cows (Kelln et al., 2011; Krause

[1] Corresponding author: John.McKinnon@usask.ca

et al., 2013). Approximately half of the above-ground DM of cereal crops consists of crop residue (McCartney et al., 2006). Canada is the third largest barley producer in the world, with annual barley grain production at 7.1 million tonnes (Statistics Canada, 2014), which means about the same amount of crop residue is available for livestock feed. Barley crop residue is considered a low-quality forage because of its low protein (5.3% CP) and energy (44.0% TDN) content (McCartney et al., 2006). Therefore, when crop residue is the main forage in beef cow diets, additional energy and protein must be provided to meet the animal's requirements for these nutrients (McCartney et al., 2006). Barley grain (13.2% CP; 71% TDN; NRC, 2000) is commonly used to supplement beef cow diets in Canada (Van De Kerckhove et al., 2011) and the Pacific Northwest region of the United States (Ovenell-Roy et al., 1998). Because of the expansion of the bioethanol industry, a large supply of bioethanol coproducts such as wheat-based dried distillers grains with solubles (**wDDGS**) has become available. In parallel, Canada's 14 canola crushing and refining plants have the capacity to crush about 10.0 million tonnes of canola seed and produce about 4 million tonnes of canola oil and 6 million tonnes of canola meal (**CM**) annually (Canola Council of Canada, 2014). Thus, it is expected that canola meal will become a readily available and cost effective feed ingredient for beef producers in North America. The objective of this experiment was to compare CM with wDDGS as a supplement when wintering beef cows are fed barley crop residue.

MATERIALS AND METHODS

Site and Crop Management

A 2-yr experiment was conducted at the Western Beef Development Centre's (**WBDC**) Termuende Research Ranch located 8 km east of Lanigan (latitude 51°51′N, longitude 105°02′W), Saskatchewan, Canada. Each year in June, 24 ha of barley (*Hordeum vulgare* 'Ranger') were seeded at 124 kg/ha, along with 56 kg/ha of actual nitrogen. Barley crop was swathed in September and the grains combined shortly after to collect straw-chaff crop residue (**STCH**) in 22 ± 5 kg (DM basis) piles using a Whole Buncher (AJ Manufacturing, Calgary, Alberta, Canada) unit attached to the combine. Subsequently, this field with STCH piles was divided and fenced with high tensile electric wire into six 4-ha paddocks to facilitate grazing. The same 24-ha field was used in both years. In each year, 3 replicated (n = 2) treatments were randomly assigned to the 6 4-ha paddocks (n = 2). Barley grain yield was 3.5 and 5.1 t/ha for yr 1 and 2, respectively. Consequently, STCH yield (barley crop production t/ha − barley grain yield t/ha) averaged 5.9 and 6.1 t/ha for yr 1 and 2, respectively.

Animal and Feeding Management

The 2-yr grazing experiment was conducted from October 26 to December 14, 2012 (yr 1; 49 d) and from October 28 to December 7, 2013 (yr 2: 39 d). Dry pregnant Black Angus cows were used in this experiment [initial BW = 660.8 ± 7.2 kg, BCS = 2.6 ± 0.02 (5-point scale), gestation d = 114 ± 2]. All cows were cared for in accordance with the Canadian Council on Animal Care guidelines (Canadian Council on Animal Care, 2009). Each year, all cows were exposed to fertility-tested bulls (ratio of 1 bull to 25 cows) that passed a breeding soundness evaluation on July 1 for a 63-d breeding season. Pregnancy was diagnosed via rectal palpation to eliminate any open cows before the experiment started. The intent was to use the same cows for both years of the experiment, unless culled for injury or failure to conceive. Each year, 60 cows were stratified from lightest to heaviest BW and randomly assigned within strata to 1 of 6 barley crop residue (STCH) paddocks, and the paddocks were randomly assigned to 1 of the 3 supplementation treatments: (1) 100% wDDGS; (2) 50% wDDGS and 50% CM (**50:50**); or (3) 100% CM. In each year, each treatment had 2 replicates (n = 2) and each replicate group consisted of 10 cows.

Cows were allocated feed in each wintering system based on BW, pregnancy status, forage nutrient density, and environmental conditions in accordance with the NRC (2000) beef model for nonlactating pregnant beef cows as predicted by the CowBytes Ration Balancing Program (AAFRD, 2011). The amount of feed (STCH + supplementation) allocated was intended for maintenance of body condition, with no BW gain other than that of conceptus growth. However, the amount of STCH allotted varied depending on use and environmental conditions. Cow access to STCH piles was controlled using temporary electric fence on a 3-d basis. Back-grazing was allowed, but cows were observed to primarily graze piles in the area they had most recently been given access. The amount of feed provided to each paddock was recorded weekly.

Cows were supplemented daily at 0800 h with either CM (42.6% CP, 71.5% TDN), wDDGS (39.2% CP, 78.8% TDN), or a 50:50 blend (wDDGS:CM; 40.9% CP, 75.2% TDN) to meet protein and energy requirements of the second trimester cows.

The average supplementation rate was 0.41% BW or 2.6 kg/d. In addition, each cow was supplied with mineral at 70 g/d [15.5% Ca, 7.0% P, 30 mg/kg Se, 20 mg/kg Co, 200 mg/kg I, 1,500 mg/kg Cu, 5,000 mg/kg Mn, 5,000 mg/kg Zn, 1,000 mg/kg Fe, 1 mg/kg F, 500,000 IU/kg vitamin A (minimum), 50,000 IU/kg vitamin D_3 (minimum), 2,500 IU/kg vitamin E (minimum); Right Now Emerald, Cargill Animal Nutrition, Winnipeg, Manitoba, Canada]. The Ca-to-P ratio was maintained at 1.5:1 by supplementing with limestone at 40 g per cow per day (15 g of Ca per cow). The mineral and limestone were mixed directly into the supplement to achieve the targeted intake. In addition, all cows had ad libitum access to cobalt-iodized salt [99.0% NaCl (minimum), 39.0% Na, 180 mg/