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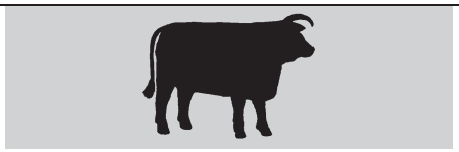

Performance characteristics of beef cows program fed by-products from corn ethanol production[1]

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ABSTRACT

The objective of this experiment was to evaluate the efficacy of program-fed, corn-silage-based diets containing reduced-fat, modified wet corn distillers grains (RFDGS); high-fat, modified wet corn distillers grains (HFDGS); or high-fat, condensed corn distillers solubles (HFCDS) containing 8.01, 10.53, and 10.99% ether extract (crude fat), respectively, on beef cow and calf performance. Angus × Simmental crossbred cows (n = 128) were program fed 1 of 4 dietary treatments for 206 d beginning in the third trimester through calf weaning. Cows were blocked by parity (first parity and 2 or more parities) and stratified within parity by BW subject to variation in BCS to 16 pens. Each block was equally represented within treatment. Control cows were fed diets based on corn silage, shelled corn, and soybean meal to provide 12.0% CP (T1). In treatment diets, corn silage and either RFDGS (T2) or HFDGS (T3) replaced shelled corn and soybean meal to provide 12.0% CP. High-fat, condensed distillers solubles (T4) replaced shelled corn and a portion of soybean meal to provide 12.0% CP. Cow DMI per day was lower ($P = 0.01$) for T3 comparing 10.13 ± 1.12, 9.88 ± 1.02, 8.07 ± 0.88, and 10.08 ± 1.20 kg for T1, T2, T3, and T4, respectively. Crude fat composition of the diets was different ($P = 0.001$), where T1 < T2 < T3 = T4. A difference ($P = 0.02$) was observed for milk production, where T4 > T2 and T3, T1 = T4, and T1 = T2 = T3. Milk urea nitrogen differed between treatments ($P = 0.02$), where T1 > T2 and T3, T4 = T1, and T4 = T2 = T3. No differences ($P > 0.05$) between treatments were observed for calf BW and cow BW and BCS at the end of the feeding period. Calf birth weight tended ($P = 0.10$) to be lower for T3 compared with T1, T2, and T4. In corn silage–based diets when beef cows are program fed to maintain similar BCS, HFDGS, RFDGS, and HFCDS can replace shelled corn and soybean meal, with similar performance.

Key words: beef cow, distillers grains, performance

INTRODUCTION

Feed costs are identified as the largest factor influencing profit and loss in the cow-calf enterprise (Miller et al., 2001). Increased corn prices and ethanol production have generated economic incentives for feeding by-product feeds within the beef-cattle industry. Distillers grains included in the diet at levels up to 15% can be considered a protein source or at levels greater than 15% as an energy source in ruminant diets (Klopfenstein et al., 2008).

Distillers by-product feeds normally contain 10 to 15% crude fat (**CF**; Klopfenstein, 2001). However, ethanol production facilities have developed new corn-milling procedures that remove increased fractions of oil from the corn germ or from the solubles fraction following distillation for applications such as biodiesel production (Meyer et al., 2012). The resulting CF content of the corn distillers grain is reduced to between 5 and 9%. Condensed distillers solubles, which is the syrup product remaining after thin stillage has undergone partial evaporation (Lardy, 2007), is less expensive to purchase than distillers grains.

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Distillers grains have been supplemented in beef cow diets (Shike et al., 2009; Radunz et al., 2010; Faulkner et al., 2012) without decreasing performance characteristics. No adverse effects have been observed when supplementing finishing steers (Pingel and Trenkle, 2005) and dairy cattle diets (Sasikala-Appukuttan et al., 2008) with condensed distillers solubles. Fat is typically fed to increase the energy density of cattle diets (NRC, 2001). New processing techniques have created a knowledge gap for nutritionists and producers regarding dietary energy. Currently, no published data exists detailing the dietary energy content of distillers grain by-products following increased removal of oil from the corn germ or from solubles fraction. Also, limited data have been published comparing different ethanol corn by-products that vary in CF content and their resulting effects on beef cow and calf performance.

We hypothesized that feeding corn ethanol by-product feeds, varying in CF content, as a replacement for shelled corn (**SC**) and soybean meal (**SBM**) in program-fed corn silage–based diets would have no adverse effects on beef cow and calf performance. Therefore, the objective of this experiment was to evaluate beef cow and calf performance of beef cows program fed corn silage–based diets of similar dietary CP containing reduced-fat, modified wet corn distillers grains (**RFDGS**), high-fat, modified wet corn distillers grains (**HFDGS**), or high-fat, condensed corn distillers solubles (**HFCDS**), targeting similar cow BCS changes between treatments.

MATERIALS AND METHODS

Cattle and Diets

This study was approved by the Illinois State University Animal Care and Use Committee. A total of 128 Angus × Simmental crossbred, winter-calving cows were housed in confinement lots at the Illinois State University Research Farm. Cows were program fed dietary treatments to maintain similar BCS as a TMR once daily at 0800 h for a 206-d feeding period during the last trimester of gestation, beginning 30 d before the birth of first calf through weaning. Cows were housed in an open-front cattle shed with concrete confinement lots, automatic water fountains, and fence-line feed bunks. Each pen provided 29.75 m^2 of uncovered and 14.19 m^2 of under-roof pen space per cow–calf pair.

Cows were blocked by parity into 2 groups (block 1 = first parity and block 2 = 2 or more parities). Cows within block 1 were stratified by BW to 4 treatment pens. Cows within block 2 were stratified by BW to 12 treatment pens. Cows of similar BW were subjected to shifting between pens, within block and treatment, to equalize BCS between pens. Each pen contained 8 cows. Experimental pens within a block were randomly assigned to 1 of 4 dietary treatments (n = 4 pens/treatment).

All diets were formulated as isonitrogenous and to meet or exceed NRC (2000) requirements for Ca and P during gestation and lactation. For the purpose of dietary adjustments, percentage of CP was based on analyzed N content of each feedstuff. The control diet (**CNT**) consisted of a traditional SC–SBM–corn silage diet, formulated to contain 12% CP on a DM basis. Other treatment diets contained RFDGS or HFDGS, respectively, as replacement for SC and SBM to provide diets containing 12% CP on a DM basis. High-fat, condensed corn distillers solubles replaced SC and a portion of SBM to provide a diet containing 12% CP on a DM basis (HFCDS). The RFDGS used in this experiment was produced by a dry grind process with front-end, partial degermination of the corn kernel that resulted in RFDGS containing 8.01 ± 0.55% CF and 24.19 ± 1.13% CP. The HFDGS and HFCDS feedstuffs were processed in a dry-grind facility, resulting in coproducts that contained 27.22 ± 1.71% CP, 10.53 ± 0.55% CF, and 16.70 ± 1.12% CP and 10.99 ± 0.88% CF, respectively. The RFDGS and HFDGS fed were delivered on a single day and stored in separate concrete bunker silos, each measuring 3.66 m tall × 24.38 m long × 6.10 m wide. The top of the modified wet corn distillers grains with solubles in each bunker was leveled, hand sprinkled with salt at the rate of 4.9 kg/m^2, and covered with plastic sheets. The wet corn distillers grains with solubles were removed from the face of each bunker as needed. The HFCDS fed were stored in an insulated, 3,785-L bulk tank that was modified for liquid feed storage. The tank was kept inside a heated building during the winter months and replenished as needed, which was approximately every 21 d. Samples of HFCDS were collected from each load, and dietary compositions were adjusted according to subsequent nutrient analyses.

All cows were weighed on 2 consecutive days to obtain an average beginning, middle, and ending BW. Beginning, middle, and end BCS of the cows were determined by visual appraisal and were obtained by averaging the BCS of 2 technicians working independently. Scores within the BCS system ranged from 1 to 9, where 1 = emaciated and 9 = obese (Herd and Sprott, 1996).

A Rumensin (Elanco, Greenfield, IN) and thiamine premix (fed to supply 200 mg/cow·d of monensin and 100 mg/cow·d of thiamine) was added to each treatment and CNT TMR diet at the rate of 90.8 g/cow·d. Thiamine was provided to aid in prevention of polioencephalomalacia (NRC, 2001). Calcium carbonate was added to each diet to provide similar ratios of Ca to P. All feed ingredients were mixed into a Reel Auggie horizontal batch mixer, Model No. 3120 (Kuhn Knight Inc., Brodhead, WI). In addition to the TMR, all cows were allowed free choice access to a commercial mineral mixture containing a minimum of 12.0% Ca, 12.0% P, 15.8% salt, 0.8% Mg, 1.2% K, 790 mg/kg Cu, 53 mg/kg Se, 3,150 mg/kg Zn, and 149,318 IU/kg vitamin A (JBS United Inc., Sheridan, IN). Calves were offered creep feed beginning 60 d after the birth of the first calf. Calves were allowed access to