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Effect of supplementation on performance and reproduction of lactating beef cows grazing lush spring pasture

K. Doungkamchan,* M. S. Jarboe,* L. M. Shoup,* W. T. Meteer,† PAS, W. P. Chapple,* and D. W. Shike*[1]
*Department of Animal Sciences, University of Illinois at Urbana-Champaign, Urbana 61801; and †University of Illinois Extension, Orr Research and Demonstration Center, Baylis 62314

ABSTRACT

Our objectives were to use 230 Angus × Simmental beef cows in a 2-yr experiment to determine the effects of supplementation on cow BW and BCS, first-service AI conception rate, and blood metabolites (nonesterified fatty acids, BHBA, and BUN). Cows (110 in yr 1 and 120 in yr 2) were randomly assigned to 1 of 2 treatments: control or supplement (SUPP). There were 3 replicates per treatment each year, and both treatments grazed clover–tall fescue pasture in early spring. The supplement contained 45% ground corncobs, 45% soybean hulls, and 10% dry molasses (DM basis), and 1.81 kg/cow per d was offered to cows fed SUPP starting 10 d before breeding. Forage samples were collected as groups were rotated to new pastures. Throughout the grazing season, forage CP decreased ($P < 0.01$), whereas ADF and NDF increased ($P < 0.01$). Day-18 BUN concentration in yr 2 tended to be decreased ($P = 0.10$) in cows fed SUPP compared with control cows. Concentration of BHBA for cows fed SUPP tended to be greater ($P = 0.07$) compared with control cows; however, nonesterified fatty acids did not differ ($P = 0.80$). There was no difference ($P \geq 0.44$) in final BW and BCS nor was there any difference ($P \geq 0.35$) in AI conception and overall pregnancy rate. In conclusion, a high-fiber, low-protein supplement did not affect BW or BCS or significantly improve first-service AI conception rate and overall pregnancy rate in cows grazing lush, early-spring pasture.

Key words: beef cow, cool-season pasture, excess protein, supplementation, reproduction

INTRODUCTION

The majority of beef producers have spring-calving herds so as to take advantage of spring pasture growth when nutrient demands of the dam are at their peak. Because nutrition and reproduction are closely tied together (Hess et al., 2005), it is important to consider the nutritional status of cows as rebreeding approaches. For spring-calving cows, breeding often coincides with lush, highly palatable, immature pasture. These immature forages usually contain a high N content and fewer carbohydrates. Due to the imbalance of N and carbohydrate and the high moisture contents of the forage, cows often enter a negative energy balance (Arelovich et al., 2003). In lactating dairy cows, high dietary CP has also been shown to reduce fertility and the viability of embryos due to the interaction between negative energy balance and excess protein (Butler, 2005). Previous research has indicated that a BUN concentration of more than 20 mg/dL (Hammon et al., 2005) alters the uterine environment, decreases the survival of spermatozoa (Westwood et al., 1998), and decrease ability of oocytes to develop to blastocysts (Santos et al., 2009).

Several supplementation strategies have been considered to alleviate the effects of the reduced energy balance due to grazing lush pasture. In the southeast United States, supplementation of cottonseed meal improved ADG of steers grazing during a 39-d period from December through January (Worrell et al., 1990) and improve N utilization of microbes in a continuous culture system (Bach et al., 1999). Little work has been done to evaluate the effect of feeding a supplement during early lactation on AI conception of beef cows grazing lush pasture.

[1] Corresponding author: dshike@illinois.edu

Therefore, the objectives of this experiment were to evaluate the effects of supplementation on cow BW and BCS, first-service AI conception rate, and blood metabolites [nonesterified fatty acids (**NEFA**), BHBA, and BUN]. We hypothesized that a dry, low-protein energy supplement would improve first-service AI conception rate and overall production performance of beef cows by serving as a dilutor of the high-N pasture forage and reducing the negative effects of an imbalanced protein-to-energy ratio.

MATERIALS AND METHODS

Animals in this trial were cared for in accordance with guidelines in the *Guide for the Care and Use of Agricultural Animals in Agriculture Research and Teaching* (FASS, 1988). Experimental procedures followed those approved by the University of Illinois Laboratory Animal Care Advisory Committee, protocol 15008.

The experiment was conducted from April 29, 2013, through July 1, 2013, and April 28, 2014, through July 7, 2014, at the University of Illinois Orr Beef Research Center, Baylis, Illinois.

Animals, Experimental Design, and Treatments

A total of 230 Angus × Simmental lactating beef cows (initial BW = 662 ± 78 kg; initial BCS = 5.8 ± 1.5; average initial age = 6.03 yr within 3–13 yr range) were used in a 2-yr experiment. Cows (110 in yr 1 and 120 in yr 2) were stratified by initial BW and age and allocated into 6 pasture groups (20 cows per group) each year. Each pasture group was randomly allotted to 1 of 2 treatments: control or supplement (**SUPP**). Each SUPP group received 1.81 kg/cow per d of a supplement for a total of 67 ± 5 d, which began 10 d before breeding. The supplement contained 45% ground corncobs, 45% soybean hulls, and 10% dry molasses (DM basis). Supplementation began 56 ± 12 d and 60 ± 14 d postpartum for cows in yr 1 and yr 2, respectively (average calving date was February 21, 2013, and February 25, 2014).

Supplementation began at the end of April when cows were turned out to pastures. As typical in a spring-calving herd, breeding often coincides with turnout to spring pastures. Cows were turned out to pastures 10 d before breeding when forage was at a lush, vegetative stage of maturity. Cows grazed pastures with an average coverage area of 30% red clover (*Trifolium pratense*) and white clover (*Trifolium repens*), and 70% endophyte-infected fescue (*Festuca arundinacea*) in each pasture. Total endophyte percentage of the fescue was 64%, as determined by a commercial laboratory (Agrinostics Limited Co., Watkinsville, GA). Each group was rotated between 3 pastures every 10 to 17 d, and all groups were moved the same day. All groups were moved 5 times throughout the supplementation period. Average pasture size was 4.2 ± 0.9 ha for control groups and 4.3 ± 1.1 ha for SUPP groups. Average stocking rate was 5.0 ± 1.28 and 5.1 ± 1.58 cow-calf pairs/ha for control and SUPP groups, respectively. A calibrated (Tracy and Faulkner, 2006) electronic plate meter (Jenquip, Fielding, New Zealand) measurement was collected daily throughout the supplementation period in both yr 1 and 2 of the experiment. A total of 20 measurements were taken every 6.1 to 12.2 m in a zigzag pattern across the pasture. The pattern was designed to cover the entire pasture uniformly regardless of area distribution within the pasture. An average of 20 readings were recorded, and an estimate of forage coverage was obtained. Groups were moved when approximately 25% of the available forage had been consumed. Average pregraze forage coverage was 4,335 ± 1,362 kg of DM/ha for control groups and 4,356 ± 1,183 kg of DM/ha for SUPP groups. Average postgraze forage coverage was 3,124 ± 683 kg of DM/ha for control groups and 3,253 ± 855 kg of DM/ha for SUPP groups. A commercial mineral (#CP63, Pike Feeds, Pittsfield, IL; 12 to 14% Ca, 8% K, 18 to 20% NaCl, 11% Mg, 90 mg/kg of I, 528,000 IU/kg of vitamin A, 88,000 IU/kg of vitamin D_3, and 2,200 IU/kg of vitamin E) and water were also offered for ad libitum consumption throughout the experiment. Cows were commingled after the end of the supplementation period and grazed common pasture (red clover, white clover, and endophyte-infected fescue). Cows were weighed on 2 consecutive days at the beginning (d 0 and 1 of supplementation) and end of the experiment (d 66 and 67 of supplementation). Body condition score was also determined at d 0 and d 67 ± 5 of supplementation.

Estrus Synchronization and AI

Cows were synchronized using 7-d CO-Synch + controlled internal drug-release (**CIDR**; Zoetis Services LLC, Parsippany, NJ) procedure (Johnson and Dahlke, 2016) method. At d 0 of supplementation (10 d before breeding), CIDR implants and Cystorelin (Merial Limited, Duluth, GA; gonadotropin-releasing hormone) injections were applied to all cows. After turning cows back to pastures, at d 7 of supplementation, CIDR were removed and Lutalyse (Zoetis Services LLC; prostaglandin) was injected into all cows. At d 10 of supplementation, all cows were artificially inseminated and turned back to pastures. In yr 1, one bull was added to each pasture group 14 d after AI and remained there for 35 d. In yr 2, one bull was added to each pasture group 11 d after AI and remained there for 61 d. Pregnancy verification to AI was performed 34 d after AI in yr 1 and 35 d after AI in yr 2. Overall pregnancy check was performed 32 d after bull removal in yr 1 and 34 d after bull removal in yr 2. Pregnancy was confirmed by a trained technician via ultrasonography (Aloka 500 instrument, Wallingford, CT; 7.5-MHz general purpose transducer array).

Blood Sampling and Analysis

In yr 1, serum samples collected on d 0 and 7 of supplementation were