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Evaluating the effects of late-gestation supplementation on timed–artificial insemination pregnancy rates and body composition in beef cattle

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ABSTRACT

Nonlactating Angus cross beef cows were used to evaluate pregnancy rates and postpartum performance following late-gestation liquid protein or dried distillers grains (DDG) supplementation. In Exp. 1, 166 multiparous cows were stratified by BW, BCS, age, and pregnancy status to receive a free-choice liquid-protein or DDG supplement fed to be isonitrogenous for 77 d during late gestation. In Exp. 2, 53 nulliparous and 36 primiparous cows were stratified similar to Exp. 1 and fed DDG at maintenance (DDG-1) or 1.2 times maintenance (DDG-1.2) energy requirements for 44 d during late gestation. Body weight and BCS were measured at initial supplementation, calving (except BW), timed AI, and weaning to determine BW and BCS change. Cows were sorted into 3 age groups (Exp. 1) and evaluated for BW and BCS change at weaning. All females were synchronized with a 7-d CO-Synch plus controlled intravaginal drug-release protocol with 72 h of timed AI. In Exp. 1, cows fed DDG had greater ($P < 0.01$) BW change at timed AI and weaning and greater BCS change ($P < 0.05$) at calving compared with cows fed liquid protein. Cows that were 3 and 4 yr old had the greatest ($P < 0.01$) BW and BCS change at weaning. In Exp. 2, there was no treatment effect ($P > 0.10$) on BW or BCS change. Timed-AI pregnancy rates were similar ($P > 0.10$) across treatments for both experiments. Late-gestation supplementation with DDG had positive effects on animal performance, with the greatest effect in the younger females.

Key words: beef cattle, body condition score, pregnancy rate, late-gestation supplementation

INTRODUCTION

Body condition during late gestation has had an effect on subsequent reproductive performance (Spitzer et al., 1995). There have been multiple experiments evaluating different approaches to improve the nutritional status of late-gestating or early-lactating beef cows through supplementation with protein, energy, or both. Results have indicated either similar or positive responses in fertility, BW gain, and BCS change when fed during late gestation or early lactation either supplemental protein, energy, or a combination of the 2 compared with a control diet (Ciccioli et al., 2003; Martin et al., 2005; Larson and Funston, 2009; Radunz et al., 2010; Winterholler et al., 2012). However, only a few experiments have compared protein and energy supplementation during late gestation (Marston et al., 1995), particularly on nutrient-stressed first- and second-calf females (Ciccioli et al., 2003).

It is known that younger cows have a higher culling rate due to reproductive failure compared with mature cows (Meek et al., 1999). The key principles of a successful heifer development program are supported by BCS at calving: prepartum nutrition affecting postpartum interval and also postpartum nutrition affecting fertility (Bellows and Short, 1978; Whittier et al., 1988; Ciccioli et al., 2003). The condition of a 2- or 3-yr-old cow is typically lowest during mid to late gestation, following weaning, and typically affects the degree of change

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in BCS at calving as indicated by Coombs et al. (1996). It is also known that dietary energy restriction during late gestation negatively affects reproductive performance (Patterson et al., 1991).

Most research evaluating pre- and postpartum supplementation strategies has been conducted in the northern part of the United States. It is unclear whether these strategies yield similar responses in the Gulf Coast region, where hay diets fed during late gestation in spring-calving cows is typically of lower quality. Therefore, 2 experiments were conducted to determine whether (a) supplementing dried distillers grains (**DDG**) as an energy source to pregnant multiparous cows of different age groups and (b) supplementing DDG at different energy levels to pregnant nulliparous and primiparous cows when fed low- to medium-quality hay during late gestation positively affects postpartum BW and BCS change and reproductive performance.

MATERIALS AND METHODS

Experiment 1 was conducted during the fall of 2011 and winter–spring of 2012 at the Hill Farm Research Station, a unit of the Louisiana State University Agricultural Experiment Station. Cows and treatments used were previously reported by Walker et al. (2013) and used to evaluate subsequent fertility and animal performance response. Experiment 2 was conducted during the spring and summer of 2013 at the Hill Farm Research Station. Use of all animals for both experiments was approved by the LSU Agricultural Center Animal Care and Use Committee.

Exp. 1

Multiparous crossbred beef cows (n = 183, BW = 556.6 ± 73.5 kg, BCS = 4.6 ± 0.72, age = 6.5 ± 2.8 yr) in the second or third trimester of gestation were stratified by age, BW, BCS (scale 1 to 9, 1 = emaciated, 9 = obese; Whitman, 1975), and pregnancy status taken at weaning and assigned to 1 of 6 pastures with 2 supplements for a combination of 3 supplementation treatments fed for 77 d before the beginning of the calving period. Treatments included QLF DFS 35 liquid protein (Quality Liquid Feeds, Dodgeville, WI) provided either free choice in a lick tank (**TNK**, n = 54) or poured into round bales at 10% of bale weight (**POR**, n = 53; expected intake of 0.91 kg/d per cow as fed) or DDG fed in a bunk daily at 1.25 kg/d per cow as fed. Dried distillers grains were fed at a rate to be isonitrogenous only based on projected liquid protein–supplement intake. Liquid supplement was provided in two 500-L lick tanks per pasture equipped with 3 revolving wheels per tank. Liquid protein–supplement intake in the TNK treatments was determined following a 12-d warm-up period by weighing the lick tanks after filling on d 0 (December 1), weighing the lick tanks before and after each refilling of the tanks during the experiment, and weighing the lick tanks on the last day (d 77, February 16). Liquid-supplement intake on a per animal basis was determined as the disappearance of liquid (kg) divided by the number of cows in each group and the number of days the liquid supplement was offered. Pouring of liquid-protein supplement into bales is described by Walker et al. (2013).

Pastures ranged from 5.3 to 8.8 ha in size, and each pasture was equipped with two 2.4-m, black polyethylene-pipe, round-bale feeders allowing 0.46 m of linear feeding space per cow. Hay fed to cattle was 1.5- to 2.5-yr-old bermudagrass hay cut in the summer of 2008 and 2009 and stored uncovered on an asphalt or unsurfaced area. All hay harvested in 2008 was fed first to all treatments simultaneously, followed by all hay harvested in 2009. Multiple core samples from the hay fed, multiple 50-mL samples of the liquid supplement (TNK and POR treatments), and multiple 0.25-kg samples of DDG were collected at the beginning and end of the feeding experiment and composited for DM and nutrient analysis. The composition of the diets is listed in Table 1. Body weight and BCS change was compared between treatment groups by measuring BW and BCS at the beginning of the supplementation period, at calving (BCS only), beginning of the breeding period, and at fall weaning where calves were weighed as well. Body weights were a measure of a full single day weight, and BCS was given to each cow by an experienced animal scientist. Calf weaning weights were reported unadjusted and adjusted to 205 d of age and sex.

Table 1. Analyzed chemical and energy composition (DM basis) of supplements and hay for Exp. 1 and 2[1]

	Exp. 1			Exp. 2	
Item, %	QLF DFS 35	DDG	Bermudagrass hay	DDG	Bermudagrass hay
DM	59.4	88.85	86.0	87.0	85.6
CP	59.18	28.6	9.4	32.4	7.6
NDF[2]	—	27.3	68.7	28.4	64.3
ADF	1.5	13.34	44.2	15.4	39.7
Fat	0.77	11.4	—	8.9	—
TDN[3]	78.83	82.03	42.8	77.6	58.0

[1]QLF DFS 35 = liquid-protein supplement (Quality Liquid Feeds, Dodgeville, WI); DDG = dried distillers grains plus solubles.

[2]NDF for the QLF DFS 35 is zero.

[3]TDN was calculated using near-infrared spectroscopy through Dairyland Laboratories Inc. (St. Cloud, MN).