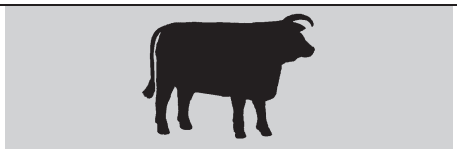
The Professional Animal Scientist 31 (2015):11–19; http://dx.doi.org/10.15232/pas.2014-01333



Effect of corn condensed distillers solubles or corn dried distillers grains during gestation or lactation on cow performance, milk production, and preweaning progeny growth[1]

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ABSTRACT

Two experiments were conducted to assess the performance of gestating (Exp. 1) or lactating (Exp. 2) beef cows fed increasing concentrations of condensed corn distillers solubles (CDS). In Exp. 1, Angus × Simmental first- (n = 40) and second-parity (n = 8) females were fed 1 of 4 diets starting on d 181 of gestation until 2 wk before calving. In Exp. 2, another set of Angus × Simmental first- (n = 40) and second-parity (n = 8) females were fed diets similar to Exp. 1 from calving until 93 d postpartum. Diets consisted of a corn silage and haylage–based control, a corn stover plus dried distillers grains with solubles diet, and 2 corn stover plus CDS diets fed at a low (LD) or high (HD) dietary inclusion. Inclusion of CDS and distillers grains decreased DMI in both experiments ($P < 0.001$). However, in Exp. 1 HD increased DMI compared with LD ($P < 0.001$). Final cow BW was decreased in both experiments, and BCS was increased due to feeding LD and HD CDS in Exp. 1 ($P \leq 0.05$). Reproductive efficiency and milk production did not differ for either experiment. ($P \geq 0.19$). Calf ADG ($P \geq 0.42$) did not differ in Exp. 1, but during Exp. 2 ADG was decreased ($P = 0.05$) in LD calves from birth to d 93 postpartum. In conclusion, CDS may need to be included at higher concentrations in low-quality roughage diets, or higher-quality roughages should be included to maintain adequate DMI.

Key words: beef cow, distillers solubles, distillers grains, milk

INTRODUCTION

Use of corn for ethanol production is expected to decrease land available for forage (pasture, hay, and silage) production. Corn stover, which includes the stalk, leaf, husk, and cob remaining after corn grain production, contains approximately half of the dry weight of a standing corn plant and represents a tremendous feed resource in North America, with potential annual yields of 133.7 Tg (Kim and Dale, 2004). However, to achieve an acceptable level of cow BW and weaning weight, energy or protein supplementation, or both, will be needed. Protein supplementation can increase forage intake and utilization and subsequently increase cattle performance (Bodine et al., 2001). Condensed distillers solubles (**CDS**), a by-product of ethanol production, is high in protein and energy compared with dietary forages and is appealing as a supplement for low-quality forages such as corn stover (Gilbery et al., 2006). Burroughs et al. (1950) and Chen et al. (1976) reported improved cellulose digestion with the addition of either dried distillers solubles or corn distillers solubles, respectively. Additionally, Gilbery et al., (2006) and Coupe et al. (2008) observed in-

[1] Appreciation is extended to the employees of the Purdue Beef Research and Teaching Center for help in conducting this research. Partially funded by a grant from the Indiana Corn Marketing Council.
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creased DMI when CDS was mixed at increasing concentrations to roughage-based diets but not when it was fed separately, indicating that the nutrients in a TMR may have been better synchronized for microbial needs.

The effects of mixing CDS with corn stover in diets fed to beef cows during late gestation or early lactation on cow performance and calf growth is unknown. Therefore, the objective of these experiments was to identify the concentration of CDS in corn-stover diets during gestation and lactation that will optimize cow reproductive efficiency and milk production, and to characterize the early development of the progeny from cows fed CDS. We hypothesized that mixing CDS with corn stover will improve reproductive performance of cows and that CDS and stover–based diets are an adequate alternative to hay or dried distillers grains with solubles (**DDGS**).

MATERIALS AND METHODS

Two studies were conducted at the Purdue Animal Sciences Research and Education Center in West Lafayette, Indiana, to determine the effect of CDS during gestation (Exp. 1) or lactation (Exp. 2) on cow BW, BCS, and reproduction and preweaning calf ADG. Research protocols using animals followed guidelines in the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (FASS, 2010) and were approved by the Purdue Animal Care and Use Committee.

Exp. 1 Animals and Diets

Angus × Simmental first- (n = 40) and second-parity (n = 8) females were placed in 2.4 × 9.1 m individual pens in a 3-sided, bedded, concrete-floor barn and fed 1 of 4 diets from 181 d of gestation until 2 wk before calving. One dietary treatment was randomly assigned to each pen and included 1) a corn silage–based diet (**G-CON**), 2) a corn stover–based, low-CDS diet (**G-LD**), 3) a corn stover–based, high-CDS diet (**G-HD**), and 4) a corn stover–based, DDGS diet (**G-DG**). Cows in Exp. 1 were allotted by cow breed (% Simmental), BW, age, and calf sire. Initial and final BW were determined by taking the average preprandial BW measured on 2 consecutive d. Monthly BW were taken before the a.m. feeding to minimize the influence of gastrointestinal fill. Body condition score (1 = emaciated, 9 = obese; Wagner et al., 1988) was determined every other month by the same experienced person. In addition, posttreatment BW of cows and calves were recorded at 194 d postpartum to aid in interpretation of progeny growth between the treatment period and weaning.

Diet composition for Exp. 1 is presented in Table 1. Diets were formulated to be isocaloric (0.89 Mcal/kg of NE_g) but differ in amount of protein and fat. Diets were also formulated to meet or exceed all nutrient requirements (NRC, 2000) of a primiparous heifer in its third trimester of gestation. All diets were formulated using individual-ingredient chemical composition obtained by wet chemistry methods (AOAC, 1990) before the start of the experiment (Sure-Tech Laboratories, Indianapolis, IN). Corn stover was harvested at approximately 80% DM after corn harvest. Corn stover was chopped in a windrow and then harvested using a silage chopper equipped with a flail header and stored in an air-tight silage bag (Up North, Cottage Grove, MN) until the initiation of the experiment. Feed was offered as a TMR once daily at 0800 h in concrete bunks, and orts were weighed, recorded, and discarded for each pen. Feed samples were taken and composited every 14 ± 7 d; oven-dried at 55°C for 3 d for DM determination; ground using a standard Wiley laboratory mill (1-mm screen; Thomas Scientific, Swedesboro, NJ); and composited at the end of the experiment for analysis of CP (micro-Kjeldahl N × 6.25), NDF, and ADF using an Ankom^{200} Fiber Analyzer (ANKOM Technology Corporation, Fairport, NY), ether extract (method 920.39; AOAC, 1990), and minerals (Ca, P, Mg, K, S; method 968.08; AOAC, 1990). Dietary treatments concluded an average of 14 d before calving. Upon termination of dietary treatments, cow–calf pairs were commingled and managed as one group until weaning at 194 d postpartum.

Exp. 2 Animals and Diets

A second set of Angus × Simmental first- (n = 40) and second-parity (n = 8) females were placed in individual pens (described in Exp. 1) and fed 1 of 4 diets from within 1 wk of calving until 93 ± 17 d postpartum. One dietary treatment was assigned randomly to each pen and included 1) a corn silage–based diet (**L-CON**), 2) a corn stover–based, low-CDS diet (**L-LD**), 3) a corn stover–based, high-CDS diet (**L-HD**), and 4) a corn stover–based, DDGS diet (**L-DG**). Cow-calf pairs were allotted by cow breed (% Simmental), BW, and age and by calf birth weight, sex, and sire. Initial and final BW were determined by taking the average preprandial weights measured on 2 consecutive d. Monthly BW were taken before the a.m. feeding to minimize the influence of gut fill. Weight of cows that were still pregnant on the initial weigh date was adjusted to a nonpregnant basis for gravid uterine weight (Ferrell et al., 1976). Body condition score and BW were assessed monthly and every other month, respectively. In addition, posttreatment BW of cows and calves were recorded at 177 ± 17 d postpartum to aid in interpretation of progeny growth between the treatment period and weaning.

Diet composition for Exp. 2 is presented in Table 2. Diets were formulated to be isocaloric (0.96 Mcal/kg of NE_g) but differ in amount of protein and fat. Diets were also formulated to meet or exceed vitamin and mineral requirements (NRC, 2000) of a primiparous heifer in its second month of lactation. All diets were formulated using individual-ingredient chemical composition obtained by wet chemistry methods (AOAC, 1990) before the start of the experiment (Sure-Tech Laboratories, Indianapolis, IN). Corn stover was harvested and stored as de-