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Effects of feeding high-moisture corn stover to gestating and lactating beef cows as an alternative to hay and corn silage on performance and reproduction

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ABSTRACT

The objectives of this study were to evaluate ensiled high-moisture corn stover as an alternative forage for beef cows. In Exp. 1, multiparous, gestating Simmental and Angus × Simmental cows (n = 96) were limit fed 1 of 3 treatments: (1) 60% high-moisture corn stover, 25% ground cornstalks, and 15% corn gluten feed (HMCS); (2) 60% corn silage, 25% ground cornstalks, and 15% corn gluten feed (SIL); or (3) 60% hay, 25% ground cornstalks, and 15% corn gluten feed (HY) from 108 ± 14 to 38 ± 14 d prepartum. In Exp. 2, lactating Simmental and Simmental × Angus cows (n = 79) were limit fed 1 of 2 treatments at calving: (1) 75% high-moisture corn stover and 25% dried distillers grains (HMCS2) or (2) 70% corn silage and 30% dried distillers grains (SIL2). Diets were limit fed to achieve NASEM (2016) requirements for maintenance and lactation. In Exp. 1, BW gain was greater ($P < 0.01$) for cows fed SIL than cows fed HY or HMCS. In Exp. 2, BW gain was greater ($P < 0.01$) for cows fed SIL2 than cows fed HMCS2; however, no differences ($P \geq 0.17$) were detected in milk production, subsequent AI conception, or overall pregnancy rates. The similar performance of gestating cows fed hay or high-moisture corn stover indicates high-moisture corn stover is a viable hay replacement. When fed to lactating cows, high-moisture corn stover could be fed as a replacement to corn silage with no effect on milk or reproduction. Overall, feeding high-moisture corn stover is a cost-saving strategy in both stages of production.

Key words: alternative forage, beef cow, high-moisture corn stover

INTRODUCTION

Increased input costs have driven beef producers to investigate low-cost alternatives to feed cattle. Feed costs account for approximately 63% of the total annual cow cost; thus, nutritional management plays a major role in the financial viability of beef enterprises (Miller et al., 2001). Using corn residues as a feedstuff has gained popularity within the beef industry. In the Midwest, crop production is abundant and these resources are plentiful. Corn residues can be harvested or chemically treated, and the Western Corn Belt has the moderate cow herds and abundant crop production that make the use of corn residues an economical option (Klopfenstein et al., 1987). During the winter months in the Midwest, gestating beef cows are commonly fed stored feeds in drylots. This drylot period has traditionally been the most expensive time period to feed cattle (Braungardt et al., 2010). Feeding the combination of corn residues with dried distillers grains and solubles (**DDGS**) is a less expensive alternative when compared with feeding cows free-choice alfalfa hay (Braungardt et al., 2010). Poor palatability and waste are among the largest factors limiting corn stover use as a livestock feed. Ensiling corn stover can decrease waste and increase palatability of the feedstuff (Colenbrander et al., 1971). Harvest date, plant maturity, and growing conditions also affect the quality of corn stover. As forages mature, there is an increased concentration of lignin in plant cell walls (Kamstra et al., 1958). Lignin is the major factor that limits the digestibility of cell-wall constituents (Jung and Allen, 1995). Harvesting the corn plant at a more immature stage could decrease lignin content and improve digestibility of the stover, which could allow high-moisture corn stover to compete with other more traditional forage sources. We hypothesized that high-moisture corn stover could be an economical alternative feed for wintering beef cows. The objective of these experiments was to evaluate the effects of high-moisture corn stover on cow performance, reproduction, and feed costs in beef cows during gestation and lactation compared with diets containing corn silage or hay.

MATERIALS AND METHODS

All animal procedures were approved by the University of Illinois Institute of Animal Care and Use Committee

The authors declare no conflict of interest.
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(Protocol #12009) and followed the guidelines recommended in the *Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching* (FASS, 2010).

Exp. 1

Animal and Diet Management. Ninety-six multiparous Simmental and Simmental × Angus crossbred cows (BW = 701 ± 59 kg; age = 6.6 ± 2.4 yr) were used for this experiment at the University of Illinois Orr Beef Research Center in Baylis, Illinois. Cows were housed in 11.0 × 10.7 m concrete lots with a 7 × 7 m open-front shed. Each pen had a 7.3-m fence-line bunk.

A randomized complete block design was used with cows blocked by BW. Cows were blocked into light and heavy BW blocks averaging 652 or 749 kg of BW, respectively. The light BW block consisted of 6 pens with 8 animals per pen, and the heavy BW block consisted of 6 pens with 8 animals per pen. Within block, cows were stratified by breed and BW and allotted to pens. Pens were randomly assigned to 1 of 3 treatments, resulting in 4 replications of each treatment.

Three treatments (Table 1) were used to investigate the effects of feeding high-moisture corn stover as an alternative to hay or corn silage during gestation on beef cow performance. Dietary treatments were (1) 60% high-moisture corn stover, 25% ground cornstalks, and 15% corn gluten feed (**HMCS**); (2) 60% corn silage, 25% ground cornstalks, and 15% corn gluten feed (**SIL**); or (3) 60% hay, 25% ground cornstalks, and 15% corn gluten feed (**HY**). Diets were limit fed from 108 ± 14 to 38 ± 14 d prepartum to achieve a DMI of 1.5% BW, and feed was delivered at approximately 0800 h each day. Salt blocks and free-choice mineral (CP65; Pike Feeds, Pittsfield, IL; 15.0% Ca, 8.1% P, 20.0% NaCl, 2.3% Mg, 2.3% K, 48 mg/kg Cu, 30 mg/kg Se, 440.9 kIU/kg vitamin A, 2.2 kIU/kg vitamin E, 88.2 kIU/kg vitamin D) were provided to all cows.

Harvesting Methods. Corn silage from Pioneer 1498 (Pioneer, Johnston, IA) and Dekalb 6757 (Monsanto, St. Louis, MO) corn was harvested on September 9, 2013, with a John Deere 6950 Silage Chopper (John Deere Company, Moline, IL). Corn silage was harvested at approximately 45% DM and yielded approximately 40.24 t/ha. Corn silage was inoculated with Pioneer 11C33 (Pioneer) and transferred into a 61-m storage bag (Ag-Bag Plastic, Miller-St. Nazianz Inc., St. Nazianz, WI) using a G6060 Ag-Bagger (Miller-St. Nazianz Inc.). The authors acknowledge that the corn silage had an above-average DM. This was not a silage hybrid, and it was harvested after it had black layered. High-moisture corn stover, from the same corn hybrids as the corn silage, was harvested on October 2, 2013, within 24 h of high-moisture corn harvest, at approximately 47% DM. The chaff spreader on the John Deere S690 combine (John Deere Company), used to harvest high-moisture corn, was turned off, and husks, cobs, and leaf were laid in a windrow. A New Holland 1411 discbine mower (New Holland Agriculture, New Holland, PA) was used to cut 4 rows of stalks to be included with the combine windrow. A Fox Max II chopper (Fox River Tractor Company, Mount Sterling, IA), equipped with a hay harvesting head, was used to harvest the high-moisture corn stover. The high-moisture corn stover was inoculated with Silo-King WS (Agri-King Inc., Fulton, IL) at the site of transfer into a 46-m storage bag (Ag-Bag Plastic, Miller-St. Nazianz Inc.). Water was added at 15.1 L/min in the holding chamber of the bagger to incorporate the dry inoculant. The DM of samples composited over the experiment was 46% for the high-moisture corn stover. The authors acknowledge that this is not typical DM for corn stover. The objective was to harvest at a DM that would be conducive to ensiling. The corn silage and high-moisture corn stover were stored for 43 and 30 d, respectively, before the start of the experiment. After storing, the pH of high-moisture corn stover was determined at a commercial laboratory (ANALAB, Fulton, IL) to be 3.5, suggesting the product had ensiled.

Performance Analysis. Full BW were collected on cows on 2 consecutive d at the onset (November 7 and 8, 2013; 108 ± 14 d prepartum) and conclusion (January 15 and 16, 2014; 38 ± 14 d prepartum) of the experiment

Table 1. Experimental diet fed to gestating cows in Exp. 1

	Treatment[1]		
Item	HMCS	SIL	HY
Ingredient inclusion, % DM			
High-moisture corn stover	60	0	0
Corn silage	0	60	0
Hay	0	0	60
Cornstalks	25	25	25
Corn gluten feed	15	15	15
Nutrient content			
Crude fat, %	1.52	3.49	1.79
CP, %	7.84	9.53	11.01
NDF, %	67.82	48.92	62.24
ADF, %	41.39	28.44	38.85
P, μg/g	1,696	2,282	2,421
K, μg/g	6,300	6,758	9,950
S, μg/g	1,334	1,455	1,647
Calculated energy content			
TDN,[2] %	54.85	66.97	57.23

[1]Treatments: HMCS = 60% high-moisture corn stover, 25% ground cornstalks, and 15% corn gluten feed; SIL = 60% corn silage, 25% ground cornstalks, and 15% corn gluten feed; HY = 60% hay, 25% ground cornstalks, and 15% corn gluten feed. Diets were limit fed from 108 ± 14 to 38 ± 14 d (±SD) prepartum to achieve a DMI of 1.5% BW.

[2]Total digestible nutrients was calculated from ADF using TDN = 93.59 − (ADF × 0.936).