Utilization of Soybean Hulls in Drylot Beef Cow-calf Rations

Rebecca L. Moore and Bryan W. Neville

The objective of this study was to evaluate the use of soybean hulls as a partial forage replacement in drylot cow-calf rations during an entire calving cycle. Specific objectives included: 1) To evaluate drylot beef cow-calf performance when fed rations including soybean hulls or not as a partial forage replacement, 2) To evaluate milk production and quality during lactation while beef cows were fed rations including soybean hulls or not as a partial forage replacement, 3) To evaluate beef calf performance based on dams being fed either soybean hulls or not as a partial forage replacement under drylot management.

Summary

One hundred and twenty beef cows were assigned to one of eight pens at the Carrington Research Extension Center. Prior to breeding during the summer of 2019, cow-calf pairs were sorted based on age, body weight, body condition score and calving date to create pen groups. Pens were provided one of two treatment diets: 1) the control ration (**CON**) consisted of silage, straw and modified distillers grains with solubles (**mDGS**), and 2) the soybean hull ration (**SBH**) replaced portions of corn silage, straw, and mDGS with pelleted soybean hulls (DM basis). Rations were formulated to meet the nutritional requirements of beef cows for lactation/early gestation, mid-gestation, and late gestation. During the four study segments evaluated (two lactation periods, mid-gestation, and late-gestation) there were no differences in body weight, body condition score, or average daily gain between cows on either treatment ($P \geq 0.12$). Colostrum quality was largely unaffected by inclusion of soybean hulls in beef cow rations. Milk production appeared to be greater during early lactation in cows fed diets containing soybean hulls, however this did not translate into any differences in calf weights at weaning. The data indicate that soybean hulls can be used to as a partial forage replacement, up to 27% of dietary DM, in beef cow rations when provided in a feedlot. Further data on potential effects of inclusion rate of soybean hulls is still needed.

Introduction

Research on feeding soybean hulls to beef cows under drylot conditions is limited. Soybean hulls have been studied more extensively in beef feedlot rations and under grazing conditions (Anderson et al., 1988; Hibberd 1986). Cows supplemented soybean hulls while grazing pasture have been shown to lose less weight than those supplemented corn (Hibberd, 1986); these authors hypothesized that digestible fiber feeds, like soybean hulls, may be more effective range supplements than starch-based feeds. This was further supported by more recent research where the high digestible fiber content of soybean hulls improved fiber digestibility in steers (Smith et al., 2017a). One of the few published beef cow studies evaluating soybean hulls demonstrated that feeding hay and soybean hulls during late gestation had no impact on cow or calf performance (Smith et al., 2017b). The study objective was to evaluate the use of soybean hulls as a partial forage replacement on a long-term basis.

Experimental Procedures

All animals involved in this study were handled in conformity with the protocols approved by the North Dakota State University Institutional Animal Care and Use Committee. Prior to breeding in summer of 2019, 121 cow-calf pairs were stratified by age (4.52 ± 0.85 years), body condition score (5.40 ± 0.10), and body weight (1433.4 ± 67.5 lbs.). Pairs were divided into one of eight pens (n = four pens per treatment; six groups of multiparous cows and two groups of primiparous cows). Replacement of open cows with replacement heifers was completed at weaning following culling of open cows. Treatments were control (**CON**; rations included corn silage, straw and mDGS), and a treatment (**SBH**; rations included soybean hulls at 26-27% of dietary DM replacing portions of corn silage, cereal straw and mDGS). Rations were developed to meet the nutritional requirements of the cow during lactation, mid-

gestation, and late-gestation (NASEM, 2016). In addition, beginning in mid-gestation cows were given *ad libitum* access to straw. Weights and body condition scores were collected on two consecutive days at the initiation and conclusion of each study segment (Lactation 2019, Mid-gestation, Late-gestation, Lactation 2020). Additionally, body weight and body condition scores were collected approximately every 28d to monitor cow performance. Colostrum samples were collected from a subset of cows from each pen (61 head total) within 24 hours to analyze milk quality. Weigh-suckle-weigh was used to further evaluate milk production in beef cows fed **CON** or **SBH**-based rations. Milk production was measured at approximately day 60±1 and 120±1 postpartum by a modified procedure described by Radunz et al (2010), Williams et al (1979) and Benson et al (1999). Calf performance was determined during birth to weaning. At birth, body weights were collected from all calves. A two-day body weight was collected from calves at weaning to allow for determination of calf weight gain. Data were analyzed with the mixed procedures of SAS (SAS Inc.). Cow performance data were analyzed by period within the study. All data was analyzed with pen serving as the experimental unit.

Results and Discussion

During four study segments evaluated (two lactation periods, mid-gestation, and late-gestation) there were no differences in body weight, body condition score, or average daily gain between cows on either treatment ($P \geq 0.12$; Table 1). Colostrum quality was analyzed for fat, somatic cell count, milk urea nitrogen, and other solids in milk samples between the two treatments and found no difference ($P \geq 0.06$; Table 2). However, protein content within colostrum samples was greater ($P = 0.02$) for cows fed control rations compared to those fed soybean hull rations (11.9 vs. 9.5 ± 0.54%, respectively). Weigh suckle weigh data indicated that milk production at d 60 of lactation was greater ($P = 0.03$) in cows fed SBH compared to those on CON, 16.0 vs. 11.8kg/d respectively. However, no differences were present at day 120 of lactation ($P = 0.55$). There were no differences in calf birth, initial, and final body weights, or average daily gain between the control and soybean hull treatments ($P \geq 0.11$; Table 3).

Cow-calf pairs in drylot.

Table 1. Effects of soybean hull inclusion on performance of beef cows fed in confinement during an entire production cycle.

	Treatment[1]			
	CON	SBH	SEM[2]	*P*-value[3]
Lactation[4]				
Initial BW, kg[5]	649.5	652	31.52	0.96
Initial BCS[5]	5.4	5.4	0.109	0.98
Final BW, kg[6]	609.8	613.1	28.17	0.94
Final BCS[6]	5.3	5.2	0.149	0.84
ADG, kg	-0.35	-0.35	0.041	0.9
Mid-Gestation				
Initial BW, kg	574.6	581.8	23.18	0.83
Initial BCS	5.3	5.2	0.149	0.84
Final BW, kg	633.3	646.2	27.22	0.75
Final BCS	5.9	6.1	0.15	0.15
ADG, kg	0.64	0.71	0.062	0.5
Late-Gestation				
Initial BW, kg	633.3	646.2	27.22	0.75
Initial BCS	5.9	6.1	0.105	0.15
Final BW, kg	673.19	696.4	25.81	0.55
Final BCS	5.6	5.6	0.091	0.9
ADG, kg	0.47	0.6	0.048	0.12
Lactation[7]				
Initial BW, kg	605.4	620.1	21.36	0.64
Initial BCS	5.3	5.4	0.081	0.3
Final BW, kg	618.1	628.3	22.68	0.76
Final BCS	5.3	5.4	0.063	0.31
ADG, kg	0.13	0.08	0.054	0.56

[1]Treatment: CON, control diet; SBH, soybean hull diet; [2] n = 4 pens per treatment; [3]*P*-value less than 0.05 considered significantly different; [4]Lactation 2019; [5]Initial body weights and body condition scores were collected at the beginning of study; [6]Final body weights and body condition scores were collected at the conclusion of study; [7]Lactation 2020.

Table 2. Effects of soybean hull inclusion on colostrum quality and milk production of beef cows fed in confinement during an entire production cycle.

	Treatment[1]			
	CON	SBH	SEM[2]	*P*-value[3]
Colostrum Analysis[4]				
Fat, %	4.1	4.9	0.33	0.14
Protein, %	11.9	9.5	0.54	0.02
SCC	2405	5319	871.1	0.06
MUN	2.7	6.6	1.54	0.12
Other	4.8	4.6	0.08	0.19
Milk Production, kg[5]				
60 days post-calving	11.8	16	1.34	0.03
120 days post-calving	8.81	9.76	1.12	0.55

[1]Treatments: CON, control diet; SBH, soybean hull diet; [2] n = 54 cows for colostrum collection and n = 48 pairs used for weigh-suckle-weigh ; [3]*P*-value less than 0.05 considered significantly different.; [4]Colostrum samples were collected within 24 hours of birth for milk analysis; [5]To determine milk production during lactation 2020, the weigh-suckle-weigh technique was used.

Table 3. Effects of soybean hull inclusion on performance of beef calves resulting from dams fed in confinement during an entire production cycle.

	Treatment[1]			
	CON	SBH	SEM[2]	*P*-value[3]
Calf Performance				
Birth Weight, kg	35.74	36.88	2.69	0.54
Initial BW, kg[4]	78.5	83.9	2.063	0.11
Final BW, kg[5]	170.65	180.2	5.989	0.3
ADG, kg[6]	0.95	0.99	0.052	0.58

[1]Treatment: CON, control diet; SBH, soybean hull diet; [2] n = 4 pens per treatment; [3]*P*-value less than 0.05 considered significantly different; [4]Initial body weight is considered the average 30-day weight post-calving; [5]Final body weight is considered the average weight at end of study (weaning); [6]ADG calculated for 95 days (initial to weaning).

The data indicate that soybean hulls can be used to as a partial forage replacement, up to 27% of dietary DM, in beef cow rations when provided in a feedlot. Previous research has also demonstrated that soybean hulls can be utilized in mid- to late-gestation as a partial forage replacement without impacting cow or calf performance (Smith et al., 2017b). Supplementing soybean hulls and DDGS have also shown to provide similar effects on body weight and condition scores in heifers provided a limit-fed diet (Engel et al., 2008). Jointly, the present and previous data indicate that soybean hulls can be used effectively as a partial forage replacement in beef cow rations. Further data on potential effects of inclusion rate of soybean hulls is still needed.

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