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Summary

Ninety-six crossbred heifers were used in an experiment to evaluate the effect of dried distillers grains plus solubles (DDGS), fed in the last trimester of gestation, on heifer performance and reproduction.

Animals were blocked by previous heifer development strategy (Antelope Research Station range developed = **ANT 1**; Antelope Research Station dry lot developed = **ANT 2**; Cottonwood research station = **CTW**), stratified by expected calving date, body weight and body condition score, and randomly allotted to one of twelve pens. Each pen was randomly assigned to one of two treatments (6 pens/treatment; 4 pens per block). Treatments were 1) dried distillers grains and grass hay **(DDGS)** or 2) soybean hulls and grass hay **(SBH).** Treatments were applied during the last-trimester of gestation. Diets were developed utilizing the 1996 NRC computer model and designed to meet nutrient requirements at 240 days of gestation under thermo-neutral conditions. Treatment diets offered similar amounts of NEm each day based on assumptions of the energy content of SBH and DDGS (assumed SBH = 80% TDN and DDGS = 88% TDN). Heifers fed the DDGS had a greater ($P<0.01$) increase in body weight and a heavier ($P=0.03$) final weight compared to the heifers fed SBH. Body condition score was not affected by diet. Calf birth weights were similar for both the DDGS and SBH treatments with a mean birth weight of 87.0 lbs ± 5.3lb and 85.0 lbs ± 3.4lbs respectively. Treatment had no effect on calving ease or calf vigor scores. These results suggest that in limit fed situations DDGS and SBH can both be supplemented at 40 percent of the diet with no negative affects on cow performance, calf birth weight, or calving difficulty.

Introduction

It is well known that one of the major causes of failed reproductive performance in cow-calf operations is nutritional inadequacies. This is usually most evident when rebreeding 2 year olds. Two-year-old heifers must raise a calf and become pregnant while still growing. The goal is finding a balance between economically available feedstuffs that will meet the nutritional requirements of the young cow and fit the management of the operation, while maintaining the productivity of the cow. Researchers have looked at supplementing fat or UIP (undegradable intake protein) as ways to increase the energy density of the diet or to meet the metabolizable protein (MP) requirements respectively, of pre-partum cows, to remediate nutritional stresses and increase subsequent reproduction. There is little documentation of fat and MP used together as a way to meet nutritional needs during gestation and the impact this may have on performance and reproduction. Patterson et al. (2001) in Nebraska noted an increase in pregnancy rate in bred heifers supplemented to meet MP requirements over heifers supplemented to meet CP requirements without a change in body weight or body condition over the winter feeding period. Studies looking at fat supplementation have had mixed results on cow performance and subsequent reproduction (Staples, 1998).

The nutritional demands of a lactating animal are very high, to increase body weight and body condition score during this period is often cost prohibitive. Obtaining optimum body condition before calving is more economical from both feed cost and reproductive stand points.

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Over the last several years by-product feeds have received much attention because of their increased availability to livestock producers as a supplemental nutrition source for cattle. Corn distillers dried grains is a widely available by-product feed for South Dakota livestock producers. Distillers dried grains are an excellent source of energy with a TDN value at least that of corn with 12% fat and are also high in protein (33% CP) with 60% of the CP as UIP (Loy, 2003;Lardy, 2003; Holt, 2004).

The objective of this experiment is to evaluate dried distillers grains plus solubles (DDGS) as a feedstuff for heifers in the last trimester of gestation.

Materials and Methods

This study was conducted at the SDSU Cottonwood Range and Livestock Research Station, Philip, SD, (winter 2005) and used 96 crossbred pregnant first calf heifers (average weight 1119 lb) in a randomized complete block design. Animals were blocked by previous heifer development strategy (Antelope Research Station range developed= **ANT 1**; Antelope Research Station dry lot developed= **ANT 2**; Cottonwood research station=**CTW**), stratified by expected calving date (ANT 1= April 9; ANT 2= April 6; CTW= March 31), body weight and body condition score (BCS), and randomly allotted to one of twelve pens. Each pen was randomly assigned to one of two treatments (6 pens/treatment; 4 pens per block). Treatments were 1) dried distillers grains and grass hay **(DDGS)** or 2) soybean hulls and grass hay **(SBH).** Treatments were applied during the last-trimester of gestation.

Diets were delivered once daily in concrete bunks in each dry lot pen where heifers were housed. Heifers were fed 9.0 lbs/d ground grass hay top dressed with either SBH (7.25lb/d) or DDGS (6.6lb/d) for the respective treatments along with 0.69 lb/d supplement designed for each respective treatment (Table 1). Diets were developed using the 1996 NRC computer model and designed to meet nutrient requirements at 240 days of gestation under thermo-neutral conditions. Diets offered similar amounts of NEm each day based on assumptions of the energy content of SBH and DDGS (assumed SBH = 80% TDN and DDGS = 88% TDN; Table 2). Diets were limit fed at a constant rate throughout the study and were designed to meet or exceed requirements for degradable intake protein (DIP), crude protein (CP), vitamins, and minerals. The nutrient balances at ~240 days of gestation are listed in Table 3.

Initial body weights and body condition scores (BCS) were taken on two consecutive days (Dec 29 and 30) following an overnight fast from feed and water. During initial processing animals were treated for parasites with Ivermectin©. Heifers were adjusted to the treatment over a four day period (day -4 to -1). The adjustment period utilized a two-day two-level hay step down (80% & 67% of the diet DM, respectively). Body weights and BCS were determined each month during the feeding period. Final weights were taken March 10 and 11 prior to first scheduled calving date. Within 24 hrs of calving, heifers and calves were weighed, assigned a calving ease and calf vigor score, and removed from treatment.

Initial body weight and BCS, final body weight and BCS, changes in body weight and BCS, calf birth weight, and calving ease and calf vigor scores were analyzed by analysis of variance using the GLM procedures of SAS with pen as the experimental unit. When a significant effect of treatment was detected ($P<0.05$) means were separated using least significant differences.

Results and Discussion

Both the DDGS and SBH treatment animals had positive weight gains during the experiment. Heifers on the DDGS treatment had a greater ($P<0.01$) increase in weight and a heavier ($P=0.03$) final weight compared to the SBH treatment animals. Body condition was similar between treatments at the initiation and termination of the experimental period (Table 4). Most of the weight change could be attributed to fetal growth (approximately 74lbs; NRC, 1996) and would explain the lack of BCS change. The BCS results are similar to those found by Patterson et al. (2001), in which supplemented UIP did not have a significant impact on BCS but did have a positive impact on subsequent reproduction. Both diets effectively met the maintenance requirements of the heifers while successfully supporting fetal growth and development.

It is important to note that both diets were provided to the animals in a limit fed situation. Limit feeding

will decrease the rate of passage of feed and result in increased diet digestibility. Limit feeding can also lower maintenance requirements. Although both diets were fed to result in similar energy values, the heifers on DDGS slightly out-performed the SBH treatment. The level of DDGS fed in this trial was safe and efficacious. There were no documented health concerns, and no animals were removed from treatment prior to the end of the feeding period.

Calf birth weights were similar for both the DDGS and SBH treatments (Table 5). Treatment had no effect on the calving ease or the calf vigor (Table 5) scores. There have been concerns regarding supplemental fat provided in late gestation causing increased calf birth weights. The calf birth weight results in this study would be similar to those reported by Hess et al. (2002) in which they concluded that higher dietary fat levels fed in late gestation did not impact calf birth weight.

Implications

Based on the results it is apparent that dried distillers grains with soluble are as effective as soybean hulls as a forage replacement at this critical production period to meet the nutritional needs for heifers. These results suggest that in limit fed situations DDGS and SBH can both be supplemented at 40 percent of the diet with no negative affects on cow performance, calf birth weight, or calving difficulty.

Continuing Research

Further analysis of blood samples taken from animals both pre- and postpartum will further answer questions regarding the implications fat and UIP supplied by the DDGS treatment may have on metabolic status of the animal postpartum and on subsequent reproductive performance. Further analysis of these factors as well as calf weaning weights may provide additional insight in to economic value of utilizing distillers grains as a protein and energy source in late gestation.

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Tables

Table 1. Composition of rations (DM basis)

	Diet			
Item	DDGS		SBH	
Ingredient	Lb[a]	% of Diet	Lb[a]	% of Diet
Grass hay	9.00	55	9.00	53
Dried distillers grains + solubles	6.60	41	-	-
Soybean hulls	-	-	7.25	43
Supplement	0.69	4	0.69	4
Total	16.29	100	16.94	100

[a]Pounds per head daily.

Table 2. Nutrient composition of distillers dried grain plus solubles (DDGS) and soybean hull (SBH) treatment diets fed to heifers pre-partum (winter 2005)

Nutrients	DDGS Diet	Soy Hull Diet
DM Intake, lb	16.3	16.9
NE_m, Mcal/d[a]	11.8	11.8
NE_m, Mcal/lb[a]	0.72	0.70
CP, lb/d[a]	2.92	2.06
CP, %[a]	17.9	12.2
Dietary fat	6.0	2.1
Cost, $/d[a]	0.88	0.93

[a] Dry matter basis.

Table 3. Nutrient balance for distillers dried grains plus solubles (DDGS) and soybean hull (SBH) diets based on animal requirements at ~240 days of gestation

Nutrient Balance (240 d of gestation)	DDGS	SBH
NE_m balance, Mcal/d	0.0	0.0
DIP balance, g/d	+121	+96
MP balance, g/d	+331	+44
CP balance, g/d	+599	+208

Model in NRC Level 1, 2000.

Table 4. Weight and body condition score (BCS) of heifers fed distillers dried grains plus solubles (DDGS) and soybean hull (SBH) treatments at 40% of the diet dry matter during the last trimester of gestation

Item	DDGS	SBH	SEM[d]
Initial wt., lb	1117	1130	1.37
Final wt., lb	1249[a]	1230[b]	4.75
Wt. change, lb.	132[a]	110[b]	3.76
Initial BCS[c]	5.94	5.88	0.04
Final BCS[c]	5.96	5.84	0.07
BCS change[c]	0.02	-0.04	0.06

[ab] Means within rows (dried distillers grains plus solubles vs. soybean hulls) having different superscripts are different ($P < 0.01$).
[c] Body condition score.
[d] Standard error of the mean.

Table 5. Calving ease and calf vigor scores, and birth weight for distillers dried grains plus solubles (DDGS) and soybean hull (SBH) treatments

Item	DDGS	SBH	SEM[c]
Calving ease[a]	1.22	1.22	0.14
Calf vigor[b]	1.42	1.20	0.20
Birth wt, lb	87.0	85.0	1.48

[a] Calving ease score: 1 = no assistance, 2= easy pull, 3=hard pull requiring calf jack, 4 = caesarian section, 5 = malpresentation.
[b] Calf vigor score: 1 = nursing w/o assistance, 2 = assisted nursing but calf lives at least 1 week, 3 = calf dead within 1 week, 4 = calf dead within 24 hours of birth, 5 = calf dead at birth.
[c] Standard error of the mean.