Effectiveness of Dried Distillers Grains with Solubles as a Replacement for Oilseed Meal in Supplements for Cattle Consuming Poor Quality Forage[1]

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Summary

A two-year study was conducted at the South Dakota State University Southeast Research Farm in Beresford, SD, to determine the effects of feeding supplemental dried distillers grains with solubles (DDGS) on the performance of mid-gestation and non-gestating, non-lactating beef cows. Ninety-six gestating beef cows (initial BW = 1276.4 ± 22.2; initial BCS = 4.7 ± 0.09) and 96 non-gestating, non-lactating beef cows (initial BW = 1214.0 ± 20.8; initial BCS = 5.4 ± 0.10) were used for year 1 and year 2, respectively. Cows were stratified by weight and allocated to one of 15 pens. Pens were then randomly assigned to one of three treatment supplements: 1) sunflower meal (SFM), 2) a 50:50 combination of SFM and dried distillers grains plus solubles (COMB), or 3) dried distillers grains plus solubles (DDGS). Supplements were formulated to be isocaloric and isonitrogenous, but provide decreasing levels of degradable intake protein (DIP; 332.6, 256.5, 206.8 g/d year 1, 338.1, 284.9, 232.2 g/d year 2). All cows received a basal diet of ground corn stalks and were allowed *ad libitum* access to a salt-mineral block. Cows were fed treatment diets for 70 days. Weights were taken on day -1, 0, 35, 69, and 70. Body condition scores (BCS) were determined on day 0 and 70. Ultrasound fat dept was determined at the 12th rib and on the rump on day 0 and 70. Weight change tended ($P < 0.06$) to be affected by a treatment by year interaction. In year 1, cows consuming the SFM supplement gained more weight than cows consuming any of the other treatments. However, in year two, gain was not affected by treatment. Treatment had no effect on BCS or ultrasound fat depth at the 12th rib or rump. Small and inconsistent differences in performance and the lack of differences in body condition between treatments suggest that DDGS can replace an oilseed meal in protein supplements without affecting animal performance. Supplementing DDGS as a sole protein source for cows consuming poor-quality forage is a viable management alternative for producers.

Introduction

The expansion of the ethanol industry has increased the availability of co-products for livestock feed. Utilization of these co-products in beef cattle diets could be a means for producers to reduce the cost of production without sacrificing animal performance. Use of DDGS in cattle diets has become an increasingly common practice in modern feedlots and dairies. A large body of research has identified optimum inclusion rates for each industry. However, research on the use of DDGS in poor-quality forage diets is limited.

Beef producers who rely on crop residue, dormant range or other poor-quality forages for winter feed may be able to reduce their cost of production by utilizing dried distillers grains with solubles (DDGS) as a crude protein (CP) source rather than a more expensive oilseed meals or commercial protein supplements. Dried distillers grains with solubles contain approximately 30% CP. Approximately 45% of the CP is degradable in the rumen and the other 55% is undegradable intake protein (UIP), or escape protein. This balance of rumen degradable and undegradable protein makes DDGS suitable for beef cow diets. Young and high producing females require more escape protein to help meet their metabolizable

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protein requirements. However, if the supply of rumen degradable protein is inadequate, fiber digestion may be reduced. Fortunately for beef producers, ruminants recycle nitrogen. Nitrogen in the bloodstream can re-enter the rumen environment in the form of urea either directly across the rumen wall or as a component of saliva. The extent of recycling that occurs in beef cows on low-protein diets is not well documented. This experiment was designed to determine if DDGS could be used to replace sunflower meal (SFM), on a CP basis, in the diets of beef cows consuming poor-quality forages.

Materials and Methods

Ninety-six gestating beef cows (initial BW = 1276.4 ± 22.2; initial BCS = 4.7 ± 0.09) and 96 non-gestating, non-lactating beef cows (initial BW = 1214.0 ± 20.8; initial BCS = 5.4 ± 0.10) were used for year 1 and year 2, respectively. Animals were stratified by weight and assigned to one of fifteen pens. Pens were then randomly assigned to one of three treatment supplements: 1) SFM, 2) a 50:50 combination of SFM and DDGS (COMB), or 3) DDGS (Table 1). Supplements were formulated to be isocaloric and isonitrogenous, but provide decreasing levels of degradable intake protein (Table 1). All cows received a basal diet of ground corn stalks (CS) and were allowed *ad libitum* access to a salt-mineral block. Cows were fed there allotted supplement first and then allowed free access to the basal forage. Cows were weighed on d -1, 0, 35, 69, and 70. Consecutive weights at the initiation (d -1 and 0) and conclusion (d 69 and 70) of the experiment were averaged to determine initial and final weights. On day 0 and 70 body conditioned scores (BCS) were determined by averaging the estimates of three experienced individuals. Fat depth at the 12^{th} rib and rump were determined by ultrasound on d 0 and 70. Feed samples were taken weekly, frozen immediately, and stored at -20^{o}C prior to analysis. Samples were later dried at 60^{o}C for a minimum of 24 hours and ground through a Wiley Mill (Aurthur H. Thomas, Philadelphia, PA) fitted with a 1mm screen. Feed samples were assayed for Kjeldahl N (Macro-Kjeldahl N; AOAC, 1995), ADF and NDF (Goering and Van Soest, 1990), and UIP (Klopfenstein et al., 2001) (Table 2).

Daily feed allocations were recorded and orts were collected and weighed weekly or as needed. All data were analyzed with pen as the experimental unit using the GLM procedure of SAS (1999 SAS Inst., Inc., Cary, NC). When treatment x year interactions were not significant ($P > 0.05$), data were pooled across years. Significance was declared at $P < 0.05$.

Results

Weight change tended to be influenced by a treatment x year interaction ($P < 0.06$; Table 3). In year 1, cows supplemented with SFM gained more weight than cows supplemented with DDGS or COMB. However in year 2, performance was not affected by treatment. Intake of cornstalks, supplement, and mineral are reported in Table 4. Intake of corn stalks did not differ between treatments for year 1. In year 2, cows fed the COMB treatment had greater ($P < 0.05$) intake of corn stalks than cows fed the DDGS treatment but did not differ from the SFM treatment. Cows fed the SFM treatment had intermediate CS intake which did not differ from COMB or DDGS. In year 1, supplement intake was greater for cows fed the SFM treatment than for cows fed DDGS but did not differ from those cows fed the COMB treatment. Supplement intake did not differ between cows fed DDGS and COMB. No significant difference was noted between treatments for mineral intake in year 1. In year 2, supplement intake was greatest ($P < 0.05$) for cows consuming SFM and lowest for cows fed DDGS. Supplement intake of cows fed COMB was intermediate. In year 2, no difference was found between treatments for mineral intake. Treatment had no affect on BCS (Table 5) or ultrasound fat depth at the 12^{th} rib or rump (Table 6).

Discussion

In the first year of the experiment, cows consuming SFM gained more weight than cows consuming DDGS or COMB. However, this response was not observed in year 2. The difference in weight gain between years is likely a result of the difference in physiological state (gestating vs. non-gestating, non-lactating) of the cows used in each year. Cows in late gestation would experience greater weight gain as a result of fetal development and have higher nutritional requirements than open cows. The reason for increased performance of cows in the SFM treatment is unclear. Samples were collected for analysis of diet digestibility, but results were not available at the time of publication. However, given the similar intake of CS across treatments, it is unlikely that diet digestibility was substantially different between treatments. Differences in the intake of treatment supplements were not unexpected. To facilitate provision of an isocaloric and isonitrogenous supplement, cows fed SFM and COMB received slightly more DM per day than cows fed DDGS. Inconsistent responses in gain and the lack of differences in BCS and ultrasound fat depth suggests that DDGS can replace oilseed meals on a crude protein basis without affecting animal performance. These data agree with the findings of Stalker et al. (2004) who observed no difference in performance of heifers fed DDGS with increasing levels of urea to correct a deficiency in degradable intake protein.

Implications

Results of these experiments suggest that DDGS can effectively replace sunflower meal on a crude protein basis without sacrificing animal performance. This provides beef producers with an economical management alternative for winter supplementation for cattle on poor-quality forages.

References Cited

AOAC, 1995. Official Methods of Analysis. 16th ed. Assoc. Offic. Anal. Chem., Arlington, VA.

Goering, H.K., and P.J. Van Soest. 1970. Forage Fiber Analysis (Apparatus, Reagents, Procedures and Some Applications. Agric. Handbook No. 379. ARS-USDA, Washington, D.C.

Klopfenstein, T.J., R.A. Mass, K.W. Creighton, and H.H. Patterson. 2001. Estimating forage protein degradation in the rumen. J. Anim. Sci. 79 (E. Suppl.): E208-217.

SAS® User's Guide: Statistics version 8.12 Edition. 1999. SAS Institute Inc., Cary, NC, USA.

Stalker, L. A., T. J. Klopfenstein, D. C. Adams, and G. E. Erickson. 2004. Urea inclusion in forage based diets containing dried distillers grains. University of Nebraska Beef Report MP 80-A. Pages 20-21.

Tables

Table 1. Composition and nutrient profile of treatment supplements

	Year 1			Year 2		
Ingredient	SFM	COMB	DDGS	SFM	COMB	DDGS
	lb DM/d					
DDGS	-	1.49	2.97	-	1.57	3.15
SFM	2.85	1.43	-	3.5	1.75	-
Soy oil	0.35	0.17	-	0.35	0.17	-
	% of diet DM					
DM	90.1	87.6	84.9	90.6	90.3	89.9
CP	26.7	28.6	30.8	24.0	27.9	32.6
	% of CP					
DIP	88.0	71.7	63.2	88.0	71.6	63.2

Table 2. Chemical composition of individual feed ingredients

Analysis	Year 1 SFM	Year 1 CS	Year 1 DDGS	Year 2 SFM	Year 2 CS	Year 2 DDGS
	%DM					
CP	29.7	3.31	30.8	26.4	3.58	32.6
DM	89.1	87.3	84.9	89.8	81.8	89.9
ASH	5.49	4.95	3.93	9.34	9.39	3.36
OM	94.5	95.1	96.1	90.7	90.61	95.6
ADF	28.3	47.2	14.8	38.7	53.6	13.4
NDF	44.1	79.8	42.6	38.7	88.2	42.4

Table 3. Cow weights and weight changes

	Year 1 SFM	Year 1 COMB	Year 1 DDGS	Year 1 SEM	Year 2 SFM	Year 2 COMB	Year 2 DDGS	Year 2 SEM
	lb							
Initial	1286.1	1285.5	1293.3	10.7	1194.2	1212.9	1215.4	10.7
Final	1355.6	1332.4	1341.2	13.0	1197.8	1231.7	1234.8	13.0
Change	69.5[b]	46.9[a]	47.9[a]	8.6	3.6	18.8	19.4	8.6

[a,b] Means with uncommon superscripts differ ($P < 0.10$).

Table 4. Intake

Ingredient	Year 1 SFM	Year 1 COMB	Year 1 DDGS	Year 1 SEM	Year 2 SFM	Year 2 COMB	Year 2 DDGS	Year 2 SEM
	lb/d DM							
Corn Stalks	28.0	28.2	28.6	0.03	18.6[c,d]	19.0[d]	17.6[c]	0.00
Supplement[a]	3.23[d]	3.19[c,d]	3.15[c]	0.03	3.26[e]	2.99[d]	2.79[c]	0.00
Mineral[b]	0.79	0.86	0.81	0.03	0.62	0.62	0.53	0.00

[a] Supplements were formulated for different intake levels.
[b] Mineral was provided as a free choice block.
[c,d,e] Means within a row under each year with uncommon superscripts differ (P < 0.05).

Table 5. Body condition scores and changes

	SFM	COMB	DDGS	SEM
Initial	5.04	5.02	5.09	0.05
Final	5.15	5.15	5.22	10.07
Change	0.11	0.13	0.03	0.08

Table 6. Ultrasound rib and rump fat depth and changes

	SFM	COMB	DDGS	SEM
12th rib fat	-- in. ---			
Initial	0.13	0.14	0.12	0.01
Final	0.13	0.14	0.12	0.01
Change	0.00	0.00	0.00	0.00
Rump fat	-- in. ---			
Initial	0.22	0.22	0.22	0.02
Final	0.22	0.21	0.21	0.02
Change	- 0.02	- 0.01	- 0.01	0.00