Hay Substitution Using a Controlled Release Distiller's Dried Grain Supplement

D.G. Landblom[1], K. Ringwall[1], L.J. Tisor[1]

[1]North Dakota State University, Dickinson Research Extension Center

Summary:

Cows supplemented with a 24% CP controlled release distillers dried grain (DDG) supplement either pre- or post-calving consumed less hay. Cows that began receiving supplement 45 days before calving consumed the least amount of hay and the least amount of supplement on a per head per day basis. Overall cow weight change and body condition score did not differ between treatments. Cow rebreeding performance for first, second, third, and overall pregnancy rate did not differ. And calf birth weight, calf weaning weight, and calf age at weaning did not differ between treatments. Economic analysis, using hay priced at $60/ton and controlled release DDG supplement at $530/ton, did not result in an economic advantage for supplementation.

Introduction:

Drought in the northern Great Plains region is common and often impacts hay production. Short hay supplies are often addressed by selling cattle or replacing hay that didn't grow with purchased hay, CRP hay, annual forages, and co-products. Co-products have become important sources for nutrient replacement when hay supplies are short.

Nutrients found in corn DDGS are similar to the original grain except the nutrients become concentrated after starch removal during the fermentation process and heating during the drying process changes rumen degradability characteristics. After drying, the protein fraction degraded in the rumen is estimated to be 27.2% and the fraction escaping rumen degradation is estimated to be 72.8%. On average, corn DDGS contain 29.5% CP, 46.0% NDF, 88.0% TDN, 10.3% fat, 0.32% calcium, 0.83% phosphorus, 1.07% potassium, and 10.56 mg/kg copper, and 0.40% sulfur (NRC 1996).

Corn distiller's grains are often considered as a protein supplement; however, due to the co-products highly digestible fiber fraction and fat content, distiller's grains are also considered for their energy content. Unlike high starch feed grains, which can interfere with fiber digestion, DDGS are practically devoid of starch and do not interfere with forage digestion. The fat content of distiller's grains is expected to provide energy for lactation and may also be beneficial with respect to reproductive performance that is independent of caloric content. Wintering costs represent one of the largest expenses in the cow-calf enterprise; however, due to the unique concentration of nutrients in distiller's grains, the cost: benefit ratio when feeding distillers grains may be favorable.

This field study will evaluated a controlled release DDG supplement to determine intake and substitution for hay value, and contrast cow and calf performance with the cost of supplementation; identifying the overall substitution value of a controlled release DDG product.

Project Objectives:

1. Compared to all hay gestation (precalving) and lactation (postcalving) diets, evaluate the effect of substituting a portion of daily hay dry matter with DDGs from a controlled release DDG block on cow body condition, calf survival, reproductive performance, and weaning weight.

2. Conduct partial economic analysis and determine treatment net return.

Procedures:

Treatments:

1. All hay control diet (no substitution).
2. Pre-calving hay substitution with DDGs from a controlled release 24% CP DDG supplement beginning 45 days before calving begins.
3. Post-calving hay substitution with DDGs from a controlled release 24% CP DDG supplement beginning after calving.

Mixed age range beef cows (3 – 10 yrs) located at the Dickinson Research Extension Center (n = 108) were divided into three treatment groups of 36 cows each and 4 pen replicates with 9 cows in each replicate. One treatment group served as an unsupplemented control; a second group began receiving the controlled release DDG supplement substitution for hay 45 days before the scheduled start of the calving season, and the third group began receiving the same controlled release DDG supplement at the start of the calving season. The controlled release DDG supplement was offered continuously from initiation until the cows and their calves were turned out on improved pasture the first week of May.

Measurements and Observations:

1. Animal Weights -
   Cows were weighed initially, cows and calves were weighed weekly until calving was completed, at the end of the wintering and calving period when the cows are turned out on Crestedwheat grass pasture, and finally at weaning. Calf birth weight, May turnout weight, and weaning weight were recorded.

2. Cow Condition Evaluation –
   At each weigh period, all cows were body condition scored using the 0 - 9 scoring system and ultrasound fat depth measurements were taken at the same time at a location between 12^{th} and 13^{th} ribs as described by the Ultrasound Guidelines Council.

3. Pregnancy Rate -
   Cows in the study were bull bred and breeding cycle pregnancy rate and overall treatment pregnancy rates were based on fetal age determined using regression analysis of ultrasound cranial width measurement.

4. Forage and Supplement Analysis -
   The forage used in the study was alfalfa-grass mixed hay that was sampled and composited before analysis for moisture, DM, crude protein, NDF, ADF, calcium, and phosphorus. Controlled release supplement were core sampled and analyzed for ash, crude protein, neutral detergent fiber (NDF), acid detergent fiber (ADF), invitro dry matter disappearance (IVDMD), invitro organic matter disappearance (IVOMD), calcium, and phosphorus.

5. Economic Analysis –
   A partial economic analysis was used to determine the value of supplementation.

Statistical Analysis:

Data were analyzed as a complete-block design using MIXED non-repeated measures procedure of SAS (1996).

Results:

This project was conducted during one of the most severe winters in North Dakota history. Multiple blizzards during the March – April calving period resulted in statewide calf death losses of approximately 85,000 head as reported through the North Dakota Extension Service. Calf death loss across all treatments in this experiment was 5.5%.

Nutrient analysis for the alfalfa-grass mixed hay fed and the controlled release protein supplement are shown in Tables 1 and 2.

Results for this cow wintering study to evaluate the substitution value of a controlled release 24% CP distiller's dried grain supplement for hay and to evaluate the subsequent effect on cow performance, rebreeding performance, weaning weight, and partial economic analysis are summarized in Tables 3-7.

Hay and supplement intake are shown in Table 3. By design, supplemented cows consumed less hay than the unsupplemented control cows, and those cows fed supplement pre-calving consumed the least amount of hay (P = 0.0001) and a greater amount of supplement (P = 0.0614) due to the 56 day longer pre-calving feeding period. The post-calving supplementation group received supplement for 33.5 days after calving and consumed less total supplement per cow (P = 0.0614), but average daily consumption was higher after lactation began (0.6025 vs. 0.855 Lb/cow/day) in the post-calving group (P = 0.055).

Cow starting, ending, and overall weight change (Table 4) did not differ between treatments; however, cow body weight decline was numerically smaller among the supplemented groups. Although not significant, weight loss among the unsupplemented control group was 2.8% greater.

Initial, calving, and ending cow body condition score (BCS) did not differ (Table 4). Although visual BCS evaluation was not sensitive enough to detect a difference between treatments, body condition evaluation based on external fat thickness over the rib using ultrasound technology identified a significant ending fat depth difference between control and supplemented cows (Table 4). On average, the fat depth decline for the supplemented cows was 23.4% less than the unsupplemented control cow groups.

Calf performance has been summarized in Table 5. Hay and controlled release supplement feeding was terminated the first week of May when the cows and their calves were moved to Crestedwheat grass pasture and subsequently to native range pastures the third week of June. Calf birth weight (P = 0.507), May turnout calf weight (P

= 0.872), final weaning weight (P = 0.971) and calf age at weaning (P = 0.381) did not differ.

Cow rebreeding performance is summarized in Table 6. First (P = 0.564), second (P = 0.172), and third (P = 0.765) breeding cycle pregnancy rates did not differ. While breeding cycle pregnancy rates did not differ significantly, on average there were approximately 15% fewer cows pregnant in the first breeding cycle among the cows that were supplemented pre-calving. Although the number of open cows did not differ, there were a numerically greater number of open cows among the post-calving supplementation group. The overall pregnancy rate following both pre- and post-calving supplementation did not differ between treatments.

Partial pre-tax economic analysis is shown in Table 7. At the onset, cows involved in the study were randomly assigned to treatments based on cow weight and lifetime most probable producing ability (MPPA). The MPPA value did not differ across treatments (P = 0.87). In the analysis, hay was priced at $60/ton and the controlled release supplement price was $530/Ton. Due to the small difference in weaning weight across treatments, calves were priced at $94.50/cwt with no price slide. Compared to the non-supplemented all hay control group, pre- and post-calving supplementation cost an additional $9.95 and $8.97/cow more, respectively.

Acknowledgement:
Partial funding was provided by the ND State Board of Agricultural Research and Education under agreement #8-25.

Table 1. Alfalfa-Grass Mixed Hay Nutrient Analysis

Moisture, %	9.1
Crude Protein, % DM	13.3
TDN, %DM	51.6
NDF, % DM	58.5
ADF, % DM	39.7
Calcium, % DM	0.95
Phosphorus, % DM	0.28

Table 2. Controlled Release 24% CP Supplement Nutrient Analysis

Ash, % DM	55.20
Crude Protein, % DM	27.78
NDF, % DM	12.85
ADF, % DM	2.54
IVDMD, % DM	85.75
IVOMD, % DM	63.39
Calcium, % DM	9.62
Phosphorus, % DM	1.52

Table 3. Hay Consumption and Controlled Release 24% CP Supplement Intake

	Control	*Ctrl-Rel DDG Pre-Calving*	*Ctrl-Rel DDG Post-Calving*	*SE*	*P-Value*
Hay Intake:					
Hay, Lbs/Cow	3561[a]	3391[b]	3469[c]	76.2	<.0001
Hay, Lbs/Head/Day	40.93[a]	38.97[b]	39.88[c]	0.88	0.0001
Controlled Release Supplement Intake:					
Days Supplement Fed	-	89.75	33.5		
Lbs/Cow	-	53.94[a]	28.58[b]	9.965	0.0614
Lbs/Cow/Day	-	0.6025[a]	0.8550[b]	0.1591	0.055

Table 4. Cow Performance Following Hay Replacement with a Controlled Release 24% CP Supplement

	Control	*Ctrl-Rel DDG Pre-Calving*	*Ctrl-Rel DDG Post-Calving*	*SE*	*P-Value*
Trial Length, Days	89.25	89.75	89.5	0.263	0.244
Cow Body Weight Change:					
Cow Start Wt., lb.	1518.7	1510.4	1497.5	57.81	0.217
Cow End Wt., lb.	1389.5	1410.0	1412.0	56.09	0.433
Cow Wt. Gain (Loss), lb.	(129.2)	(100.4)	(85.5)	16.39	0.217
Cow Wt. Gain (Loss)/Head/Day, lb	(1.44)	(1.12)	(0.96)	0.184	0.213
% Weight Decline	8.50	6.60	5.71		
Cow Body Condition Score Change:					
Start BCS	6.39	6.42	6.39	0.233	0.938
Calving BCS	6.39	6.47	6.47	0.223	0.854
End BCS	5.75	6.06	5.83	0.317	0.469
BCS Increase or (Loss)	(0.64)	(0.36)	(0.56)	0.133	0.358
% BCS Decline	10.0	5.61	8.76		
Cow Ultrasound Fat Depth Change:					
Start Rib Fat Depth, mm	5.86	5.91	6.03	0.702	0.955
End Rib Fat Depth, mm	3.58[a]	5.09[b]	5.00[b]	0.867	0.092
Rib Fat Depth Inc. (Decline), mm	(2.28)	(0.82)	(1.03)	0.548	0.185
% Rib Fat Depth Decline	38.9	13.9	17.1		

Table 5. Calf Performance Following Pre- and Post-Calving Hay Replacement with a Controlled Release 24% CP Supplement

	Control	*Ctrl-Rel DDG Pre-Calving*	*Ctrl-Rel DDG Post-Calving*	*SE*	*P-Value*
Cow Weight Change:					
Cow Weight at Calving, lb	1472.3	1503.6	1507.1	68.34	0.460
Cow Weight at Weaning, lb	1547.0	1464.4	1492.4	39.52	0.185
Cow Weight Gain (Loss)	74.7	(39.2)	(14.7)		
Weaning Cow BCS	6.22	6.02	6.03	0.248	0.825
Calf Performance:					
Calf Birth Weight, lb	98.3	95.0	94.7	2.34	0.507
Calf May Turnout Weight, lb	170.2	175.0	175.0	6.98	0.872
Calf Age at Weaning, Days	187.8	190.6	193.2	2.44	0.381
Calf Weaning Weight, lb	644.5	643.7	640.1	13.67	0.971
Calf Wt Gain/Day of Age, lb	2.91	2.87	2.82	0.051	0.484

Table 6. Rebreeding Performance Following Pre- and Post-Calving Hay Replacement with a 24% CP Controlled Release Supplement

	Control	*Ctrl-Rel DDG Pre-Calving*	*Ctrl-Rel DDG Post-Calving*	*SE*	*P-Value*
Breeding Cycle Pregnancy Rate:					
1st Breeding Cycle, %	52.8	38.9	55.1	11.14	0.564
2nd Breeding Cycle, %	23.4	38.9	24.9	5.83	0.172
3rd Breeding Cycle, %	21.3	19.4	13.4	7.85	0.765
Open, %	2.8	2.8	6.7	3.19	0.620
Overall Pregnancy, %	97.2	97.2	93.6	3.13	0.660

Table 7. Partial Economic Analysis

	Control	*Ctrl-Rel DDG Pre-Calving*	*Ctrl-Rel DDG Post-Calving*	*SE*	*P-Value*
Cow MPPA Value[a]	101.7	102.3	101.9	0.962	0.870
Feed Intake/Cow:					
Hay Lbs/Cow	3561[a]	3391[b]	3469[c]	76.2	<.0001
Controlled Release Suppl. Lbs/Cow	-	53.94[a]	28.58[b]	9.965	0.0614
Feed Cost/Cow:					
Hay @ $60/T	106.83	101.73	104.07		
Controlled Release Suppl. @ $530/T	-	14.29	7.57		
Total Wintering Cost	106.83	116.02	111.64		
Calf Performance:					
Weaning Weight, lb	644.5	643.7	640.1	13.67	0.971
Economic Analysis:					
Income/Cow -					
Calf Price Received/Cwt, $	$94.50	$94.50	$94.50		
Total Calf Value Received, $	$609.05	$608.29	$604.89		
Expenses -					
Hay & Controlled Release Suppl Cost, $	$106.83	$116.02	$111.64		
Net Return, $	$502.22	$492.27	$493.25		
Difference vs. Control, $	-	-9.95	-8.97		

[a] MPPA Value: Index of a cow's Most Probable Producing Ability. This value is generated from Dickinson Research Extension Center cows enrolled in the NDSU/ND Beef Cattle Improvement Association's Cow Herd Appraisal Performance Software program. The index ranks cows based on their lifetime production ability.