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Summary

Two experiments evaluated the influence of dried distillers grains supplementation frequency on forage digestibility and growth of yearling steers. In Exp. 1, treatments were dried distillers grains fed at 16.7% of the diet either daily, every other day or every third day. Diet DM, OM and NDF digestibility decreased linearly as dried distillers grains supplementation occurred less frequently. In Exp. 2, 48 crossbred steers were used in a two-year study to compare corn/soybean meal with dried distillers grains as winter supplements. Steers performed similarly when supplements were fed 6 days/week but performance was decreased when dried distillers grains was fed 3 days/week. Better animal performance may result from more frequent supplementation of dried distillers grains.

Introduction

In many forage-based production systems, supplemental protein is provided during periods of limited forage quality and/or quantity to increase animal weight gain and improve forage intake and digestibility. Supplemental feeds comprise a significant portion of variable costs of beef production and providing protein supplements less frequently may reduce costs without negatively impacting performance.

In situations where forage energy content does not support desired productivity, energy supplementation may be necessary. Energy supplements containing nonstructural carbohydrates, such as cereal grains, often depress forage intake and digestibility. However, balancing the diet for degraded intake protein requirements may alleviate this problem. Dried distillers grains (DDG) is an excellent source of energy that does not contain nonstructural carbohydrates. Additionally, the high undegraded intake protein and phosphorus content make DDG an ideal supplement for growing cattle consuming forage based diets.

Objectives of these experiments were to determine the influence of DDG supplementation frequency on intake, digestibility and growth performance of beef cattle consuming forage based diets.

Procedure

Experiment 1: Digestion Trial

Eight crossbred steers (818 ± 66 lb) were assigned randomly to treatment in a replicated 3 X 3 Latin square design with three periods. Treatments were DDG fed either daily, every other day or every third day. Dried distillers grains comprised 16.7% of the diet dry matter for all treatments. Steers were housed in individual pens (6 x 3 m) in a semi-enclosed barn with unrestricted access to fresh water. Periods lasted 21 days and total tract diet digestion was assessed from day 16 to 21 of each period. On day 1 through 9 of each period, cool season grass hay, chopped to a 15-cm particle size, was provided ad libitum, with orts from the previous day determined before feeding. Beginning on day 10 of each period, amount of hay fed was reduced to 90% of the average hay intake on day 1 through 9. Limiting amount of hay offered resulted in elimination of orts during the fecal collection period.

Before hay feeding, DDG was provided to those steers receiving DDG every day at 16.7% of the previous day's DMI. For steers assigned to every other day and every third day treatments, DDG was fed at 33.3% of the average DMI for the previous two day and 50.0% of the average DMI for the previous three days, respectively, on the appropriate supplementation day. Nutrient content of hay and DDG is listed in Table 1.

Table 1. Digestion trial feedstuff nutrient content (Exp 1).

Item	Grass Hay	Dry Distillers Grains
DM, %	95.9	92.1
OM, %	90.2	97.7
NDF, %	67.2	43.5
IVDMD, %	53.4	—
CP, %DM	6.7	34.1
Fat, %DM	—	10.2

Steers were fitted with fecal bags on day 16, with bags changed once every 12 hours, for a total fecal collection period of 6 days. Digestibility of DDG NDF was assumed to be 80%.

Experiment 2: Steer Performance Trial

Each year for two years, 48 crossbred steers (470 ± 49 lb) were stratified by weight and assigned randomly to replicated supplementation groups, with 6 steers per group. Steers in the same supplementation group were identified by a colored ear tag. Two supplementation groups (ear tag colors) were assigned randomly to treatments. Treatments were designed to result in similar ADG using 1996 NRC software. The control (CON) treatment consisted of ad libitum access to grass hay in a drylot and the daily equivalent of 4.4 lb/steer (DM) corn-soybean based supplement (Table 2) fed 6 days/week. Steers in all other treatments grazed upland winter range in a common pasture and were sorted into one of 6 pens 6 days/week according to ear tag color and fed the daily equivalent of either 6.0 lb/steer (DM) corn-soybean based supplement 6 days/week (SBM), 4.2 lb/steer (DM) DDG based supplement 6 d/week (DDG6) or 4.2 lb/steer (DM) DDG based supplement 3 days/week (DDG3). Steers in the DDG3 treatment were offered twice the amount

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offered to DDG6 on alternate supplementation days however DDG3 fed steers only consumed the daily equivalent of 3.9 lb/steer (DM) supplement over the course of the experiment. Treatments were designed to supply similar amounts of energy and meet metabolizable protein and degraded intake protein requirements according to NRC (1996). Previous research has shown dried distillers grains has about 125% the energy of corn. Therefore, calves were supplemented with 70% as much dry matter to provide equivalent energy intake.

Steers were weighed on two consecutive days upon initiation and termination of the 62-day trial without limiting intake prior to weighing. Hay used in the trial was subsampled and analyzed for DM, CP and IVDMD, while supplements fed were analyzed for CP.

A partial budget was used to compare costs and calculate cost of gain associated with each treatment. Hay, corn and soybean meal were valued using a 10 year average price (*Crop and Livestock Prices for Nebraska Producers, 2005*; $60.87/ton, $2.22/bu, and $9.68/cwt respectively) while a price of $75/ton was used for dried distillers grains. Costs included $11.79/ton for labor and equipment associated with feeding hay and $35/ton for delivery of corn, soybean meal and distillers grains. Winter range valued at half the current average rate for a summer AUM, according to published data (*Nebraska Farm Real Estate Market Developments, 2003-2004*). It was assumed cattle were checked daily, therefore costs associated with delivering supplement were the same for all treatments.

Table 2. Supplement composition and feedstuff nutrient content (%DM; Exp. 2).

	Treatment[a]			
Ingredient	Hay	CON	CSM	DDG
Dry distillers grains	—	—	—	97.80
Dry rolled corn	—	53.67	65.64	—
Soybean meal	—	43.31	32.16	—
Molasses	—	—	—	—
Limestone	—	1.67	1.22	1.22
Salt-	1.13	0.82	0.82	
Trace mineral premix[b]	—	0.17	0.12	0.12
Vitamin premix[c]	—	0.05	0.04	0.04
Nutrient content				
CP, %	6.6	27.8	25.7	32.0
IVDMD, %	53.4	—	—	—

[a]Steers fed a corn/soybean based supplement in a dry lot (CON) or while grazing native winter range (CSM) or fed dried distillers grains while grazing range either 6 (DDG6) or 3 (DDG3) days per week.
[b] Contained (g/kg of premix): 130 Ca; 10 Co; 15 Cu; 2 I; 100 Fe; 80 Mn; and 120 Zn.
[c]Contained 29.9 million IU of vitamin A, 6.0 million IU of vitamin D, and 7,000 IU of vitamin E/kg of premix.

Table 3. Effect of dried distillers grains supplementation frequency on DM, OM, and NDF intake and OM and NDF digestibility by steers (Exp 1).

	Treatment[a]				*P*-value[c]	
Item	D	2D	3D	SEM[b]	L	Q
Daily DMI, % BW						
Hay	2.36	2.22	2.22	0.04	0.03	0.13
Total	2.67	2.50	2.51	0.05	0.04	0.14
Daily OM intake, % BW						
Hay	1.93	1.80	1.81	0.03	0.03	0.13
Total	2.37	2.22	2.23	0.04	0.04	0.15
Daily NDF intake, % BW	1.69	1.58	1.59	0.03	0.04	0.13
Diet digestibility, %						
DM	58.1	56.0	55.0	0.4	0.001	0.32
OM	62.3	60.3	59.1	0.5	0.001	0.53
NDF	58.8	57.8	57.4	0.6	0.12	0.73
Hay digestibility, %						
DM	51.4	50.1	50.4	0.7	0.33	0.32
OM	55.4	54.4	54.7	0.7	0.45	0.44
NDF	58.8	57.8	57.4	0.6	0.12	0.73

[a]D = daily supplementation; 2D = supplementation every other day; 3D = supplementation every third day.
[b]Standard error of the mean, n = 18.
[c]L = linear effect of supplementation frequency; Q = quadratic effect of supplementation frequency.

Results

Experiment 1: Digestion Trial

Hay ($P = 0.06$) and total ($P = 0.08$) DMI decreased linearly as supplementation frequency decreased (Table 3). Similarly, as DDG supplementation frequency decreased so did hay ($P = 0.07$) and total ($P = 0.08$) organic matter intake. Daily NDF intake decreased linearly ($P = 0.07$) as supplementation frequency decreased.

Apparent total-tract DM ($P = 0.002$), OM ($P = 0.002$) and NDF ($P = 0.07$) disappearance of the diet decreased linearly as supplementation frequency decreased.

Among other possibilities, decreased digestibility as a consequence of less frequent feeding may be related to the fat content of distillers grains (10.2 %). On the day of supplementation dried distillers grains comprised 50% of the diet in steers supplemented every third day, adding 5% fat to the diet. Hay has 2.0 to 2.5% ether extract. Feeding fat at these levels may be enough to depress digestibility.

Table 4. Weight and average daily gain of steers fed a corn/soybean based supplement in a dry lot (CON) or while grazing native winter range (CSM) or fed dried distillers grains while grazing range either 6 (DDG6) or 3 (DDG3) days per week (Exp. 2)

	Treatment					
Item	CON	CSM	DDG6	DDG3	SE[a]	*P*-value
Initial BW, lb	468	468	470	470	1	0.98
Final BW, lb	585[b]	594[b]	581[b]	560[c]	1	0.004
ADG, lb/day	2.0[b]	2.0[b]	1.8[b]	1.4[c]	0.1	0.004

[a]Standard error of the mean, n = 16.

Table 5. Costs associated with feeding a corn/soybean based supplement to steers in a dry lot (CON) or grazing native winter range (CSM) or feeding dried distillers grains either 6 (DDG6) or 3 (DDG3) days per week to steers grazing range (Exp. 2).

Item	CON	CSM	DDG6	DDG3
Supplement cost, $/hd	25.05	31.37	15.57	14.78
Hay cost, $/hd	20.27	—	—	—
Range cost, $/hd	—	8.60	11.11	11.38
Total cost, $/hd	45.32	39.97	26.68	26.16
Cost of gain, $/cwt	37.29	31.76	23.78	29.30

Experiment 2: Steer Performance Trial

Steers receiving CON, CSM and DDG6 treatments had similar ADG but gain was reduced in the DDG3 treatment. Decreased gain in DDG3 steers is likely due to reduced forage digestibility as observed in Exp. 1. Other research has demonstrated reduced gain in animals fed DDG less frequently (*2003 Nebraska Beef Report*, pp. 8-10). Incomplete consumption of supplement may also have contributed to reduced performance. Steers in the DDG3 treatment consumed the equivalent of 0.3 lb per day less supplement than DDG6 steers.

These results agree with past research (*2004 Nebraska Beef Report*, pp. 22-24) and indicate balancing diets for degradable intake protein requirements when feeding supplements containing non-structural carbohydrates may reduce effects of starch on fiber digestibility. Cost of gain was greatest for CON treated steers primarily because of costs associated with feeding hay (Table 5). Total costs were least but gain was also least for DDG3 steers making cost of gain greatest among steers grazing range. Feeding dried distillers grains six days per week resulted in the lowest cost of gain.

Conclusion

Forage digestibility and animal performance were reduced and cost of gain increased when DDG were fed less frequently. These results may be related to the fat content of DDG. Previous research has shown DDG has about 125% the energy of corn. Therefore, calves were supplemented with 70% as much DM to provide equivalent energy intake. This concept is validated by the equal gains of calves fed CSM and DDG6 primarily because of lower amount fed.

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