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Dry distillers grains improved gain and efficienicy relative to corn. Heifers supplemented daily consumed more hay and gained faster, but were not more efficient than those supplemented three times weekly.

Summary

An experiment was conducted with 120 crossbred heifers to determine the value of dry distillers grains (DDG) in high-forage diets, and to evaluate the effect of supplementing daily compared to three times weekly. Heifers were fed to consume grass hay ad libitum and supplemented with DDG, dry rolled corn (DRC), or DRC with corn gluten meal (DRC+CGM). Supplements were fed at two levels and offered either daily or three times per week in equal proportions. Heifers supplemented daily ate more hay, gained faster (1.37 vs. 1.24 lb per day), but were not more efficient than those supplemented on alternate days. At the low level of gain, DDG heifers gained more and were more efficient than DRC or DRC+CGM. At the high level of gain, DDG and DRC+CGM were not different, although both resulted in improved gain and efficiency relative to DRC.

Introduction

Because the energy supplied from wet corn gluten feed (WCGF) and wet distillers grains (WDG) is largely in the form of digestible fiber (and fat in the case of WDG), they fit well as energy supplements in high-forage diets (*1996 Nebraska Beef Report, pp. 65-66)*. However, use of the wet products has been somewhat localized around corn milling plants due to the expense of shipping. Drying these products makes them more accessible to forage-dependent cow-calf and stocker operations. Although drying has been shown to decrease the energy value of distillers grains in finishing diets (*1994 Nebraska Beef Report, pp. 38-40)*, the energy value of DDG in high-forage diets is unknown.

Due to the costs associated with supplementation, there has been considerable interest in decreasing the frequency with which supplement is delivered. Researchers have reported success in decreasing the frequency of delivery of high-protein supplements, due largely to animals' ability to recycle N to the rumen. Irregular feeding of energy supplements has been less successful. However, feeding less frequently generally requires more supplement to be offered at each feeding. Because energy supplements are often grain-based, feeding these higher levels that are necessary with infrequent supplementation may lead to negative associative effects and impaired forage utilization. Byproducts may provide an opportunity to provide a high-energy supplement less frequently without negatively impacting forage utilization, as well as reducing the risk of digestive problems associated with feeding grain.

The objectives of this study were to determine the energy value of DDG in a high-forage diet, and to evaluate the impact of supplementation frequency on intake and performance.

Procedure

One hundred and twenty crossbred heifers (584 + 4.5 lb) were used in a randomized complete block design to compare DDG to DRC in a high-forage diet and to evaluate the impact of providing an energy supplement daily or three times weekly. Treatments were arranged in a 3 x 2 x 2 factorial, with three supplements, two levels and two supplementation frequencies. Heifers were limit-fed (1.75% BW) for five days before and at the end of the 84-day experimental period. Heifer weights were recorded on three consecutive days following each limit-feeding period.

Heifers were individually fed in Calan electronic headgates. Chopped native grass hay (8.7% CP) was fed for ad libitum consumption, with dry matter intakes (DMI) determined weekly. All heifers were fed a dehydrated alfalfa-based supplement at 0.5 lb per day as an MGA carrier (0.5 mg/day). The DDG and DRC supplements (Tables 1 and 2) were formulated to meet NRC-predicted energy and metabolizable protein (MP) requirements at two targeted levels of gain. An energy value equal to corn was used for DDG. Urea was included where degradable intake protein deficiencies were calculated. The DRC+CGM supplements were designed to supply a similar level of undegradable intake protein (UIP) as the DDG supplements.

The two levels were designed to attain ADG of 1.00 (LOW) and 1.75 (HIGH) lb/day, with LOW supplements fed at 0.21% of BW and HIGH fed at 0.81% of BW, in addition to ad libitum hay and the MGA supplement. Heifers were weighed every 28 days with supplement levels adjusted accordingly. Heifers were supplemented every day (DAILY), or in equal portions on Monday, Wednesday, and Friday (ALT), such that seven-day supplement intakes were similar between DAILY and ALT heifers.

The NRC (1996) model uses net energy content of the diet in conjunction with feed intake to predict animal performance. Therefore, if intake and performance are known, energy content of the feed can be predicted. Individual intakes, diet compositions, weights and weight gains were used to calculate an energy value of DDG in the treatment diets. The energy value of corn was determined similarly so that DDG could be expressed relative to corn.

Table 1. Composition of low-gain supplements.

	Composition, %DM		
Ingredient	DDG	DRC	DRC+CGM
Dry distillers grains	90.33	—	—
Dry rolled corn	—	88.47	60.53
Corn gluten meal	—	—	30.73
Urea	2.79	4.66	1.86
Molasses	2.42	2.42	2.42
Salt	3.73	3.73	3.73
Vitamin premix	0.17	0.17	0.17
Trace mineral premix	0.56	0.56	0.56

Table 2.Composition of high-gain supplements.

	Composition, %DM		
Ingredient	DDG	DRC	DRC+CGM
Dry distillers grains	94.88	—	—
Dry rolled corn	—	84.28	62.35
Corn gluten meal	—	8.63	32.53
Urea	—	1.97	—
Molasses	2.46	2.46	2.46
Limestone	1.48	1.48	1.48
Salt	0.99	0.99	0.99
Vitamin premix	0.04	0.04	0.04
Trace mineral premix	0.15	0.15	0.15

Data were analyzed using the GLM procedure of SAS. Initial weight was included as a covariate. Interactions between supplement type, level and frequency were tested. When interactions were not significant, main effects were reported.

Results

Heifers supplemented DAILY consumed more hay ($P < 0.01$) and more total DM ($P < 0.01$) than those in ALT treatments. Gains were higher ($P < 0.01$) when supplement was provided daily (1.37 and 1.24 lb / day for DAILY and ALT, respectively). However, efficiency did not differ ($P = 0.97$) with frequency of supplementation. Heifers fed for the high level of gain consumed an average of 5.2 lb of supplement per day. This translates to an average of 12.1 lb per feeding for those in ALT treatments. We had hypothesized that providing energy in the form of highly digestible fiber (DDG), rather than starch (DRC), might be beneficial in alternate-day feeding, particularly at these high levels. This was not the case, however, as no supplement by frequency interactions were observed for any intake or performance criteria.

Hay DMI were higher ($P < 0.01$) for LOW heifers than HIGH (1.78 vs 1.50% BW, respectively). However, HIGH heifers had greater ($P < 0.01$) supplement intakes, which led to greater ($P < 0.01$) total DM intakes (1.99 and 2.28% BW for LOW and HIGH, respectively). The lower hay intakes observed for HIGH heifers reflects the substitution effect high levels of supplementation can have. At the high level of supplementation, hay represented only about two thirds of total DMI, whereas the diet of LOW heifers was nearly 90% hay.

Heifers in DDG treatments ate less hay ($P = 0.03$) and less total DM ($P = 0.03$) than DRC+CGM heifers, and tended to eat less hay ($P = 0.10$) and total DM ($P = 0.08$) than DRC heifers at the high level of supplementation (Table 4). This was not the case, however, at the low level, where intakes did not differ ($P > 0.54$) with supplement type.

A supplement by level interaction was detected for ADG ($P < 0.01$) and feed efficiency ($P = 0.01$). At the low level of gain, heifers in DDG treatments gained more ($P < 0.03$) and were more efficient ($P < 0.01$) than those in DRC+CGM or DRC treatments (Table 3). No difference was observed ($P = 0.20$) between DRC and DRC+CGM for either parameter at the low level of supplementation. At the high level of gain, DDG and DRC+CGM produced higher gains ($P < 0.01$) and improved efficiencies ($P < 0.01$) compared to DRC (Table 3). However, there was no difference ($P > 0.20$) in gain or efficiency between DDG and DRC+CGM at the higher level of gain. Because intakes did not differ between DDG and DRC, but ADG and efficiency were improved by DDG, we can conclude that DDG has a higher energy value than DRC in this diet. Calculated values indicated that DDG had a net energy value 27% higher than DRC. This compares to an improvement in efficiency of 25% and an increase in gain of 21% of DDG heifers compared to those in DRC treatments.

Heifers at the high level of gain would logically have higher MP requirements than those at the low level. Because DDG and DRC+CGM were formulated to supply an equal amount of UIP, it may appear that the response in the HIGH treatments was to UIP. However, all treatments were designed to meet MP requirements, suggesting the difference in response between HIGH and LOW was not due to UIP.

An alternative explanation of the different responses observed in the two levels of gain may be a negative associative effect elicited by the amount of starch present in the DRC supplement. When fed at the high level, the DRC supplement could have altered the rumen environment such that maximum forage utilization was not achieved. This may not have been the case, however, as hay and total DM intake did not differ between DRC and DRC+CGM. Another potential explanation may be differences in forage utilization brought on by differences in the amount of fat in the three supplements. Using NRC (1996) values of fat content and applying them to observed intakes shows total dietary fat amounts of 3.2% for DDG and 2.6% for DRC and DRC+CGM in the low-gain treatments. Heifers in the HIGH treatments had 5.0%, 2.9%, and 2.8% dietary fat for DDG, DRC and DRC+CGM, respectively. The level of fat in the HIGH DDG treatment may not be high enough to affect forage utilization, but hay

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Table 3. Effect of supplement type on gain and efficiency within level of supplementation.

	Level of Gain	
Treatment	LOW[a]	HIGH[a]
ADG + SEM, lb		
DDG[b]	0.99[d] + .05	1.89[d] + .05
DRC[b]	0.81[e] + .06	1.57[e] + .05
DRC+CGM[b]	0.71[e] + .05	1.88[d] + .05
Feed efficiency + SEM, feed:gain[c]		
DDG[b]	12.8[d] + .5	8.0[d] + .5
DRC[b]	15.9[e] + .5	9.8[e] + .5
DRC+CGM[b]	17.9[e] + .5	8.4[d] + .5

[a]LOW = supplement fed at 0.21% BW, HIGH = supplement fed at 0.81% BW
[b]DDG = dry distillers grains; DRC = dry rolled corn; DRC+CGM = DRC with corn gluten meal
[c]Feed:gain calculated as gain:feed
[d,e]Unlike superscripts within a column differ ($P < 0.01$)

Table 4.Effect of supplement type on hay and total dry matter intake within level of supplementation.

	Level of Gain	
Treatment	LOW[a]	HIGH[a]
Hay DMI + SEM, %BW		
DDG[b]	1.76 + .04	1.42[c] + .04
DRC[b]	1.77 + .04	1.51[d] + .04
DRC+CGM[b]	1.80 + .04	1.55[d] + .04
Total DMI + SEM, % BW		
DDG[b]	2.05 + .04	2.28[c] + .04
DRC[b]	2.06 + .04	2.38[d] + .04
DRC+CGM[b]	2.08 + .04	2.40[d] + .04

[a]LOW = supplement fed at 0.21% BW, HIGH = supplement fed at 0.81% BW
[b]DDG = dry distillers grains; DRC = dry rolled corn; DRC+CGM = DRC with corn gluten meal
[c,d]Unlike superscripts within a column differ ($P < 0.10$)

intake by DDG heifers was significantly lower than DRC+CGM, and tended to be lower than DRC at the high level of supplementation.

In conclusion, providing high-energy supplements to growing heifers on a forage-based diet three times per week resulted in lower intakes and gains relative to heifers supplemented daily. However, feed efficiency was not affected by supplementation frequency. These results were not affected by the form of energy being supplied. Heifers consuming DDG supplements generally ate less forage than those eating corn-based supplements at the high level of feeding. At both levels of gain, DDG heifers gained more and were more efficient than DRC heifers. At the low level of gain, ADG and efficiency were better for DDG than DRC+CGM. However, no difference between the two supplements was observed at the high level of gain. Dry distillers grains appear to have a higher energy value than DRC in high-forage diets.

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