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Sarah Morris

University of Nebraska-Lincoln

Terry J. Klopfenstein

University of Nebraska-Lincoln, tklopfenstein1@unl.edu

Don C. Adams

University of Nebraska-Lincoln, dadams1@unl.edu

Galen E. Erickson

University of Nebraska-Lincoln, gerickson4@unl.edu

Kyle J. Vander Pol

University of Nebraska-Lincoln

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The Effects of Dried Distillers Grains on Heifers Consuming Low or High Quality Forage

Sarah E. Morris
Terry J. Klopfenstein
Don C. Adams
Galen E. Erickson
Kyle J. Vander Pol¹

Summary

Two forage sources, high and low quality, were used to evaluate effects of five levels of dried distillers grains on forage intake. Ninety heifer calves were fed high or low quality forage, supplemented with 0, 1.5, 3, 4.5, or 6 lb DM dried distillers grains. Forage intakes linearly decreased as dried distillers grains increased. Average daily gain increased linearly with increased dried distillers grains indicating that dried distillers grains can be a protein and energy supplement source and a substitute for forage. Dried distillers grains are an economical supplement to cattle on either high or low quality forage diets.

Introduction

Traditionally, cereal grains have been used to supplement cattle on forage based diets; however, due to the amount of starch in these grains, a negative associative effect has been seen between starch and forage digestibility, leading to overall depressed forage utilization. This depressed level of forage utili-

zation is due to competition between amolytic microbes and cellulolytic microbes. The production of ethanol, through fermentation of the starch in grain, results in a by-product known as distillers grains. This by-product is a viable alternative to cereal grains because the starch has been removed, eliminating the starch and forage digestibility issues. Dried distillers grains (DDG) and /or DDG plus solubles (DDGS) are a feasible supplement for cattle producers not near ethanol plants because the dried by-product is easily transported and can be stored for an extended time. With increasing supplies of DDGS and increasing cost of forage (2004 Nebraska Beef Cattle Report, p. 25) we hypothesize that DDGS can substitute for forage. The objectives of this trial were to determine effects of increasing levels of DDGS on forage intake, predict forage intakes of grazing animals supplemented with DDGS, and evaluate the economical worth of supplementing DDGS.

Procedure

Experimental design, animal performance and forage intake

Ninety head of heifer calves (631 lb) were stratified by weight and then assigned randomly to one of

ten treatments in a 2 × 5 factorial design. The diets consisted of either smooth brome grass hay (BROME), a low quality forage source (53% TDN), or alfalfa hay and sorghum silage mix (ALSS 60% and 40% mix, respectively), a high quality forage source (65% TDN). The BROME was used to simulate winter range or hay feeding. The ALSS was used to simulate grazed summer forage. These two forage sources simulated the differences in nutritive values between growing and dormant range. Diets were supplemented with one of five levels of DDGS: 0, 1.5, 3, 4.5, or 6 lb DM DDGS. Heifers were individually fed forage in Calan electronic gates ad libitum with their respective amounts of DDGS. The forage and DDGS were weighed separately, mineral supplement was weighed separately and mixed with DDGS, and placed in the bunks with the DDGS on top of the forage. The DDGS were placed on top of the forage so the heifers would eat DDGS before eating forage. Five days before and at the end of the 84-day experiment, heifers were limit fed. At the end of the limit feeding periods, heifer weights were recorded for three consecutive days. Additional weights were obtained beginning on day 46 for three consecutive days. Orts were collected weekly. Total forage dry

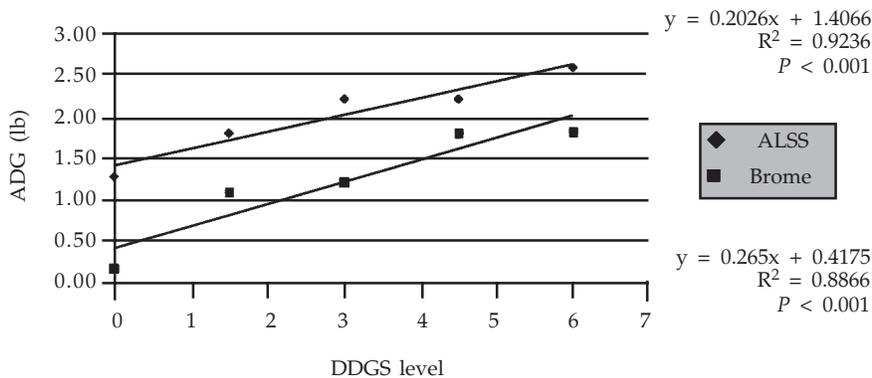


Figure 1. Average daily gain for both forage diets tested.

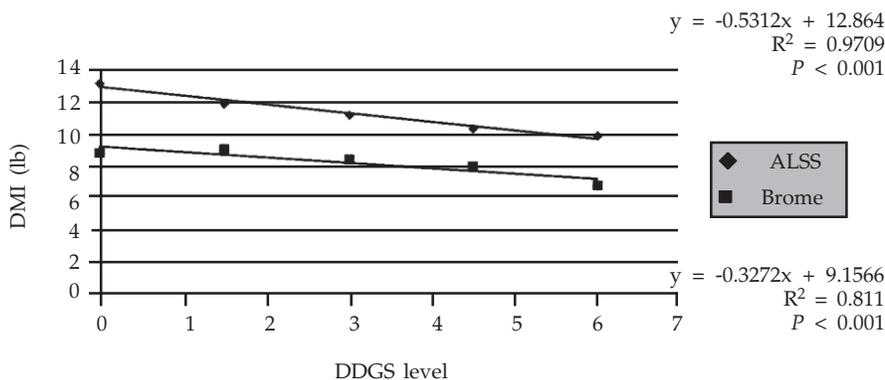


Figure 2. Dry matter forage intake for both diets tested.

matter intakes were determined from the trial based on dry matter offered (DMO) andorts, with the assumption that all DDGS were consumed. Impact of the five levels of DDGS on forage intakes was analyzed, as well as differences between the forage sources.

Economical analysis

The value of supplementing DDGS was determined by combining the values of the additional gain obtained and the decreased forage intake. The additional gain was valued by determining the income from selling the additional weight at the end of the grazing period. The selling price was estimated using the following regression equation $y = 0.00005x^2 - 0.1071x + 127.3$ where y = price paid and x = animal weight. This equation was previously developed

from the September-October average of feeder calf prices from 1992 to 1999. This equation relates well to actual prices ($r = 0.987$) and accounts for price slide of heavier cattle selling for less money per hundred weight. The forage replaced by DDGS was valued at the 10-year average for Nebraska, for brome hay (\$64/ton dry matter) and alfalfa hay (\$70/ton dry matter).

Results

Average daily gain and total forage intake

Average daily gain was significantly different ($P < 0.001$) between forage diets. Heifers on ALSS and BROME control diets gained 1.41 and 0.42 lb/day, respectively. Average daily gain for both diets linearly increased as level of DDGS

increased (Figure 1). The rate of increase in gain was greater for the BROME diet (0.265 lb per lb DDGS) than for the ALSS diet (0.20 lb per lb DDGS). Forage intakes were significantly different between forage sources ($P < 0.001$). Control heifers on ALSS diets consumed 12.6 lb/day DM in contrast to controls on BROME diets consuming 9.5 lb/day DM. Forage intake linearly decreased as level of DDGS increased (Figure 2). The rate of decline was greater for the calves fed ALSS than those fed BROME (0.53 v 0.33 lb forage per lb of DDGS).

Both ADG and forage intake were significantly different ($P < 0.001$) for the two types of forage. The two qualities of forage were selected to simulate range-like conditions, so that intakes could be projected for cattle grazing range at different times of the year, for the spring/summer with the high quality forage and fall/winter with the low quality forage. The higher ADG and forage intake, seen with the controls on the ALSS, are similar to what would be observed on spring/summer range. Cattle can consume more of the higher quality forage and digest it more rapidly, resulting in increased animal performance. In contrast to the ALSS group, ADG and forage intake were lower ($P < 0.001$) for animals on the control for BROME. Decreased forage intake resulting in decreased animal performance is typical of animals grazing dormant or winter range. Cattle on winter range may perform poorly because they cannot consume enough of the highly lignified forage to meet their requirements.

Economical analysis

Supplementing DDGS to cattle on either high or low quality forage diets appears to be profitable through increased selling weight and decreased forage costs. Tables 1 and 2 show the values of all levels

(Continued on next page)

Table 1. Value of dried distillers grains and solubles (DDGS) due to improved animal performance (IAP) and reduced forage intake (RFI) with the high quality forage, alfalfa sorghum silage (ALSS).

Supplemental DDGS, lb per day (DM):	0	1.5	3.0	4.5	6
Beginning wt, lb ^a	631	631	631	631	631
End wt, lb ^b	749	775	800	826	851
Sale price, \$ per 100 lb ^c	75.13	74.34	73.61	72.96	72.36
Revenue, \$ ^d	562.82	575.88	589.07	602.42	615.99
DDGS value from IAP, \$ per ton ^e		207.39	208.34	209.54	211.01
DDGS value from RFI, \$ per ton ^f		30.10	30.10	30.10	30.10
Total DDGS value, \$ per ton ^g		237.49	238.44	239.64	241.11

^aAverage start weight for this trial.

^bExpected weight after 84 days based on the equation $y = 0.20x + 1.41$ where $y = \text{ADG}$ and $x = \text{DDGS intake}$.

^cSale price per 100 lb determined from the equation $y = 0.00005x^2 - 0.1071x + 127.3$ where $y = \text{sale price}$ and $x = \text{sale weight}$.

^dRevenue determined by multiplying end weight and sale price/100.

^eDDGS value (DM) due to improved animal performance. Calculated from additional revenue over 0 DDGS.

^fDDGS value (DM) due to reduced forage intake assuming a forage cost of \$70.00 per ton dry matter.

^gTotal DDGS value (DM) from IAP + RFI.

Table 2. Value of dried distillers grains and solubles (DDGS) due to improved animal performance (IAP) and reduced forage intake (RFI) with the low quality forage, smooth brome hay (BROME).

Supplemental DDGS, lb per day (DM):	0	1.5	3.0	4.5	6
Beginning wt, lb ^a	631	631	631	631	631
End wt, lb ^b	666	669	733	766	800
Sale price, \$ per 100 lb ^c	78.15	76.85	75.67	74.59	73.63
Revenue, \$ ^d	520.51	537.54	554.51	571.55	588.77
DDGS value from IAP, \$ per ton ^e		270.25	269.87	270.07	270.87
DDGS value from RFI, \$ per ton ^f		27.52	27.52	27.52	27.52
Total DDGS value, \$ per ton ^g		297.77	297.39	297.59	298.39

^aAverage start weight for this trial.

^bExpected weight after 84 days based on the equation $y = 0.27x + 0.42$ where $y = \text{ADG}$ and $x = \text{DDGS intake}$.

^cSale price per 100 lb determined from the equation $y = 0.00005x^2 - 0.1071x + 127.3$ where $y = \text{sale price}$ and $x = \text{sale weight}$.

^dRevenue determined by multiplying end weight and sale price/100.

^eDDGS value (DM) due to improved animal performance. Calculated from additional revenue over 0 DDGS.

^fDDGS value (DM) due to reduced forage intake assuming a forage cost of \$60.00 per ton dry matter.

^gTotal DDGS value (DM) from IAP + RFI.

of DDGS with the high- and low-quality forage diets, respectively. Supplementation of DDGS at any level with either high- or low-quality forage appears to be more profitable than not supplementing at all; however, the DDGS are valued higher with the low quality than with the high quality forage. Total DDGS value averaged over all levels was \$298 and \$237, respectively. These values depend on the values placed on the forage. Grazed forages would be somewhat less expensive and would lower the

value of the DDGS; however, most of the value was from increased cattle gains.

In conclusion, dried distillers grains appear to be a viable supplement to cattle on forage-based diets, resulting in increased animal performance and decreased forage intakes. These results suggest supplementing DDGS does not adversely affect forage digestibility, although digestibility was not directly measured. Forage intakes can be predicted for cattle on either high or low quality forage diets

supplemented with up to 6 lb DM DDGS. Economically it appears to be advantageous to supplement DDGS to cattle on either low or high quality forage diets; however, the value of the DDGS is higher when supplementing low quality forage diets.

¹Sarah Morris, graduate student; Terry Klopfenstein, professor; Galen Erickson, assistant professor, Kyle Vander Pol, research technician, Animal Science, Lincoln; Don Adams, professor, Animal Science, West Central Research and Extension Center, North Platte.