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Summary

A feedlot experiment evaluated the effect of increasing fiber in distillers grains diets on ADG, F:G, and nutrient mass balance. The treatments consisted of 1) 30% modified distillers grains plus solubles, no roughage (MDGS), and 2) 30% modified distillers grains plus solubles, 30% wet corn gluten feed, and 15% corn silage (MDGS+fiber). The remainder of each diet consisted of a 1:1 ratio of high moisture corn and dry rolled corn and 5% supplement. Feeding MDGS+fiber increased ($P \leq 80.02$) ADG, DMI, and HCW; however, it did not improve F:G compared to MDGS. By increasing the fiber content of the diet, more organic matter (OM) and N remained in the manure. Percentage N loss was not different between dietary treatments; however, amount of N lost increased with MDGS + fiber due to the greater N intake and excretion.

Introduction

Previous research focused on reducing N losses by increasing the C:N ratio of feedlot manure or the amount of organic matter on the pen surface by using either roughage or corn milling byproducts (*1996 Nebraska Beef Report*, pp. 74-77; *2003 Nebraska Beef Report*, pp. 54-58; *2004 Nebraska Beef Report*, pp. 69-71). Corn bran, a component of wet corn gluten feed, was effective in reducing N losses (*2000 Nebraska Beef Report*, pp. 54-57), and cattle performance was maintained if steep was added with corn bran (*2004 Nebraska Beef Report*, pp. 61-63; *2005 Nebraska Beef Report*, pp. 54-56). Distillers grains plus solubles (DGS) improved cattle performance and was a source of neutral detergent fiber (NDF). Feeding wet DGS increased amount of OM in the manure and increased manure N (*2008 Nebraska Beef Report*, pp. 53-56) but not to the same extent as corn bran. The objective of this study was to evaluate the effects of feeding distillers grains or distillers grains with added fiber from corn gluten feed and roughage on cattle performance and nutrient mass balance.

Procedure

Cattle Performance

The experiment utilized 96 calves weighing 675 ± 15 lb, which were fed for 178 days in 12 pens from November to May of 2007. The steers were blocked by BW, stratified within block, and assigned randomly to a pen (8 steers/pen). Dietary treatments consisted of 1) 30% modified DGS, 65% corn fed as a 1:1 ratio of high moisture corn (HMC) to dry rolled corn (DRC) on a DM basis, and 5% supplement (MDGS); and 2) 30% modified DGS, 30% wet corn gluten feed (WCGF), 15% corn silage, 20% corn fed as a 1:1 ratio of HMC:DRC (DM basis), and 5% supplement (MDGS+fiber). Initial diet for the MDGS treatment consisted of HMC and DRC fed at a 1:1 ratio, 37.5% alfalfa hay, 15% corn silage, 5% supplement, and 30% MDGS. Over the 21-day adaptation period, the corn silage and alfalfa hay were replaced with a 1:1 ratio of HMC:DRC. For the MDGS+fiber treatment, cattle were fed 42.5% WCGF and modified DGS (1:1 ratio, DM basis), 37.5% alfalfa hay, 15% corn silage, and 5% supplement. Alfalfa hay was replaced by an increasing ratio of WCGF and modified DGS as well as HMC:DRC over a 21-day period. Steers received Rumensin, Tylan, and Thiamine at 320, 90, and 130 mg/steer daily, respectively, in both treatments.

Steers were implanted on day 1 with Synovex Choice (Fort Dodge Animal Health) followed by a re-implant on day 85 with Synovex Choice. Steers were slaughtered on day 178 at a commercial abattoir (Greater Omaha). Hot carcass weight (HCW) and liver scores were recorded on day of slaughter, fat thickness, LM area, and USDA called marbling score were collected after a 48-hour chill. Final BW, ADG, and G:F were calculated based on HCW adjusted to a common dressing percentage of 63%. Feed efficiency data were analyzed as G:F and reported as F:G.

Nutrient Balance

Nutrient mass balance was determined using 12 open feedlot pens with retention ponds to collect runoff. When rainfall occurred, runoff collected in the retention ponds was drained and quantified using an ISCO air-bubble flow meter (ISCO, Lincoln, Neb.). After cattle were removed from pens, scraped manure was piled on a cement apron and sampled (n = 30) for nutrient analysis while being loaded. Manure was weighed before it was hauled to the University of Nebraska compost yard. Manure samples were freeze dried for nutrient analysis and oven dried for DM calculation. Ingredients were sampled weekly, and feed refusals were analyzed to determine nutrient intake using a weighted composite on a pen basis. Individual steer N retention was calculated using the NRC net energy and protein equations (NRC, 1996). Nutrient excretion was determined by subtracting nutrient retention from intake. Total N lost (lb/steer) was calculated by subtracting manure N and runoff N from excreted N. Percentage of N loss

Table 1. Effect of dietary treatments on performance and carcass characteristics for finishing steers.

Dietary Treatment[1]	MDGS	MDGS+fiber	SEM	*P*-Value[2]
Performance				
Initial BW, lb	679	681	5	0.54
Final BW, lb	1259	1316	21	0.02
DMI, lb/day	19.5	21.3	0.6	0.01
ADG, lb	3.20	3.51	0.09	0.01
F:G	6.09	6.08	—	0.63
Carcass characteristics				
Hot carcass weight, lb	792	829	14.0	0.02
Marbling score[3]	500	526	18.45	0.19
LM area, in^2	13.0	13.2	0.3	0.50
12th rib fat, in	0.39	0.45	0.03	0.09
Yield grade	2.84	3.06	0.13	0.12

[1]Dietary treatments: MDGS = modified distillers grains plus solubles; MDGS+fiber = modified distillers grains plus solubles, 30% wet corn gluten feed, 15% corn silage.
[2]F-test statistic for dietary treatments.
[3]400=Slight 0, 500=Small 0.

Table 2. Effect of dietary treatment on nitrogen mass balance[1].

Dietary Treatment[2]	MDGS	MDGS+fiber	SEM	P-Value [3]
N intake	90.7	118.3	1.7	<0.01
N retention[4]	11.8	13.0	0.4	0.01
N excretrion[5]	78.9	105.4	1.5	<0.01
N manure	23.7	35.7	4.6	0.01
N run-off	1.1	1.1	0.2	0.98
N lost	54.1	68.6	4.7	0.01
N loss %[6]	68.6	5.0	5.1	0.50
DM removed	2144	3455	547	0.04
OM removed	380	652	81	0.01

[1]Values are expressed as lb/steer over entire feeding period unless noted.
[2]Dietary treatments: MDGS = modified distillers grains plus solubles; MDGS+fiber = modified distillers grains plus solubles, 30% wet corn gluten feed, 15% corn silage.
[3]F-test statistic for dietary treatment.
[4]Calculated using the NRC net protein and net energy equations.
[5]Calculated as N intake – N retention.
[6]Calculated as N lost divided by N excretion.

was calculated as N lost divided by N excreted.

Animal performance and nutrient balance data were analyzed as a complete randomized design with pen as the experimental unit using the MIXED procedure of SAS. The effects of treatment were included in the model as fixed effects.

Results

Cattle Performance

Dry matter intake ($P = 0.01$), ADG ($P = 0.01$), final BW ($P = 0.02$), and HCW ($P = 0.02$) were greater for cattle consuming MDGS+fiber compared to cattle being fed MDGS (Table 1). However, F:G was not different between dietary treatments ($P = 0.63$). Steers fed MDGS+fiber tended to have greater fat depth ($P = 0.09$) and greater USDA yield grades and marbling scores.

Nutrient Balance

Nitrogen intake, retention, and excretion were greater for the cattle fed MDGS+fiber ($P < 0.01$) compared to those fed MDGS (Table 2). Excretion was increased by 33.6% due to both greater DMI for cattle fed MDGS+fiber and greater % CP in MDGS+fiber diets compared to MDGS. Amount of OM and N removed in the manure was increased by 71.6% and 50.6%, respectively, for the MDGS+fiber treatment ($P = 0.01$) compared to MDGS. There was no difference ($P = 0.98$) between treatments observed in the small amount of N in the run off, with only 1.0 to 1.4% N in runoff as a percentage of N excretion. There was a difference ($P = 0.01$) in the amount of N lost, with a greater amount lost in the MDGS+fiber treatment compared to MDGS. Steers fed MDGS+fiber excreted 26.5 lb more N over the 178 days ($P < 0.01$). A portion of the extra excreted N was removed in manure (12.0 lb), and a greater amount was lost into the air (14.5 lb) for MDGS+fiber treatment compared to MDGS. There was not a difference ($P = 0.50$) between treatments in the percentage of N loss expressed as a percentage of N excreted, which was 68.6% for MDGS and 65.0% for MDGS+fiber treatments.

These data indicate increasing fiber from wet corn gluten feed and corn silage increased DMI and ADG without impacting F:G. However, dietary CP concentration was increased which increased N intake and excretion. A portion (54.7%) of the extra N excreted when fiber and protein were increased in the diet was lost into the air and a portion was removed as manure N (45.3%).

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