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Summary

An experiment was conducted to evaluate the influence of individual nutrient components in distillers grains on performance of growing calves. A 40% corn control treatment was included for direct comparison to a diet containing 40% modified distillers grains. Four additional treatments were formulated to isolate the contribution of solubles, protein, fiber, and a combination of fiber and solubles on cattle performance. Average daily gains and ending BW were greater, while F:G lower for cattle fed 40% modified distillers grains compared to the corn control. We were able to determine that protein, when overfed, contributes to the higher energy value of distillers relative to corn in growing diets.

Introduction

The ethanol and beef industries have maintained a mutually beneficial relationship in the Midwest for the last decade or more. However, ethanol producers are removing a portion of the oil via centrifugation, and possibly, fiber during a secondary fermentation process. Extraction of these components changes the nutritional composition of byproducts fed to cattle. A previous growing trial compared de-oiled vs normal fat modified distiller grains plus solubles (MDGS) at 40% dietary inclusion (*2014 Nebraska Beef Cattle Report*, pp. 32–33). Only small numeric differences between de-oiled and normal fat byproducts were observed, which suggest fat content may not be the most important factor in determining the feeding value of MDGS. Therefore, it was hypothesized that other nutrients may be responsible for the improved energy value of MDGS compared to DRC. The objective of this research was to evaluate the effects of isolated nutrient components found in distillers grains on growing steer performance.

Procedure

A study conducted at the University of Nebraska–Lincoln Agricultural Research and Development Center near Mead, NE utilized 450 crossbred, steers (initial BW 655 ± 52 lbs) to determine the feeding value of isolated components in MDGS using growing calves. Prior to initiating the trial cattle were limit fed a diet of 50% alfalfa and 50% Sweet Bran® for five days at 2% of BW to reduce variation in gastrointestinal fill. Steers were weighed two consecutive days (day 0 and 1) to establish an accurate initial BW and implanted with Ralgro® on d1. Based on initial BW, steers were blocked into three BW blocks (Light, Middle, or Heavy), stratified within BW block, and assigned randomly to a pen within their BW block. Cattle were placed into 30 pens with 15 steers per pen, resulting in 5 replications per treatment and pens were assigned randomly to one of six dietary treatments.

Treatments contained equal amounts of grass hay (50%) and a meal supplement at 10% inclusion (DM basis). The six treatments consisted of 1) a 40% corn control (CON) with no MDGS 2) MDGS at 40% inclusion (MDGS), and 3) a diet (SOL) containing 15% condensed distillers solubles (CCDS), equivalent to the solubles contribution in MDGS. An additional three diets were formulated to simulate the nutrient content of each individual component of MDGS plus a combination of solubles and fiber (COMBO). The protein component diet (PROT) included 20% corn gluten meal, while the fiber component treatment included corn bran (16.4%) and germ meal (3.6%). The same ratio of corn bran and germ was used in the COMBO diet with the addition of 15% CCDS (Table 1). The COMBO treatment was included to examine any associative effects between CCDS and fiber components within MDGS. Additionally, Soypass® was included at 5% of total diet DM across all treatments (Table 1) to insure MP requirements were met. Monensin was included at 200 mg/steer daily across all six treatments. At the end of the 81 d feeding period, cattle were limit fed for 5 days prior to collecting ending BW, similar to the beginning of the trial. Ending BW was measured on two consecutive days and averaged. Animal performance was analyzed using the MIXED procedure of SAS (SAS Institute, Inc. Cary, N.C.). Pen was the experimental unit and BW block was a random effect.

Results

Numerical differences in DMI were observed (Table 2; $P = 0.06$). Intake was greater for MDGS, SOL, and COMBO compared with the fiber component diet (FIB; $P = 0.06$), while CON and PROT were intermediate. Steers fed MDGS had the greatest ADG while those on FIB had the least ($P < 0.01$). All remaining treatments (CON, SOL, PROT, COMBO) had intermediate ADG compared to MDGS and FIB ($P > 0.05$). Feed to gain conversions were improved for MDGS and PROT, intermediate for FIB, and poorer for CON, SOL, and COMBO treatments ($P < 0.02$). Ending BW was heaviest for MDGS and lightest for CON and FIB ($P < 0.01$). Cattle fed PROT, SOL, and COMBO had intermediate ending BW with PROT being greater compared to SOL or COMBO ($P < 0.01$).

In agreement with past research, data from this experiment suggest that growing calves on a roughage-based diet containing an optimum level of MDGS (40%) consistently perform better than cattle fed DRC at the same inclusion. The feeding value of MDGS in this study was 118% the value of corn, which is lower than the previously reported feeding value of distillers grains in forage diets of 136% the value of corn (*2015 Nebraska Beef Cattle Report*, pp. 34–35). When evaluating the individual nutrient components in distillers grains, only PROT resulted in feed conversions similar to MDGS and better than CON. The feeding value of corn gluten meal

Table 1. Ingredient composition of forage based component diets fed to growing steers

Ingredient[a]	Treatment					
	CON	MDGS	SOL	PROT	FIB	COMBO
Grass Hay	50	50	50	50	50	50
DRC[b]	40	—	25	20	20	5
MDGS[b]	—	40	—	—	—	—
CCDS[b]	—	—	15	—	—	15
CGM[b]	—	—	—	20	—	—
Corn bran	—	—	—	—	16.4	16.4
Germ	—	—	—	—	3.6	3.6
Supplement[c]						
Soy Pass®	5	5	5	5	5	5
FGC[d]	1.95	2.99	2.52	2.99	2.19	2.74
Limestone	1.38	1.39	1.36	1.39	1.39	1.38
Urea	1.05	—	0.49	—	0.79	0.25
Salt	0.30	0.30	0.30	0.30	0.30	0.30
Tallow	0.25	0.25	0.25	0.25	0.25	0.25
BTM[d]	0.05	0.05	0.05	0.05	0.05	0.05
Vitamin ADE	0.02	0.02	0.02	0.02	0.02	0.02
Rumensin-90®[e]	0.01	0.01	0.01	0.01	0.01	0.01
Nutrient Composition[f]						
CP, %	12.5	17.7	12.5	22.7	12.5	12.5
NDF, %	32.6	43.9	31.2	33	39.9	40.5
Fat, %	2.4	5.1	3.0	2.2	2.6	4.0
Ca, %	0.667	0.679	0.672	0.679	0.675	0.697
P, %	0.304	0.543	0.439	0.342	0.238	0.373

[a]All values represented on a % DM basis.
[b]DRC: Dry rolled corn, MDGS: Modified distillers grains, CCDS: Condensed distillers solubles, CGM: Corn gluten meal.
[c]Supplement formulated to be fed at 10% of dietary DM.
[d]FGC: Fine ground corn, BTM: Beef trace minerals
[e]Formulated to supply 200 mg/hd/d.
[f]Individual nutrients measured as % of total diet (DM).

Table 2. Effects of feeding corn, modified distillers, or protein and fiber components on growing steer performance

	Treatment[a]						SEM	*P*-value
	CON	MDGS	SOL	PROT	FIB	COMBO		
Performance								
Initial BW,lb	668	668	669	669	669	668	1.1	0.85
Ending BW,lb	937[f]	959[d]	940[ef]	950[de]	933[f]	944[ef]	6.1	< 0.01
DMI,lb	21.62[de]	21.77[d]	22.04[d]	21.18[de]	20.81[e]	21.98[d]	0.43	0.06
ADG,lb	3.32[fg]	3.58[d]	3.34[efg]	3.47[de]	3.26[g]	3.40[ef]	0.07	< 0.01
F:G, lb:lb[b]	6.48[e]	6.04[d]	6.55[e]	6.07[d]	6.35[de]	6.41[e]	0.004	0.02
Feeding Value[c]	—	118%	93%	134%	110%	103%	—	—

[a]Protein: included 20% corn gluten meal to simulate the protein component of MDGS; Fiber: contained 16.4% bran and 3.6% full-oil germ to provide similar fiber levels to those found in MDGS; Combo: consisted of 16.4% bran, 3.6% full-oil germ, and 15% condensed distillers solubles.
[b]Analyzed as G:F, the reciprocal value of F:G
[c]Calculated as the percent change in the G:F of each treatment and the control, divided by the percentage of corn replaced in each treatment.
[d–g]Means with different superscripts differ ($P < 0.05$).

in PROT was 134% the feeding value of corn and is very similar to the previously reported feeding value of 136% the value of corn. Since all diets were formulated to meet MP requirements, the response to PROT suggests that protein in MDGS, when overfed to provide energy, is important to the improved performance response of MDGS in high forage growing diets. No other nutritional component appeared to contribute toward the greater energy value of MDGS relative to corn, although FIB resulted in a feeding value that was 10% greater than corn. Replacing 20 percentage units of corn with corn bran and corn germ may have alleviated some negative associative effects between corn starch and fiber digestion. The addition of distillers solubles did not appear to contribute positively to the feeding value of distillers grains in high forage diets. Potential positive associative effects were tested between solubles and fiber in the COMBO diet, but these diets were unable to match the performance of those fed MDGS. These data suggest that the carbon skeleton of amino acids can contribute significantly to the feeding value of MDGS in high forage diets.

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