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Degermed corn distiller's grains with solubles (DGS) have feed value similar to traditional distiller's grains

Abstract

Rapid expansion of the fuel ethanol industry has greatly increased availability of distillery byproducts. Distiller's grains with solubles (DGS) are the predominant byproduct of fermenting grains into fuel ethanol. During this process, starch is removed from the grain and the residual components of the grain are concentrated in the DGS. Improvements in the conversion of cereal grains to ethanol have been fueled by recent changes in the production process. Broin Companies (Sioux Falls, SD) have developed a technology that removes the germ before the fermentation process. The resulting byproduct contains more protein, less crude fat, and less phosphorus compared to traditional distiller's grains. Feeding even modest levels of DGS can contribute to greater phosphorus excretion from feedlots, suggesting that strategies aimed at reducing phosphorus levels are well warranted. The objective of this study was to compare diets based on steam-flaked corn with and without DGS and to compare a highprotein, low-fat, low-phosphorus byproduct to more traditional distiller's grains.

Keywords

Cattlemen's Day, 2007; Kansas Agricultural Experiment Station contribution; no. 07-179-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 978; Beef; Cattle; Distiller's grains with solubles (DGS); Degermed corn

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DEGERMED CORN DISTILLER'S GRAINS WITH SOLUBLES (DGS) HAVE FEED VALUE SIMILAR TO TRADITIONAL DISTILLER'S GRAINS

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and M. E. Corrigan*

Introduction

Rapid expansion of the fuel ethanol industry has greatly increased availability of distillery byproducts. Distiller's grains with solubles (DGS) are the predominant byproduct of fermenting grains into fuel ethanol. During this process, starch is removed from the grain and the residual components of the grain are concentrated in the DGS. Improvements in the conversion of cereal grains to ethanol have been fueled by recent changes in the production process. Broin Companies (Sioux Falls, SD) have developed a technology that removes the germ before the fermentation process. The resulting byproduct contains more protein, less crude fat, and less phosphorus compared to traditional distiller's grains. Feeding even modest levels of DGS can contribute to greater phosphorus excretion from feedlots, suggesting that strategies aimed at reducing phosphorus levels are well warranted. The objective of this study was to compare diets based on steam-flaked corn with and without DGS and to compare a high-protein, low-fat, low-phosphorus byproduct to more traditional distiller's grains.

Experimental Procedures

Six hundred and ten crossbred-yearling heifers (765 lb) were used in a finishing study comparing three diets. All three diets were based on steam-flaked corn and were formulated to contain 14% crude protein. The first diet served as the control and it contained no DGS. The second diet contained 13% of corn dried distiller's grains with solubles (DDGS), and the third diet contained 13% of a partially degermed (DEGERM) corn DDGS.

Upon arrival at the feedlot, heifers were offered *ad libitum* access to chopped alfalfa hay and fresh water. Two days after arrival, cattle were identified with uniquely numbered ear tags in both ears and received injections of Bovishield 4 and Fortress-7 vaccines. In addition, animals were administered Safe-Guard¹ via an oral drench and implanted with Revalor² H. Twenty-four pens were used in this study with eight pens per treatment and 24 to 25 animals per pen. Heifers were allowed *ad libitum* access to four step-up diets leading to the final finishing diet (Table 1). Heifers were housed in dirt-surfaced pens (~210 ft²/animal) with automatic water fountains and 33 linear feet of bunk space.

¹Safe-Guard is a registered trademark of Hoechst Celanese Corporation.

²Revalor is a registered trademark of Intervet, Inc.

Starting on day 97, chromic oxide (indigestible marker) was included in the ration at 0.21% (dry basis) and was fed for seven days. On day 104, fecal samples were collected from each animal. Diet samples were also collected daily from day 97 through day 103, pooled together, and sub-sampled. Sub-samples were frozen and retained for determination of dry matter, organic matter, phosphorus, and chromic oxide concentrations.

On day 118, cattle were shipped to a commercial abattoir in Emporia, KS, where carcass data were collected. Carcass weight and liver abscess scores were obtained at the time of harvest. Measurements taken after a 24-hour chill were ribeye area; subcutaneous fat thickness over 12th rib; kidney, pelvic, and heart fat; marbling score; USDA quality grades; and USDA yield grades. Final body weight was calculated by dividing carcass weight by a common dressing percentage of 63.5.

Results and Discussion

Animal performance data are summarized in Table 2. Average daily gains and feed efficiencies were statistically similar among the control diet and the two diets with DGS. Heifers fed the degermed DGS consumed the

least feed whereas those heifers fed the traditional distiller's grains consumed the most feed. This study suggests that DGS derived from the new generation of ethanol plants have a feeding value similar to the traditional distiller's grains.

Total tract digestibility values (Table 3) demonstrate some of the challenges with feeding DGS. When highly digestible steam-flaked corn was replaced with the less digestible DGS, fecal production increased by 5%. Not only was manure production increased, but the concentration of phosphorus in the manure also increased. The degermed DGS contained less phosphorus than the more traditional distiller's grains, which led to numerically less fecal excretion of phosphorus.

In this study, carcass characteristics and quality (Table 4) were not altered when a diet of 13% DGS was fed.

Implications

Feeding DGS to feedlot cattle yielded growth performance and carcass characteristics comparable to grain-based diets, but increased manure production by 5%. Degermed DGS have feed value similar to the more traditional distiller's grains.

Table 1. Experimental Diets

Item	Control	DDGS ^a	DEGERM ^b
Ingredient			
Steam-flaked corn	80.9	71.2	71.9
DGS	0.0	13.0	13.0
Concentrated separator byproduct	5.0	5.0	5.0
Alfalfa hay	6.0	6.0	6.0
Soybean meal	2.9	0.0	0.0
Urea	1.2	0.7	0.0
Supplement ^c	1.8	1.9	1.9
Nutrient, %			
Dry matter	82.1	82.8	82.8
Crude protein	14.0	14.0	14.0
Fat	3.8	4.8	3.9
Calcium	0.7	0.7	0.7
Phosphorus	0.29	0.38	0.31

^aDDGS = Corn dried distiller's grains with solubles.

^bDEGERM = Partially degermed corn dried distiller's grains with solubles.

^cFormulated to provide 300 mg/day Rumensin, 90 mg/day Tylan, and 0.5 mg/day MGA.

Table 2. Animal Performance and Efficiency of Yearling Heifers Fed Finishing Diets Based on Steam-flaked Corn

Item	CONTROL	DDGS ^a	DEGERM ^b	SEM
No. of head	203	204	203	-
No. of pens	8	8	8	-
Days on feed	118	118	118	-
Initial weight, lb	765	765	765	10.0
Final weight, lb	1066	1073	1054	14.8
Dry matter intake, lb/day	20.1 ^{xy}	20.7 ^x	19.7 ^y	0.35
Average daily gain, lb/day	2.55	2.61	2.44	0.07
Feed:gain	7.89	7.93	8.08	0.002

^aDDGS = Corn dry distiller's grains with solubles.

^bDEGERM = Partially degermed corn dry distiller's grains with solubles.

^{xy}Means within a row without common superscripts are different (P<0.05).

Table 3. Apparent Total Tract Digestibility by Yearling Heifers Fed Finishing Diets Based on Steam-flaked Corn

Item	CONTROL	DDGS ^a	DEGERM ^b	SEM
No. of head	203	204	203	-
No. of pens	8	8	8	-
Intake				
Dry matter, lb	17.95	18.14	17.31	0.13
Organic matter, lb	17.11	17.17	16.45	0.13
Phosphorus, g	23.61 ^x	31.28 ^y	24.34 ^x	0.43
Fecal excretion				
Dry matter, lb	4.32 ^x	5.03 ^y	4.81 ^y	0.08
Organic matter, lb	3.40 ^x	4.10 ^y	3.81 ^y	0.07
Phosphorus, g	11.98	14.08	12.16	0.64
Apparent total tract digestibility, %				
Dry matter	75.9 ^x	72.3 ^y	72.2 ^y	0.92
Organic matter	80.1 ^x	76.1 ^y	76.8 ^y	0.85
Phosphorus	49.5	55.0	50.2	1.9

^aDDGS = Corn dried distiller's grains with solubles.

^bDEGERM = Partially degermed corn dried distiller's grains with solubles.

^{xy}Means within a row without common superscripts are different (P<0.05).

Table 4. Carcass Characteristics of Yearling Heifers Fed Finishing Diets Based on Steam-flaked Corn

Item	CONTROL	DDGS ^a	DEGERM ^b	SEM
Hot carcass weight, lb	677	681	669	9.39
Dressing percentage	63.5	63.2	62.8	0.27
Longissimus muscle area, sq inches	13.86	13.52	13.53	0.13
Kidney, pelvic, and heart fat, %	2.24	2.24	2.20	0.08
12th rib fat, inches	0.32	0.35	0.32	0.02
USDA yield grade				
Yield grade 1, %	41.1	32.6	38.9	4.91
Yield grade 2, %	39.8	47.5	41.8	3.10
Yield grade 3, %	18.6	18.9	19.3	3.65
Yield grade 4, %	0.5	1.0	0.0	0.47
Yield grade 5, %	0.0	0.0	0.0	-
Average yield grade, %	1.78	1.88	1.80	0.08
USDA quality grade				
Prime, %	1.0	0.5	0.5	0.54
Choice, %	40.2	46.9	43.4	5.48
Select, %	52.9	49.2	50.7	5.29
No Roll, %	5.9	3.4	5.4	1.15
Marbling score ^c	385	392	397	8.5
Liver abscess, %	4.9	4.9	3.9	1.7

^aDDGS = Corn dried distiller's grains with solubles.

^bDEGERM = Partially degermed corn dried distiller's grains with solubles.

^cA+ = one or more large, or multiple small, active abscesses, with or without adhesions; A = two to four small, well-organized abscesses; and A- = one or two small abscesses or scars.