

# Fecal Starch Content and Apparent Starch Digestibility using Field Methods in Feedlot Cattle Fed 25, 50, or 75% Modified Distillers Grains with Solubles

## A.S. Leaflet R2850

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### Summary and Implications

Recent cattle feeding economics in the upper Midwest have encouraged increasing inclusion of distillers grains in feedlot rations. There have been suggestions that changes in grain processing may be beneficial as starch content of the diet decreases. Recently methods have been developed to estimate fecal starch digestibility in field studies using fecal protein as a marker. An estimate of fecal starch digestibility across a wide range of distillers grain inclusion and starch levels would be useful information to evaluate the utility of more extensive grain processing. This study was an evaluation of field estimates of fecal starch digestion as part of a larger study evaluating dietary cation-anion exchange in very high levels of distillers grains with solubles. Estimated starch digestibility tended to decrease as the level of modified distillers grains with solubles increased from 0 to 75% of the diet, suggesting that additional research evaluating further processing of corn for high distillers grains diets may be warranted.

**Table 1. Ingredient composition of diets<sup>1</sup>**

Item	Control	50% Modified distillers grains with solubles	75% Modified distillers grains with solubles
	-----Percent of diet dry matter-----		
Corn	81.7	36.5	11.5
Modified distillers grains with solubles	25	50	75
Chopped grass hay	12	12	12
Soybean meal	4	--	--
Urea	.8		
Limestone	1.1	1.1	1.1
Sodium chloride	.3	.3	.3
Vitamin A premix <sup>2</sup>	.08	.08	.08
Trace minerals <sup>3</sup>	.024	.024	.024
Rumensin premix <sup>4</sup>	.00196	.00196	.00196

<sup>1</sup>Summer (2013)

<sup>2</sup>The premix contained 3.85 million IU of vitamin A (as retinyl palmitate) per kg, providing 3,080 per kg of DM in the diet.

<sup>3</sup>The trace mineral premix contained the following percentage: Ca 13.2, Co 0.10, Cu<sup>+2</sup> 1.5, Fe<sup>+2</sup> 10.0, Fe<sup>+3</sup> 0.44, I 0.20, Mn<sup>+2</sup> 8.0, S 5.0, and Zn 12.0.

<sup>4</sup>Premix contained 176.2 g sodium monensin per kg, providing 34.3 mg of sodium monensin per kg of DM in the diet.

### Introduction

With volatile feed prices and increased availability of corn coproducts in recent years, cattle feeders in the upper Midwest have increased the inclusion level of feeds such as distillers grains. These diets test the upper boundaries of inclusion of corn coproducts also greatly decrease the amount of grain and thus, starch in the diet. One of the factors that may affect the response of the cattle to higher levels of distillers grains in the diet may be the digestibility of the remaining diet components such as starch. Recently field methods have been developed to estimate rumen starch digestibility in the field using crude protein in the diet as a marker. These methods have gained acceptance with steam flaked corn diets as a method to evaluate flake quality. Recently it has been proposed that these methods may be used to evaluate grain processing effectiveness in high corn coproduct diets. This study demonstrates this method in diets that differ widely in the inclusion of modified distillers grains and therefore starch content.

### Materials and Methods

The cattle used in this study were part of a larger study designed to evaluate dietary cation-anion balance on performance, blood chemistry and body fluid components in steers fed varying concentrations of modified distillers grains (Summer, 2013). The diets are shown in Table 1, and calculated diet nutrient composition is shown in Table 2.

**Table 2. Calculated diet nutrient composition<sup>1</sup>**

Item	Control	50% Modified distillers grains with solubles	75% Modified distillers grains with solubles
Crude protein, % of DM	12.4	19.3	24.7
NEg, Mcal/lb.	.62	.63	.63
Ca % of DM	.57	.62	.65
P, % of DM	.36	.56	.67
K, % of DM	.60	.76	.88
Na, % of DM	.14	.32	.34
S, % of DM	.15	.42	.56

<sup>1</sup>Calculated from NRC (2000) per Summer (2013)

Detailed descriptions of cattle background and treatment in the larger study can be found in Summer (2013). The corn in the diet was coarsely rolled. The cattle were crossbred steers fed 170 days. Midway through the feeding period fecal samples were collected from two pens per treatment on two consecutive days. Samples from 10 fresh stools per pen were composited by pen, placed on ice and frozen prior to shipment to Dairyland Labs, Arcadia, WI for analysis of starch, crude protein and dry matter. Bunk samples were also collected and analyzed for the same nutrients.

Starch digestion was estimated using fecal crude protein as a marker using the methods of Zinn et al. (2007). The actual equation is as follows: starch digestion, % of intake =  $100 \{ 1 - [(0.938 - 0.497FN + 0.0853FN(2)) FS/DS] \}$ , where FS is fecal starch concentration (% of DM), DS is dietary starch concentration (% of DM) and FN is fecal nitrogen concentration (% of DM). Data were analyzed using the proc mixed statement of SAS and evaluated for the linear and quadratic effects of MDGS inclusion.

### Results and Discussion

Diet starch (dry matter basis) averaged 57.45%, 26.44%, and 11.09% for the 0, 50 and 75% modified distillers grains with solubles (MDGS) diets, respectively. Diet crude protein averaged 13.7%, 18.2% and 22.0% for the 0, 50 and 75% MDGS diets, respectively. Results of fecal starch and estimated starch digestibility are shown in Table 3. As expected based on dietary concentrations, fecal protein increased and fecal starch content decreased with increased inclusion of modified distillers grains with solubles. Estimated fecal starch digestibility tended to decrease ( $P < .08$ ) with increased inclusion of MDGS and decreased dietary starch. This would suggest that as starch content in the diet decreases through dilution of corn with increasing levels of distillers grains, dry rolled corn may possibly respond to increased processing. Reduced starch digestibility with increasing inclusion of MDGS in the diet may be a function of increased fiber content and reduced overall starch content of the diets, and the associated changes in rumen bacterial population. This study suggests that corn processing on high corn coproduct-low starch diets is an area which warrants further research.

**Table 3. Fecal starch, protein and estimated starch digestibility for 25, 50 and 75% modified distillers grains with solubles based diets.**

Item	Control	50% Modified distillers grains with solubles	75% Modified distillers grains with solubles	S.E.	Linear Effect of MDGS	Quadratic Effect of MDGS
Fecal starch, % of DM	27.28	20.76	9.06	2.34	$P < .01$	NS
Fecal crude protein, % of DM	15.38	17.56	18.67	.75	$P < .01$	NS
Estimated starch digestibility, %	88.53	81.97	81.94	.24	$P < .08$	NS

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