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# Effects of Wet Corn Gluten Feed and Roughage Inclusion Levels in Finishing Diets Containing Modified Distillers Grains Plus Solubles

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## Summary

A finishing trial evaluated wet corn gluten feed (WCGF) and roughage inclusion levels in diets containing 30% modified distillers grains plus solubles (MDGS, DM basis) using a 3 x 3 factorial treatment structure. No significant WCGF x roughage level interactions were observed. There was a quadratic response due to WCGF level for dry matter intake (DMI) and average daily gain (ADG), which were lowest for cattle fed 30% WCGF; however, feed-gain ratio (F:G) increased linearly with increasing WCGF. Gain responded quadratically and was lowest for cattle fed 0% corn silage. F:G and DMI increased linearly with increasing corn silage. Feedlot performance was improved by feeding 0% or 15% WCGF compared to 30% WCGF in finishing diets containing 30% MDGS. The optimal level was 7.5% corn silage in diets containing 30% MDGS with or without WCGF.

## Introduction

Feedlots have the opportunity to utilize wet corn gluten feed (WCGF), wet distillers grains plus solubles (WDGS) or modified wet distillers grains plus solubles (MDGS). Combinations of WCGF and WDGS making up to 60% of the diet have been shown to improve cattle performance (2007 Nebraska Beef Report, pp. 25-28). Furthermore, WCGF is useful in managing acidosis, and it is beneficial to reduce or eliminate roughage levels in finishing diets when WCGF is included (2004 Nebraska Beef Report, pp. 61-63). However, in finishing diets

containing WDGS, roughage inclusion is still necessary (2007 Nebraska Beef Report, pp. 29-32). One possible advantage of feeding a combination of WDGS and WCGF in finishing diets may be that WCGF inclusion could be used to replace roughage.

The objectives of the current study were to: 1) evaluate the effects of feeding WCGF in combination with 30% MDGS (DM basis), and 2) determine the optimum roughage level in diets containing 30% MDGS fed with or without WCGF.

## Procedure

Four hundred fifty crossbred steer calves (body weight [BW] = 655 ± 45 lb) were used in a randomized complete block design. Upon arrival, steers were vaccinated and weaned on smooth bromegrass for 21-28 days. Steers were then allowed to graze sorghum stalks for 15 days. While on stalks, steers were supplemented with 5 lb/head/day of WCGF. Steers were brought back to the feedlot five days

before initiation of the trial and limited a diet consisting of 50% WCGF and 50% grass hay (DM basis) at 2% of body weight. On day 0 and day 1, steers were individually weighed in order to get an accurate initial BW, and all steers were implanted with Synovex-Choice (Fort Dodge Animal Health, Fort Dodge, Iowa) on day 1. On day 64, steers were re-implanted with Synovex-Choice and poured with Duraset II (Pfizer Animal Health, New York, N.Y.). The weights from day 0 were used to assign steers to treatment. Steers were blocked by BW into three blocks, stratified by BW within block and assigned randomly to one of 45 pens (10 steers/pen). Pens were assigned randomly to one of nine finishing diets (5 pens/diet). During the trial, four steers were removed due to death and one steer was removed for other health reasons. All causes of removal from trial were determined to be unrelated to treatments.

All diets (Table 1) contained 30% MDGS, a mixture of dry-rolled and

Table 1. Composition of finishing diets and formulated nutrient analysis.<sup>1</sup>

Roughage Level <sup>2</sup> :	0			7.5			15			
	WCGF Level:	0	15	30	0	15	30	0	15	30
DRC <sup>3</sup>	32.50	25.00	17.50	28.75	21.25	13.75	25.00	17.50	10.00	
HMC	32.50	25.00	17.50	28.75	21.25	13.75	25.00	17.50	10.00	
MDGS	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	
WCGF	—	15.00	30.00	—	15.00	30.00	—	15.00	30.00	
Corn silage	—	—	—	7.50	7.50	7.50	15.00	15.00	15.00	
Dry Supplement <sup>4</sup>	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
<b>Formulated Nutrient Composition</b>										
Crude Protein, %	16.2	17.9	19.5	16.2	17.8	19.4	16.1	17.7	19.3	
Ca, %	0.68	0.69	0.70	0.70	0.71	0.72	0.71	0.72	0.74	
P, %	0.45	0.54	0.64	0.45	0.54	0.63	0.45	0.54	0.63	
K, %	0.60	0.73	0.86	0.67	0.80	0.92	0.73	0.86	0.99	
S, %	0.31	0.35	0.39	0.31	0.35	0.39	0.31	0.35	0.39	
Ether Extract, %	6.72	6.63	6.54	6.67	6.58	6.49	6.61	6.52	6.43	

<sup>1</sup>Values presented on a DM basis.

<sup>2</sup>Dietary inclusion levels of corn silage in the finishing diet were 0, 7.5 or 15.0% of diet DM.

<sup>3</sup>DRC = dry-rolled corn; HMC = high-moisture corn; MDGS = modified distillers grains plus solubles; WCGF = wet corn gluten feed.

<sup>4</sup>All diets were formulated to provide 360 mg/steer daily Rumensin<sup>®</sup>, 90 mg/steer daily Tylan<sup>®</sup>, and 130 mg/steer daily thiamine.

**Table 2. Effects of WCGF inclusion level on performance and carcass characteristics of steers fed finishing diets containing 30% MDGS.**

WCGF Inclusion Level <sup>1</sup> :	0.0	15.0	30.0	Lin <sup>2</sup>	Quad <sup>3</sup>
<b>Performance</b>					
Initial BW, lb	655	656	655	0.83	0.58
Final BW, lb <sup>4</sup>	1329	1332	1299	< 0.01	< 0.01
DMI, lb/day	22.28	22.48	22.01	0.15	0.04
ADG, lb	4.03	4.05	3.86	< 0.01	< 0.01
F:G <sup>5</sup>	5.52	5.54	5.70	< 0.01	0.13
<b>Carcass Characteristics</b>					
HCW, lb	837	839	818	< 0.01	< 0.01
12 <sup>th</sup> rib fat, in	0.56	0.58	0.53	0.10	0.07
LM area, in <sup>2</sup>	14.1	14.0	14.2	0.81	0.35
Marbling score <sup>6</sup>	511	512	487	0.03	0.15
Choice or above, %	51.6	53.6	41.6	0.11	0.19
Yield grade <sup>7</sup>	2.97	3.05	2.79	0.02	0.01
Liver abscesses, %	0.07	0.05	0.06	0.72	0.66

<sup>1</sup>Dietary inclusion levels of WCGF in the finishing diet (DM basis).

<sup>2</sup>Contrast for the linear effect of WCGF inclusion level *P*-value.

<sup>3</sup>Contrast for the quadratic effect of WCGF inclusion level *P*-value.

<sup>4</sup>Final BW calculated as hot carcass weight divided by a common dressing percentage of 63%.

<sup>5</sup>Analyzed as gain:feed, reciprocal of feed conversion.

<sup>6</sup>Marbling score: 400 = Slight 0, 450 = Slight 50, 500 = Small 0, etc.

<sup>7</sup>Yield grade: 2.50 + (0.0038\*HCW, lb) + (0.2\*2.0% KPH) + (2.5\*12<sup>th</sup> rib fat, in) - (0.32\*LM area, in<sup>2</sup>).

**Table 3. Effects of roughage inclusion level on performance and carcass characteristics of steers fed finishing diets containing 30% MDGS.**

Roughage Inclusion Level <sup>1</sup> :	0	7.5	15.0	Lin <sup>2</sup>	Quad <sup>3</sup>
<b>Performance</b>					
Initial BW, lb	656	655	655	0.13	0.23
Final BW, lb <sup>4</sup>	1296	1330	1335	<0.01	0.01
DMI, lb/day	21.06	22.36	23.35	<0.01	0.33
ADG, lb	3.83	4.04	4.07	<0.01	<0.01
F:G <sup>5</sup>	5.49	5.53	5.73	<0.01	0.06
<b>Carcass Characteristics</b>					
HCW, lb	816	838	841	<0.01	0.01
12 <sup>th</sup> rib fat, in	0.51	0.57	0.58	<0.01	0.25
LM area, in <sup>2</sup>	14.2	14.1	14.0	0.40	0.74
Marbling score <sup>6</sup>	490	503	517	0.02	0.90
Choice or above, %	40.9	48.2	57.6	0.01	0.85
Yield grade <sup>7</sup>	2.75	2.98	3.08	<0.01	0.32
Liver abscesses, %	0.09	0.06	0.04	0.19	0.90

<sup>1</sup>Dietary inclusion levels of corn silage in the finishing diet were 0, 7.5 or 15.0% of diet DM.

<sup>2</sup>Contrast for the linear effect of roughage inclusion level *P*-value.

<sup>3</sup>Contrast for the quadratic effect of roughage inclusion level *P*-value.

<sup>4</sup>Final BW calculated as hot carcass weight divided by a common dressing percentage of 63%.

<sup>5</sup>Analyzed as gain:feed, reciprocal of feed conversion.

<sup>6</sup>Marbling score: 400 = Slight 0, 450 = Slight 50, 500 = Small 0, etc.

<sup>7</sup>Yield grade: 2.50 + (0.0038\*HCW, lb) + (0.2\*2.0% KPH) + (2.5\*12<sup>th</sup> rib fat, in) - (0.32\*LM area, in<sup>2</sup>).

high-moisture corn fed at a 1:1 ratio, and 5% supplement (DM Basis). Treatments were arranged as a 3 x 3 factorial and the factors included in this study were WCGF (ADM, Columbus, Neb.) levels of 0%, 15% or 30% on DM basis and roughage levels of 0%, 7.5% or 15% inclusion. Corn silage was used as the roughage source. Diets were formulated to

contain 0.65 % calcium and 0.60% potassium and to supply 360 mg/steer Rumensin® (Elanco Animal Health, Greenfield, Ind.), 90 mg/steer Tylan® (Elanco Animal Health), and 130 mg/steer thiamine daily.

Cattle were adapted to grain by feeding 37.5%, 27.5%, 17.5%, 7.5% and 3.75% alfalfa hay, which replaced the corn mixture in the finishing

diets, for 3, 4, 6, 6 and 5 days, respectively. The first four steps included 15% corn silage and were formulated to supply 45%, 35%, 25% and 15% roughage (DM basis). For step 5, corn silage was reduced from 15% to 7.5% for finishing diets containing 0% or 7.5% corn silage. Corn silage was assumed to be 50% forage and 50% grain (DM basis). Steers were fed once daily and allowed *ad libitum* access to feed and water. Cattle were fed for 167 days (December 13, 2007 to May 27, 2008) and harvested at a commercial packing plant (Greater Omaha Pack, Omaha, Neb.). Hot carcass weight and liver scores were collected the day of harvest; 12th rib fat, LM area and USDA marbling score were collected following a 24-hour chill. Yield grade was calculated using the following equation: YG = 2.50 + (0.0038\*HCW, lb) + (0.2\*2.0% KPH) + (2.5\*12<sup>th</sup> rib fat, in) - (0.32\*LM area, in<sup>2</sup>) (*Meat Industry Handbook*, 2001). Final BW, ADG and F:G were calculated using hot carcass weight divided by an average dressing percentage of 63%.

Data were analyzed using the MIXED procedure of SAS (Version 9.1, SAS Inc., Cary, N.C.) as a 3 x 3 factorial treatment design. Factors included in the model were WCGF, roughage inclusion level and WCGF x roughage inclusion level interaction. The random variable was weight block. Pen served as the experimental unit. Orthogonal contrasts were used to detect linear and quadratic relationships for the main effect of WCGF level and the main effect of roughage level if no interaction was detected. If an interaction occurred, only simple effects were tested.

## Results

The hypothesis was that cattle performance would improve with increasing WCGF level and decreasing roughage levels. Interestingly, this was not the case, as no significant WCGF x roughage inclusion level interactions were observed. Therefore, only main effects of either WCGF level or roughage level are presented. For the

(Continued on next page)

main effect of the WCGF inclusion level (Table 2), there was a quadratic ( $P < 0.05$ ) response for final BW, ADG and DMI. Final BW, ADG and DMI were highest for cattle fed 15% WCGF and lowest for cattle fed 30% WCGF. As the WCGF inclusion level increased, F:G increased linearly ( $P < 0.01$ ).

For the main effect of the roughage inclusion level (Table 3), there was a quadratic ( $P < 0.02$ ) effect on final BW and ADG, and both were lowest for cattle fed 0% roughage. As the roughage inclusion level increased, DMI and F:G increased (linear;  $P < 0.01$ ). However, F:G was highest for cattle fed 15% corn silage (quadratic;  $P = 0.06$ ). The observed increase in DMI due to increasing roughage level is common and likely due to acidosis control if ADG improves (7.5% silage) or may be due to an energy dilution effect whereby the cattle are attempting to eat to a constant energy level (15% corn silage) if ADG is maximal.

The only observed carcass characteristic differences within WCGF level were HCW, marbling score and yield

grade. There was a quadratic ( $P < 0.01$ ) response for HCW and yield grade, which was numerically highest for cattle fed 15% WCGF. There was a linear ( $P = 0.03$ ) decrease for marbling score as the inclusion level of WCGF increased. No differences due to the WCGF inclusion level were observed in incidence of liver abscesses, 12th rib fat thickness, LM area or percentage choice. Roughage level had a quadratic ( $P = 0.01$ ) effect on HCW, which was lowest for cattle fed 0% roughage. A linear ( $P < 0.05$ ) increase due to increasing roughage level was observed for 12th rib fat thickness, marbling score, yield grade and percentage choice. The incidence of liver abscesses and LM area were not affected by roughage level.

These data suggest performance was similar for cattle fed either 0% or 15% WCGF, and cattle performance decreased when feeding 30% WCGF in finishing diets containing 30% MDGS. These results are in agreement with previous research at Nebraska (2007 *Nebraska Beef Report*, pp. 25-26). The previous study also evaluated a control diet without co-products;

cattle fed 30% WDGS with 30% WCGF had improved performance compared to the control, but performance was not as good as 30% WDGS alone. In the current study, when roughage was excluded (0%), DMI, ADG and 12th rib fat thickness were decreased compared to diets containing 7.5% or 15% corn silage. These results are in agreement with previous research in which roughage was eliminated from finishing diets containing 30% WDGS (2007 *Nebraska Beef Report*, pp. 29-32).

In summary, feeding 0% or 15% WCGF with 30% MDGS improved cattle performance, compared to feeding 30% WCGF with 30% MDGS. Furthermore, it appears that the optimum roughage level is 7.5% of diet DM when using corn silage in finishing diets containing 30% MDGS with or without WCGF.

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