Effects of Substituting Wet Distillers Grains with Solubles in a Wet Corn Gluten Feed-Based Diet on Finishing Performance

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Summary

A finishing study evaluated feeding a wet corn gluten feed (WCGF) ration containing no high moisture corn with varying inclusion levels of wet distillers grains plus solubles (WDGS), as well as a control diet containing 20% WDGS and 20% WCGF. Wet distillers grains with solubles replaced WCGF at 10%, 20%, 30% and 40% of the diet. As WDGS replaced WCGF, feed-to-gain ratio (F:G) decreased linearly. However, two steers developed polioencephalomalacia on the treatment that contained 40% WDGS. Steers fed the control diet containing 40% byproduct had greater average daily gain (ADG) and lower F:G than the average of all WCGF:WDGS combination diets. Byproduct feed-based finishing rations can be fed without corn, but performance may be slightly depressed.

Introduction

Feeding WDGS between 15% and 40% of diet dry matter improves performance, with 130% the feeding value of corn (*2008 Nebraska Beef Report*, pp. 35-36). Feeding WCGF also can improve performance (*2008 Nebraska Beef Report*, pp. 33-34). Feeding a ration that replaces all the corn with WCGF was evaluated (*1995 Nebraska Beef Report*, pp. 34-36), but replacing corn with both WDGS and WCGF has not been evaluated. We hypothesized that feeding the two byproducts together would produce a positive associative effect, due to the fat and undegradable protein of WDGS.

The objective of the current research was to determine the effect of replacing all of the corn in a finisher ration with a combination of WCGF and WDGS on both feedlot and carcass performance.

Procedure

A finishing trial was conducted at the UNL research feedlot near Mead, Neb., using yearling crossbred steers (n = 306; BW = 863 $\pm$ 55 lb). Steers were limit fed at 2.0% of their BW for five days prior to the initiation of the trial. Steers were weighed on two consecutive days (days 0 and 1) to establish an initial BW. Using the BW obtained on day 0, cattle were blocked by BW, stratified within block and assigned randomly to pens. Six pens (1 replication) contained 11 steers, and the other 24 pens contained 10 steers/pen. Pens were assigned randomly within block to one of six treatments, with five pens per treatments. Six treatments consisted of: 1) control (CON) with 20% WCGF (Sweet Bran®, Cargill, Blair, Neb.), 20% WDGS (Abengoa Bioenergy, York, Neb.), and 50% high moisture corn (HMC); 2) 90% WCGF with 0% WDGS (90WCGF:0WDGS); 3) 80% WCGF with 10% WDGS (80WCGF: 10WDGS); 4) 70% WCGF with 20% WDGS (70WCGF:20WDGS); 5) 60% WCGF with 30% WDGS (60WCGF:30WDGS); and 6) 50%WCGF with 40% WDGS (50WCGF:40WDGS). The WDGS used in this study was from corn and consisted of 32.7% dry matter (DM), 32.4% crude protein (CP), 12.7% fat and 0.74% sulfur. The high-moisture corn (HMC) used in this study was ensiled for approximately 30 days before feeding began, and contained 68.4% DM, 10.3% CP, 4.5% fat and 0.16% sulfur. The WCGF used in this study contained 27.1% CP, 3.0% fat, 0.50% sulfur and 59.4% DM. All diets contained 5% cornstalks and 5% supplement (Table 1). A 21-day adaptation period was utilized, in which a combination of byproduct feeds replaced grass hay at decreasing levels of 32.5%, 22.5%, 12.5% and 5% grass hay fed for three, four, seven and seven days, respectively. Cornstalks and supplement inclusion levels remained constant throughout the entire adaptation and finishing period.

Steers were implanted on day 1 with Revalor-S® (Intervet, Milsboro, Del.) Weekly feed ingredient samples were analyzed for DM at 60°C for 48 hours. Steers in the medium (180 head) and light (66 head) weight blocks were slaughtered on day 127 and steers in the heavy weight block (60 head) were slaughtered on day 107 at Greater Omaha (Omaha, Neb.). Hot carcass weight (HCW) and liver abscess data

Table 1. **Composition of diets fed to yearling steers in a finishing trial measuring effects of varying inclusion levels of WDGS in a WCGF-based ration[1] (%DM).**

		Treatments[2]				
Ingredients	Control	50WCGF 40WDGS	60WCGF 30WDGS	70WCGF 20WDGS	80WCGF 10WDGS	90WCGF 0WDGS
HMC	50	—	—	—	—	—
WCGF	20	50	60	70	80	90
WDGS	20	40	30	20	10	—
Corn stalks	5	5	5	5	5	5
Supplement[3]	5	5	5	5	5	5
Nutrient Composition						
CP	17.6	27.0	26.4	25.9	25.4	24.8
Calcium	0.99	1.01	1.01	1.02	1.02	1.02
Phosphorus	0.55	0.87	0.88	0.89	0.90	0.91
NDF	24.1	36.7	36.8	37.0	37.1	37.2
Fat	5.50	6.65	5.67	4.70	3.73	2.76
Sulfur	0.34	0.56	0.54	0.51	0.49	0.47

[1]Values in table expressed on a DM basis.
[2]Control = 20% WCGF, 20% WDGS; 50WCGF = 50% WCGF, 40% WDGS; 60WCGF = 60% WCGF, 30% WDGS; 70WCGF = 70% WCGF, 20% WDGS; 80WCGF = 80% WCGF, 10% WDGS; 90WCGF = 90% WCGF, 0% WDGS.
[3]Supplements formulated to provide 30g/ton of DM rumensin, 90mg/steer daily tylan and 130mg/steer daily thiamine.

Table 2. Effect of different inclusion levels of WDGS on both feedlot and carcass performance in a WCGF-based ration.[1]

	CON	50WCGF 40WDGS	60WCGF 30WDGS	70WCGF 20WDGS	80WCGF 10WDGS	90WCGF 0WDGS	SEM	Linear *P*-value	Quadratic *P*-value	Con vs. Other[5] *P*-value
Performance										
Initial BW	871	868	870	870	864	861	8	0.27	0.57	0.42
Final BW[2], lb	1258	1243	1216	1204	1234	1222	30	0.59	0.20	0.16
DMI, lb/day	26.55	24.15	25.65	26.82	27.07	28.54	0.60	< 0.01	0.55	0.83
ADG, lb	3.43	3.15	2.92	2.84	3.12	3.04	0.22	0.98	0.19	0.02
F:G	7.88	7.79	8.81	9.54	8.69	9.45	0.58	0.02	0.15	0.04
Carcass Characteristics										
HCW, lb	793	783	766	758	777	770	19	0.59	0.21	0.16
Marbling score[3]	531	511	480	497	517	510	19	0.30	.21	0.07
12[th] Rib fat, in	0.42	0.38	0.40	0.41	0.40	0.42	0.03	0.29	0.86	0.53
LM area, in^2	12.92	12.83	12.50	12.11	12.42	12.69	0.38	0.65	0.06	0.18
Calculated YG[4]	2.93	2.84	2.82	2.94	2.98	2.91	0.14	0.33	0.61	0.81
Choice percentage	57	47	33	49	56	45	11	0.37	0.85	0.23

[1]CON = 20% WCGF, 20% WDGS; 50WCGF = 50% WCGF, 40% WDGS; 60WCGF = 60% WCGF, 30% WDGS; 70WCGF = 70% WCGF, 20% WDGS; 80WCGF = 80% WCGF, 10% WDGS; 90WCGF = 90% WCGF, 0% WDGS.
[2]Calculated from carcass weight, adjusted to a common dressing percentage (63%).
[3]Marbling score: 400 = Slight^o; 450 = Slight^{50}; 500 = Small^o; etc.
[4]Yield grade: 2.50 + (2.5*fat thickness, in.) - (0.32*REA, in^2) + (0.2*2.5 KPH) + (0.0038*HCW, lb.).
[5]Contrast of control vs. other treatments.

were collected at slaughter. After a 48-hour chill, LM area, 12[th] rib fat thickness and USDA marbling score were recorded. Final BW, ADG and F:G were calculated using HCW adjusted to a common yield of 63%. Yield grade was calculated using the USDA yield grade equation YG = 2.5 + (fat depth, in.) – 0.32 (LM area, in^2) + 0.2 (KPH fat, %) + 0.0038 (HCW, lb).

Performance and carcass data were analyzed using the MIXED procedure of SAS. The trial was a randomized complete block design with pen as the experimental unit. Orthogonal contrasts were used to detect linear, quadratic, cubic and quartic effects of WDGS replacement of WCGF, excluding the control. A contrast was used to compare the CON to all other diets containing blends of WCGF and WDGS.

Results

Dry matter intake (DMI) decreased linearly ($P < 0.01$) as inclusion level of WDGS increased (Table 2). Cattle fed CON ration were intermediate and as a result were not different from the average of all the WCGF:WDGS rations. The linear decrease in DMI ($P < 0.01$) as WDGS inclusion increased may have been due to the relatively high level of dietary fat and sulfur in the 50WCGF:40WDGS ration. Gain was greater and F:G was lower ($P < 0.04$) when comparing CON to all other treatments. Within levels of WDGS added to WCGF, neither linear nor quadratic contrasts were significant for ADG; however, F:G improved linearly ($P = 0.02$) as inclusion level of WDGS increased. Final BW did not differ among treatments and was unaffected by inclusion level of WDGS. No differences in carcass data were observed among treatments compared to the control; however, there was a trend ($P = 0.07$) for a difference in marbling score. There were no significant differences for HCW, 12[th] rib fat thickness, calculated yield grade and % yield grade 4 between CON and all other treatments. A tendency for a quadratic response was observed for LM area ($P = 0.06$), with steers fed 70WCGF:20WDGS having the lowest LM area. Significant cubic responses were observed for both marbling score and percent choice ($P = 0.03$).

During the course of the feeding trial, four animals were removed from the trial due to health-related illnesses. Two of the four steers were diagnosed with polio. These animals were on the 50WCGF:40WDGS treatment at the time, which contained the highest level of WDGS. Two of the animals were treated for polio, but were not returned to treatment pens afterward. The other two animals died due to causes unrelated to treatments. The animals that were removed from this study were not included in the performance calculations.

The cattle in this feeding trial did not gain as well as expected, primarily due to harsh weather. Due to the amount of snow, the pens remained wet and muddy during a large portion of the feeding trial, creating an unfavorable environment for the cattle, which likely caused a negative effect on ADG and F:G.

Dietary sulfur levels for this trial ranged from 0.34% for the CON to 0.56% for 50WCGF:40WDGS (Table 1). Dietary sulfur levels increased from 0.47% to 0.56% as WDGS replaced WCGF. Fat levels ranged from 2.8% (90WCGF:0WDGS) to 6.6% (50WCGF:40WDGS), which likely explains the F:G response observed. The relatively high dietary fat and sulfur levels could explain the decrease in DMI observed for cattle fed the 50WCGF:40WDGS treatment. In addition, the high sulfur levels in this treatment accounted for the two animals that were diagnosed with polioencephalomalacia.

In conclusion, the results of this study suggest a byproduct-based ration will perform relatively similar to a typical Nebraska ration with 20% WDGS, 20% WCGF. The results also suggest 40% is the optimal WDGS inclusion level in WCGF-based diets because F:G was lowest for this treatment; however, dietary sulfur levels must be closely monitored.

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