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Wet Distillers Grains Plus Solubles or Solubles in Feedlot Diets Containing Wet Corn Gluten Feed

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Summary

Effects of the addition of 0% to 40% wet distillers grains plus solubles (WDGS) or 0% to 20% condensed corn distillers solubles (CCDS) to feedlot diets containing high moisture corn (HMC) and 35% wet corn gluten feed (WCGF) were evaluated. As WDGS replaced HMC, average daily gain (ADG) decreased linearly and dry matter intake (DMI) tended to decrease. Replacement of HMC with WDGS in the 35% WCGF diet caused a linear decrease in ADG and a trend for a linear decrease in DMI. When CCDS replaced HMC, no difference in steer performance was observed. The sulfur content, rather than fat content, of WDGS may be the limiting factor with feeding WDGS in combination with WCGF, and solubles may effectively reduce the dietary inclusion of corn by up to 20% of diet DM in finishing diets containing 35% WCGF.

Introduction

Previous research has evaluated feeding combinations of byproducts to replace corn in feedlot diets *(2005 Nebraska Beef Report*, pp. 45-46; *2007 Nebraska Beef Report*, pp. 25-26 and 27-28). These trials combined wet corn gluten feed (WCGF) with wet distillers grains plus solubles (WDGS). These two feeds complement each other, perhaps due to differences in fat and sulfur (S) between the two feeds. Feeding 60% of the diet as a combination of 50% WCGF: 50% WDGS results in ADG and feed-to-gain ratio (F:G) similar to those found when feeding a traditional dry-rolled/high moisture corn (HMC) feedlot diet.

Limited data have been collected on feeding dry-milling condensed corn distillers solubles (CCDS) in feedlot diets, and no data have been collected on feeding CCDS with WCGF. Therefore, the objective of the current study was to evaluate the effect of adding WDGS or CCDS to WCGF in feedlot diets on cattle performance and carcass characteristics.

Procedure

An 82-day finishing study used 279 crossbred steer calves in a randomized complete block design experiment. Steers had been on a common finishing diet for 100 days prior to study initiation. This study was initiated at re-implant processing. Steers were limit fed a WCGF-based diet at 1.8% of BW for five days to capture three-day initial weights. The average BW from the first two days was used to block the steers into three blocks, stratify steers by BW within block and assign steers randomly to pens. Pens then were assigned randomly within each block to one of seven dietary treatments, with five pens per treatment and eight steers per pen.

Dietary treatments (Table 1) consisted of 35% WCGF with either 0% WDGS or CCDS; 13.35%, 26.7% or 40% WDGS; or 6.65%, 13.35% or 20% CCDS replacing HMC in the diet (DM basis). All diets contained 5% ground cornstalks and 5% dry supplement. The WDGS and CCDS were sourced from Abengoa Bioenergy Corporation, York, Neb. The WCGF (Sweet Bran®) was from Cargill, Blair, Neb. The HMC was processed through a roller mill at harvest, ensiled in a bunker silo 166 days prior to study initiation and averaged 30% moisture.

Steers were adapted to finishing diets over six days from a previous finishing ration that contained 25% HMC, 50% WCGF, 15% corn silage, 5% corn stalks and 5% dry supplement, all on a DM basis. Steers were implanted with Synovex Choice (Fort Dodge, Overland Park, Kan.) at trial initiation. All diets provided 350 mg monensin, 127 mg thiamine, and 88 mg of tylosin per steer daily. Feed samples were collected weekly and composited by month to evaluate DM, fat, neutral detergent fiber (NDF), crude protein (CP) and S.

The levels of WDGS and CCDS were formulated to provide equal fat addition from either product, assuming CCDS contained 25% fat and WDGS contained 12.5% fat, based on historical fat analysis with the Soxhlet ether extract procedure. After trial initiation, it was discovered that the Soxhlet lipid extraction procedure over-estimates lipid values for CCDS due to extraction of non-lipid material in the extraction process. Therefore, a new procedure to accurately measure lipid content of CCDS was developed, utilizing a biphasic extraction of lipid material from CCDS into a 1:1 hexane:diethyl ether solvent.

Table 1. Diet composition and analysis for diets containing WCGF with either WDGS or CCDS (DM basis).[1,2]

		Treatments					
Ingredient	Control	13.3 WDGS	26.7 WDGS	40 WDGS	6.7 CCDS	13.3 CCDS	20 CCDS
HMC	55.0	41.7	28.3	15.0	48.3	41.7	35.0
WCGF	35.0	35.0	35.0	35.0	35.0	35.0	35.0
WDGS	0.0	13.3	26.7	40.0	0.0	0.0	0.0
CCDS	0.0	0.0	0.0	0.0	6.7	13.3	20.0
Cornstalks	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Supplement	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Diet Analysis							
Crude protein	15.6	18.8	21.9	25.1	16.8	17.9	19.1
NDF	23.3	26.7	30.2	33.6	22.8	22.3	21.8
Fat	4.1	5.0	5.9	6.9	4.8	5.5	6.2
Sulfur	0.26	0.35	0.44	0.52	0.33	0.39	0.45

[1]All values expressed on a DM basis
[2]HMC = high moisture corn; WCGF = wet corn gluten feed (Sweet Bran); WDGS = wet distillers grains plus solubles; CCDS = dry mill condensed corn distillers solubles; 13.3WDGS = 13.3% WDGS; 26.7WDGS = 26.7% WDGS; 40WDGS = 40% WDGS; 6.7CCDS = 6.7% CCDS; 13.3CCDS = 13.3% CCDS; and 20CCDS = 20% CCDS.

The solvent was then separated from the sample with water before extracting the solvent/lipid mixture and driving off the solvent to capture the lipid. Upon trial completion, the new lipid analysis indicated CCDS had 1.3 times the fat content of the WDGS and therefore did not produce equal levels of fat addition from the WDGS and CCDS sources.

Steers were slaughtered on day 83 at Greater Omaha Pack (Omaha, Neb.), where liver scores and hot carcass weights were recorded. Fat thickness and LM area were measured, and the USDA marbling score was recorded after a 48-hour chill. Hot carcass weight, fat thickness, LM area and assumed 2% kidney, heart and pelvic fat measurements were used to calculate yield grade. Final BW, ADG and F:G were calculated based on hot carcass weight adjusted to a common dressing percentage (63%) in order to minimize errors associated with gut fill.

Data were analyzed using the MIXED procedure of SAS and tested for linear, quadratic and cubic effects of WDGS or CCDS inclusion level.

Seven pens of cattle were removed from the analysis due to incorrect feeding for two days during the study. This resulted in three complete blocks of treatments and two incomplete blocks of treatments.

Table 2. Main effects of WDGS level with 35% WCGF on performance measurements and carcass characteristics.[1]

Item	Control	13.3 WDGS	26.7 WDGS	40 WDGS	SE	*P*-Value Lin.	Quad.	Cubic
Initial BW, lb	983	984	984	982	2.5	0.85	0.95	0.96
Final BW[2], lb	1295	1293	1282	1270	11.7	0.37	0.77	0.93
DMI, lb/day	22.98	22.67	22.69	21.05	0.488	0.06	0.80	0.86
ADG, lb	3.79	3.76	3.63	3.43	0.134	< 0.01	0.34	0.89
Feed:Gain	6.02	6.02	5.95	6.13	0.144	0.86	0.70	0.77
Carcass Characteristics								
Hot carcass weight, lb	815	815	808	796	7.4	0.38	0.76	0.93
12th rib fat thickness, in	0.58	0.54	0.53	0.51	0.026	0.07	0.80	0.76
LM area, in^2	12.85	12.63	12.60	12.37	0.289	0.15	0.98	0.67
Calculated yield grade[3]	3.34	3.31	3.26	3.25	0.105	0.44	0.99	0.97
Marbling score[4]	519	523	535	504	18.1	0.52	0.34	0.46

[1]WDGS = wet distillers grains plus solubles; 13.3WDGS = 13.3% WDGS; 26.7WDGS = 26.7% WDGS; 40WDGS = 40% WDGS.
[2]Calculated from carcass weight, adjusted to a 63% common dressing percentage.
[3]Calculated as 2.5 + (2.5*Fat Depth) + (0.2* 2% KPH) + (0.0038* Hot Carcass Wt.) – (0.32*Ribeye Area) from Meat Evaluation Handbook, 2001.
[4]400 = Slight^0; 500 = Small^0.

Table 3. Main effects of CCDS level with 35% WCGF on performance measurements and carcass characteristics.[1]

Item	Control	6.7 CCDS	13.3 CCDS	20 CCDS	SE	*P*-Value Lin.	Quad.	Cubic
Initial BW, lb	983	984	985	981	2.5	0.99	0.79	0.92
Final BW[2], lb	1295	1293	1297	1292	11.7	0.96	0.72	0.85
DMI, lb/day	22.98	22.67	22.06	22.55	0.488	0.55	0.80	0.81
ADG, lb	3.79	3.77	3.80	3.79	0.134	0.92	0.72	0.73
Feed:Gain	6.02	6.02	5.78	5.95	0.144	0.52	0.58	0.49
Carcass Characteristics								
Hot carcass weight, lb	815	815	817	814	7.4	0.97	0.71	0.85
12th rib fat thickness, in	0.58	0.55	0.57	0.56	0.026	0.78	0.80	0.16
LM area, in^2	12.85	12.67	12.57	12.11	0.289	0.19	0.58	0.68
Calculated yield grade[3]	3.34	3.37	3.43	3.53	0.105	0.15	0.97	0.90
Marbling score[4]	519	516	551	519	18.1	0.24	0.04	0.04

[1]CCDS = dry mill condensed corn distillers solubles; 6.7CCDS = 6.7% CCDS; 13.3CCDS = 13.3% CCDS; and 20CCDS = 20% CCDS.
[2]Calculated from carcass weight, adjusted to a 63% common dressing percentage.
[3]Calculated as 2.5 + (2.5*Fat Depth) + (0.2* 2% KPH) + (0.0038* Hot Carcass Wt.) – (0.32*Ribeye Area) from Meat Evaluation Handbook, 2001.
[4]400 = Slight^0; 500 = Small^0.

Results

As the level of WDGS increased in the diets with 35% WCGF, ADG decreased linearly ($P < 0.01$; Table 2), and DMI tended to decrease linearly ($P = 0.06$); F:G was not affected by treatment. Twelfth rib fat thickness also tended to decrease linearly ($P = 0.07$) as the level of WDGS increased in the diet; however, there were no significant differences in hot carcass weight, LM area, 12th rib fat, yield grade or marbling score.

Steers fed up to 20% CCDS with 35% WCGF had similar feedlot performance and carcass characteristics as steers fed 35% WCGF with no CCDS (Table 3). There was a significant ($P = 0.04$) cubic effect of CCDS inclusion level on the marbling score; however, this effect is difficult to explain and probably not biologically significant.

The steers fed 20% CCDS performed similarly to the steers fed 26.7% WDGS. These two diets contained similar fat levels (6.2% and 5.9% fat for the 20% CCDS and 26.7% WDGS diets, respectively). The S levels were similar for the two diets, with 0.45% and 0.44% S in the 20% CCDS and 26.7% WDGS diets, respectively. When the level of WDGS was increased to 40% of diet DM (6.9% fat and 0.52% S), steer performance decreased. Previous research (Vander Pol et. al., *2006 Nebraska Beef Report* pp. 51-53) suggests that the fat level in the 40% WDGS diet is probably not high enough to depress DMI or ADG. However, one of the first signs of S excess in the diet is depressed DMI with decreased ADG. The cattle on the 40% WDGS with 35% WCGF may have had depressed DMI due to dietary S. However, no steers on this trial were observed with symptoms of, or treated for, polioencephalomalacia.

In summary, these results suggest feeding up to 20% of diet DM as CCDS with 35% WCGF can be used to reduce the percentage of HMC fed in feedlot diets without diminishing cattle performance or carcass characteristics. However, when HMC is replaced with WDGS in 35% WCGF diets, cattle ADG decreases as WDGS inclusion level increases. The S content, rather than fat content, of WDGS may be the limiting factor with feeding WDGS in combination with WCGF.

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