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Summary

Effects of adding 0, 9, 18, 27, or 36% condensed corn distillers solubles (CDS) to finishing diets containing a blend of dry-rolled and high-moisture corn and no other byproducts, were evaluated. As CDS replaced corn, DMI decreased linearly, while ADG and F:G increased quadratically. Feeding up to 36% CDS may effectively reduce dietary inclusion of corn, while improving ADG and F:G in finishing diets, with calculated maximal ADG at 20.8 and best F:G at 32.5% inclusion of CDS (DM).

Introduction

Condensed distillers solubles (CDS) is typically blended with the distillers grains fraction to produce wet, modified, or dry distillers grain plus solubles. The amount of CDS added to the grains is mostly dependent upon the ethanol plant's capacity to store the liquid CDS. When supply of CDS exceeds storage availability, CDS is available to producers as a relatively inexpensive, yet energy-dense feed ingredient.

Limited data are available on feeding CDS in finishing diets, especially at relatively high levels (above 10% of diet DM). However, previous research on both the addition of CDS to diets containing wet corn gluten feed (*2009 Nebraska Beef Cattle Report*, pp. 64-65), and on increasing the CDS to grains ratio in wet distillers grains with solubles (*2009 Nebraska Beef Cattle Report*, pp. 59-61) has found no negative impacts of CDS on cattle performance. Therefore, the objective of the current study was to determine the effects of feeding high levels of CDS on finishing performance and carcass characteristics in a corn-based diet as the sole byproduct.

Procedure

A 132-day finishing study was conducted using 250 crossbred, yearling steers (BW = 783 ± 40 lb). Cattle were received in the fall and placed on a common diet of soybean hulls and wet corn gluten feed. Steers were limit fed at 2.0% of BW for five days prior to trial initiation and then weighed on two consecutive days (days 0 and 1) to establish initial BW. Cattle were blocked by day 0 BW, stratified by BW within block, and assigned randomly to pen. Pens were assigned randomly to one of five treatments with 10 steers per pen and five pens per treatment.

Five treatments (Table 1) consisted of: 0, 9, 18, 27, or 36% condensed corn distillers solubles (CDS), which replaced both urea and a 1:1 blend of dry-rolled corn (DRC) and high-moisture corn (HMC). The CDS (Nebraska Energy LLC., Aurora, Neb., and Southwest Iowa Renewable Energy, Council Bluffs, Iowa.) used in this study contained 30.0% DM, 21.9% CP, 18.6% fat, and 1.1% sulfur. Urea decreased from 1.58% in the 0% CDS diet to 0.35% in the 36% CDS diet. Soypass™ was included in all diets, replacing corn from day 1 to day 40 to meet the metabolizable protein requirement of those steers. All diets contained 7.5% alfalfa hay and 5% dry supplement, which was formulated to provide 345 mg/steer Rumensin®, 90 mg/steer Tylan®, and 130 mg/steer thiamine daily. Dietary fat increased from 3.7 to 9.0%, whereas dietary sulfur increased from 0.12 to 0.48%, as CDS increased.

Steers were implanted on day 1 with Revalor-S (Intervet, Millsboro, Del.). All animals were harvested on day 133 at Greater Omaha Pack (Omaha, Neb.), at which time hot carcass weights (HCW) and liver scores were recorded. Fat thickness, loin muscle area, and USDA marbling score were recorded after a 48-hour chill. Yield grade was calculated using HCW, fat thickness, LM area, and an assumed 2% kidney, pelvic, and heart fat. Final BW, ADG, and F:G were calculated using hot carcass weight adjusted to a common (63%) dressing percentage.

Performance and carcass data were analyzed using the MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.) as a randomized complete block design

Table 1. Diet composition and analysis for diets containing 0% to 36% CDS (DM).[1, 2]

	CDS, % Diet DM				
Item	0	9	18	27	36
Ingredient, %					
DRC	43.75	39.25	34.75	30.25	25.75
HMC	43.75	39.25	34.75	30.25	25.75
CDS	—	9.0	18.0	27.0	36.0
Alfalfa Hay	7.5	7.5	7.5	7.5	7.5
Urea[3]	1.58	1.28	0.96	0.65	0.35
Supplement[4]	3.42	3.72	4.04	4.35	4.65
Analyzed Composition, %					
Crude Protein	13.6	13.9	14.1	14.4	14.7
Fat	3.7	5.0	6.4	7.7	9.0
Sulfur	0.12	0.21	0.30	0.39	0.48

[1] All values expressed on a DM basis.
[2] CDS = dry milling corn condensed distillers solubles; DRC = dry-rolled corn; HMC = high-moisture corn.
[3] Urea replaced fine ground corn in supplement.
[4] Soypass was fed for days 1-40.

Table 2. Effect of CDS inclusion on cattle performance and carcass characteristics.

	CDS, % Diet DM						*P*-value	
Item	0	9	18	27	36	SEM	Lin.[1]	Quad.[2]
Performance								
Initial BW, lb	779	780	779	781	781	1.2	0.24	0.85
Final BW, lb	1231	1280	1287	1271	1261	12.8	0.22	0.01
DMI, lb/day	22.7	22.8	22.7	22.1	21.2	0.36	<0.01	0.07
ADG, lb	3.42	3.78	3.84	3.71	3.64	0.10	0.25	0.01
F:G	6.62	6.02	5.92	5.95	5.81	0.11	<0.01	0.02
Live final BW, lb	1274	1328	1309	1293	1283	25.2	0.82	0.16
Carcass Characteristics								
HCW, lb	776	806	810	801	794	8.0	0.22	<0.01
Dressing %	60.9	61.3	61.9	61.9	61.9	0.4	0.04	0.35
LM area, in^2	12.3	12.6	12.8	12.4	12.5	0.21	0.76	0.29
12^{th} rib fat, in	0.52	0.57	0.52	0.55	0.53	0.02	0.98	0.60
Calculated YG	3.37	3.44	3.30	3.42	3.35	0.08	0.80	0.94
Marbling Score[3]	564	555	553	563	557	12.4	0.86	0.71

[1]Lin. = *P*-value for the linear response to CDS inclusion.
[2]Quad. = *P*-value for the quadratic response to CDS inclusion.
[3]Marbling Score: 500 = Small00, 600 = Modest00.

with pen as the experimental unit. Weight block was included as a random effect. Orthogonal contrasts were used to test the effects of CDS inclusion level.

Results

As CDS inclusion increased, DMI decreased linearly ($P < 0.01$), while ADG increased quadratically ($P = 0.01$; Table 2), with maximum ADG calculated at 20.8% CDS using the first derivative of the quadratic response. Feed:gain also decreased quadratically ($P < 0.01$) as CDS inclusion increased. The lowest F:G was calculated at 32.5% CDS, at which steers were 12% more efficient than those fed 0% CDS. Relative feeding values were also calculated for each CDS inclusion versus 0% CDS by dividing the difference in G:F by the G:F of 0% CDS, then by the decimal percentage inclusion of CDS. Relative feeding values were 210, 166, 142, and 139% of corn for 9, 18, 27, and 36% CDS, respectively. These improvements in ADG and F:G are presumably partially due to the high fat level, and thus high energy density of the diets, as CDS inclusion increases. Previous studies have shown that dietary fat levels of up to 7% in finishing diets have positive impacts on performance. The results of the current study confirm this, and suggest even up to 9% dietary fat may be acceptable, when this fat is supplied by CDS. It also has been suggested that there is a higher tolerance for fat from CDS, relative to other fat sources (*2010 Nebraska Beef Cattle Report,* p. 74). It is interesting to note that since F:G plateaus at the highest inclusions of CDS, perhaps even higher levels could be acceptable or economical. The limiting factor to inclusions higher than 36% CDS would likely be challenges in the physical handling properties of the diet, dietary fat, and/or dietary sulfur. The dietary sulfur level of 0.48% in the diet containing 36% CDS appears to have had no negative impact on performance, and no cases of polioencephalomalacia were reported.

Final BW and HCW increased quadratically as CDS inclusion increased, with steers fed 18% CDS having 34 lb heavier HCW than those fed 0% CDS. No other differences were observed for carcass characteristics, as steers in all treatments were finished to a similar endpoint.

Feeding up to 36% CDS may effectively reduce dietary inclusion of corn, while improving gain and gain efficiency in finishing diets. Maximal animal performance was observed between 20.8 and 32.5% inclusion of CDS (DM).

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