Replacing Steam-Flaked Corn and Dry Rolled Corn With Condensed Distillers Solubles In Finishing Diets

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Summary

The interaction between corn processing method and condensed distillers solubles (CDS) was evaluated using either steam-flaked corn (SFC) or dry rolled corn (DRC). As CDS replaced corn at either 15 or 30% of the diet DM, DMI intake decreased quadratically for both SFC and DRC. Within DRC- based diets, ADG increased quadratically with 15% CDS being greatest and F:G improved quadratically with 30% inclusion being best. When SFC was used as the grain source, ADG increased linearly and F:G improved quadratically with increasing levels of CDS. A greater performance response was observed with SFC compared to DRC when feeding increased levels of CDS.

Introduction

Condensed distillers solubles (CDS) is a byproduct from the dry milling ethanol process. Feeding increased levels of CDS in finishing rations improved performance in diets containing a blend of dry rolled (DRC) and high-moisture corn (*2012 Nebraska Beef Cattle Report*, pp. 64-65). Wet distillers grains with solubles (WDGS) interacts with corn processing methods (*2007 Nebraska Beef Cattle Report*, pp. 33-35). This interaction revealed a greater response to higher levels of WDGS in DRC diets compared to SFC based diets. It is unknown how CDS interacts with different corn processing methods. Therefore, the objective of this study was to determine if an interaction exists between corn processing method (DRC or SFC) and level of CDS in finishing diets.

Materials and Methods

Four hundred sixty-two crossbred steers (initial BW = 869 ± 35 lb) were utilized in a finishing trial at the Panhandle Research Feedlot located near Scottsbluff, Neb. Five days prior to the start of the experiment, cattle were limit fed a diet consisting of 25% corn silage, 25% beet pulp, and 50% alfalfa hay (DM basis). Two day initial weights were recorded on days 0 and 1, and the average was used as initial BW. Cattle were blocked (n = 3) based on initial BW and assigned randomly to one of 42 feedlot pens (11 steers/pen). Pens were assigned randomly to treatments which allowed for seven replications per treatment.

A randomized block design was utilized with a 2 x 3 factorial arrangement of treatments. The first factor was corn processing method (DRC or SFC), and the second factor was level of CDS (0, 15, 30%; DM basis) which replaced a portion of corn, soybean meal, and urea (Table 1). Cattle were adapted to the finishing diets over a 20-day period with corn replacing alfalfa hay, while inclusion of CDS remained the same in all diets. The CDS used in this trial (Colorado Agri Products, Bridgeport, Neb.) contained 24.3% DM, 16.0% CP, 20.3% EE, and 0.39% S. Diets included soybean meal and urea in order to meet or exceed MP requirements. All diets contained 4.0% supplement which was formulated to provide 360 mg of Rumensin® and 90 mg of Tylan® per steer daily (Elanco Animal Health).

Steers in the light block were implanted on day 1 with Component TE-IS. Steers in the mid and heavy block were implanted with Component TE-S (Elanco Animal Health). The lightweight block was re-implanted on day 70 with Component TE-S. The middle and heavy BW blocks were harvested on day 119 and the light BW block on 132 (Cargill Meat Solutions, Fort Morgan, Colo.). Hot carcass weight and liver scores were recorded on the day of slaughter. Fat thickness, LM area, and USDA marbling score were recorded after a 48-hour chill. Final BW, ADG, and F:G were calculated using HCW adjusted to a common 63% dressing percentage.

Performance and carcass characteristics were analyzed using the MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.). Corn processing method, CDS inclusion level, and corn processing method x CDS inclusion level were included in the model. Pen was the experimental unit and BW block was included as a random effect. Orthogonal contrasts were used to test linear and quadratic effects of

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Table 1. Experimental diets[1] (DM basis).

	SFC[2]			DRC		
	CDS, % Diet DM			CDS, % Diet DM		
	0	15	30	0	15	30
Ingredient %						
DRC	—	—	—	83.59	69.54	55.50
SFC	82.19	68.70	55.34	—	—	—
CDS	—	15.0	30.0	—	15.0	30.0
Corn silage	7.0	7.0	7.0	7.0	7.0	7.0
Alfalfa hay	3.5	3.5	3.5	3.5	3.5	3.5
Supplement[3]	4.0	4.0	4.0	4.0	4.0	4.0
Soybean meal	2.7	1.4	—	1.3	0.65	—
Urea	0.61	0.40	0.16	0.61	0.31	—

[1]SFC = Steam-flaked corn, DRC = dry rolled corn, CDS = condensed distillers solubles.
[2]Flake density was 28 lb/bu.
[3]Formulated to provide 360 mg Rumensin and 90 mg of Tylan per head daily.

Table 2. Effect of corn processing method and condensed distillers solubles (CDS) inclusion level on performance and carcass characteristics.

	Steam-flaked corn			Dry rolled corn				*P*- value[1]		
CDS level:	0	15	30	0	15	30	SEM[2]	Corn	CDS	Inter
Performance										
Initial BW, lb	869	869	870	869	869	869	36.4	0.91	0.34	0.83
Final BW, lb[3,4,5]	1377	1389	1407	1337	1389	1350	18.2	< 0.01	< 0.01	< 0.01
DMI, lb/day[6]	26.1	25.5	23.6	26.7	25.9	23.2	0.66	0.30	< 0.01	0.14
ADG, lb[3,4,5]	4.15	4.26	4.39	3.84	4.25	3.95	0.01	< 0.01	< 0.01	< 0.01
F:G[3,4,5,7,8]	6.29	5.99	5.35	6.99	6.10	5.85	0.26	< 0.01	< 0.01	0.03
Carcass Characteristics										
HCW, lb[4,5]	867	875	886	842	875	850	11.4	< 0.01	0.01	< 0.01
12th rib fat, in[4]	0.55	0.60	0.60	0.56	0.55	0.56	0.01	0.02	0.23	0.07
LM area, in sq.	13.0	13.0	13.0	12.9	13.1	12.8	0.18	0.34	0.53	0.42
Marbling score[9]	553	555	559	551	558	554	13.8	0.79	0.65	0.81
Yield grade[4,10]	3.39	3.57	3.61	3.43	3.43	3.45	0.11	0.09	0.12	0.16
Liver abscess, %	7.9	11.8	3.9	14.3	9.2	8.0	—	0.29	0.26	0.38

[1]Corn = main effect of corn processing method, CDS = main effect of condensed distillers solubles inclusion level, Inter = corn processing method and condensed distillers solubles inclusion level interaction.
[2]SEM = standard error of the mean for the interaction.
[3]Final BW calculated from hot carcass weight, adjusted to a common dressing percentage of 63.
[4]Linear effect of CDS within SFC ($P < 0.05$).
[5]Quadratic effect of CDS within DRC ($P < 0.05$).
[6]Quadratic effect of CDS across all treatments ($P < 0.05$).
[7]Linear effect of CDS within DRC ($P < 0.05$).
[8]Quadratic effect of CDS within SFC ($P = 0.07$).
[9]Marbling score: 400 = Slight 0, 500 = Small 0
[10]Yield grade = 2.5 + 2.5(fat thickness, in) – 0.32(LM area, in^2) + 0.2(KPH fat, %) + 0.0038(hot carcass weight, lb).

CDS inclusion level across both corn processing types when no interaction was observed. In the case of a significant ($P < 0.05$) interaction, linear and quadratic effects were tested within corn processing method.

Results

Dry matter intake for both SFC and DRC fed cattle decreased quadratically ($P < 0.04$) as CDS level increased (Table 2). Corn processing method did not have an effect ($P = 0.30$) on DMI although numeric differences were observed. There were corn processing method x CDS level interactions ($P < 0.05$) for carcass adjusted final BW, ADG, and F:G. Quadratic increases ($P < 0.01$) in final BW and ADG were observed for DRC based diets, where final BW and ADG increased at 15% CDS level and decreased at the 30% level. There was a quadratic improvement ($P < 0.03$) in F:G as CDS level increased in DRC-based diets. A 14.6% improvement in F:G was observed when increasing CDS inclusion from 0 to 15% in DRC-based diets, but a smaller increase was observed (4.3%) when increasing CDS inclusion from 15 to 30%. These results are similar to previous data when feeding increased levels of CDS in DRC and high-moisture corn based diets at a 1:1 ratio (*2012 Nebraska Beef Cattle Report*, pp. 64-65). However for SFC- based diets, final BW and ADG increased linearly ($P = 0.01$) as CDS level increased. Similar to DRC-based diets a quadratic improvement ($P = 0.07$) in F:G was observed for SFC fed steers. When CDS was included at 15% in SFC diets, there was a 5% improvement in F:G. When comparing the 15% to 30% CDS in SFC diets there was an additional 12% improvement in F:G. When comparing corn processing methods with no CDS, an 11.2% improvement in F:G was observed for SFC compared with DRC.

There was no effect on LM area from corn processing method ($P = 0.34$) or CDS level ($P = 0.53$). There tended to be an interaction ($P = 0.07$) for 12th rib fat thickness. Steam flaked corn diets had greater ($P = 0.02$) 12th rib fat thickness compared to DRC diets. Fat thickness increased linearly ($P = 0.02$) for SFC diets, but for DRC based diets it was not different ($P = 0.88$) across inclusions of CDS. Diets with SFC tended ($P = 0.09$) to have greater yield grades than DRC based diets. There was a linear increase ($P = 0.01$) for yield grade in SFC diets; however, there was no difference across inclusions of CDS in DRC- based diets. There were no effects ($P > 0.65$) from corn processing method or CDS level on marbling score. No effects were observed for liver abscess incidence due to corn processing method ($P = 0.29$) or CDS level ($P = 0.26$).

Results from this study suggest corn processing method interacts with level of CDS. This response is somewhat different compared with WDGS, increasing level of CDS did not reduce ADG and F:G in SFC based diets. The response reported with SFC suggests that more than 30% CDS may be fed and warrants investigation.

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