1996

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CATTLE 96-3

Summary

A trial was conducted as a randomized block design to assess the effects of condensed corn distillers solubles (CCDS) on performance and carcass merit of yearling steers (n=216) fed 90% concentrate finishing diets. CCDS was included at 0 (MSBM), 5 (5CCDS), 10 (10CCDS), or 20% (20CCDS) of diet DM, replacing soybean meal, molasses, and corn. Average daily gain increased (P<.05) for steers fed CCDS but, along with a numerical trend (P=.14) of increasing DMI, resulted in no improvement in F/G (P>.20). Steers were harvested on day 108. Carcass weight and dressing percent for steers fed CCDS were greater than control steers (P<.01). Other carcass characteristics did not differ by treatment (P>.20). Ruminal fluid was collected by stomach tube from steers (n=72) at -.5, +1, +4, and +7 hours from feeding. Values reported are means across sampling times. Ruminal fluid pH was higher for CCDS fed cattle than MSBM (P<.05). Butyrate increased with increasing CCDS level (P<.05). Differences in acetate, propionate, and NH_3N were not significant (P>.20). The CCDS was an effective protein and energy source in 90% concentrate corn-based finishing diets. Based on performance, maximum inclusion rate is at least 20% of diet DM.

Key Words: Condensed Corn Distillers Solubles, Finishing Diets, Steers

Introduction

The fermentation of corn grain to ethanol produces, in addition to ethanol, distillers grains and a liquid fraction called thin stillage (or "sweet water"). This liquid fraction is often condensed to a syrup which can range from 30 to 50% DM, 10 to 20% fat, and 20 to 30% protein, depending on source. The syrup is commonly referred to as condensed corn distillers solubles (CCDS).

Limited work has been conducted to determine optimum and maximum dietary levels of CCDS in feedlot diets. This study was designed to determine (1) the effects of increasing levels of CCDS on feedlot performance and carcass characteristics of cattle fed finishing diets and (2) effects of CCDS level on rumen function.

Materials and Methods

Two hundred sixteen crossbred yearling steers (initial weight 858 lb) were randomly allotted within breed type to 24 pens (9 steers/pen, 6 pens/treatment) and fed 90% concentrate diets (Table 1) containing CCDS[3] at 0 (MSBM), 5 (5CCDS), 10 (10CCDS, or 20% (20CCDS) of the diet DM.

Diets were mixed and fed once daily at 8:30 a.m. Steers were allowed to consume feed ad libitum during the trial. A receiving diet was fed prior to and for the first 2 days of the trial. Four step-up diets were fed for 5 days each. The finishing diets were formulated to contain 12.5% protein, .70% Ca, .65% P, and 1.08% K. Diets also contained monensin at 28 grams per ton of diet DM. High moisture corn was replaced with dry corn starting on day 59 because supplies were depleted. Feed

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Table 1. Finishing trial diet composition (% DM)

Ingredient	MSBM	5CCDS	10CCDS	20CCDS
Dry rolled corn	38.00	38.89	37.29	32.58
High moisture corn	38.00	38.89	37.29	32.58
Alfalfa hay	10.00	10.00	10.00	10.00
Soybean meal	5.30	3.90	2.52	—
Molasses	5.00	—	—	—
CCDS	—	5.00	10.00	20.00
Limestone	.16	.45	.70	1.15
Dicalcium phosphorus	1.70	1.25	.80	.80
Potassium chloride	.90	.70	.50	—
Urea	.35	.35	.35	.35
Trace mineral salt	.50	.50	.50	.50
Premix	.09	.07	.05	2.04
Chemical analysis				
DM, %	82.02	75.96	70.09	61.37
CP, %	12.59	12.58	12.52	12.42

ingredients were sampled weekly and stored frozen for later analysis for DM and Kjeldahl N.

Initial and final shrunk weights were determined after removal feed and water overnight. All steers were vaccinated for IBR, BVD, PI3, BRSV, and black leg and received ivermectin and a trenbalone acetate-estradiol implant. One steer died 32 days into the study due to causes not related to treatment.

Ruminal fluid was collected by stomach tube from nine animals per treatment on day 69 and day 70 of the trial. Samples were collected .5 hours before and 1, 4, and 7 hours after feeding, strained through cheesecloth, analyzed immediately for pH, and then acidified and frozen for later analysis for VFA and NH_3N. Values reported are means across sampling times.

Performance and carcass variables were analyzed as a randomized block design using the GLM procedures of SAS. Variables were tested for linear, quadratic, and cubic effects of CCDS level. Treatment means were separated by the PDIFF option of LSMEANS when F was significant. Block represented pen type (confinement vs open, dirt lots). Mean ruminal pH, NH_3N and VFA concentrations were analyzed as a completely random design using GLM procedures.

The steers were fed for a total of 108 days. They were harvested 1 day after the off-test weight was taken. Carcass data were collected for determination of quality and yield grades.

Results and Discussion

Average daily gain was greater ($P<.05$) for steers fed CCDS (Table 2) but, along with a numerical trend ($P=.14$) of increasing DMI, resulted in no improvement in feed efficiency ($P>.20$). Adjustment of daily gain for differences in dressing percent accentuated treatment differences and did not alter conclusions drawn from the unadjusted data.

Mean ruminal fluid pH (Table 3) was higher for cattle fed finishing diets containing CCDS than MSBM ($P<.05$). Molar proportion of butyrate increased with increasing CCDS level ($P<.05$), but differences in acetate, propionate and NH_3N were not significant ($P>.20$).

Carcass weight and dressing percent for steers fed CCDS were greater than control steers ($P<.10$). Other carcass characteristics (Table 4) did not differ by treatment ($P>.20$).

CCDS used in this study was an effective protein and energy source in a 90% concentrate, corn-based finishing diets. When replacing soybean meal, molasses and corn, CCDS apparently results in increased gain, a trend toward greater intake, similar feed efficiency, and increased dressing percent. Based on performance, maximum inclusion rate is at least 20% of diet DM.

Table 2. Feedlot performance data

Item	MSBM	5CCDS	10CCDS	20CCDS
DMI, lb/day	20.81	21.63	22.24	21.58
CPI, lb/day	2.62	2.71	2.78	2.67
ADG, lb/day	3.48[a]	3.68[b]	3.81[b]	3.70[b]
F/G	5.95	5.88	5.81	5.85

[a,b]$P<.05$.

Table 3. Rumen fermentation data[a]

Item	MSBM	5CCDS	10CCDS	20CCDS
pH	5.75[d]	6.07[ef]	6.18[e]	5.99[f]
Mean NH_3N[b]	4.18	3.01	2.87	1.57
Acetate[c]	52.18	51.65	50.87	49.71
Propionate[c]	34.63	36.74	35.23	34.86
Butyrate[c]	9.13[ef]	7.50[d]	9.96[ef]	11.11[f]

[a]Means across sampling times.
[b]mg/dl.
[c]Molar percentage.
[d,e,f]$P<.05$.

Table 4. Carcass data

Item	MSBM	5CCDS	10CCDS	20CCDS
Carcass wt, lb	780[b]	802[c]	818[c]	820[c]
Dressing percent	63.0[b]	63.8[c]	64.0[c]	65.0[d]
Rib fat, in.	.44	.48	.45	.48
Rib eye area, $in.^2$	14.04	14.17	14.19	14.11
Kidney, pelvic, heart fat	1.94	2.11	2.16	2.07
Yield grade	2.47	2.64	2.62	2.73
Quality grade[a]	5.11	5.22	5.01	5.03

[a]5.00 = low choice.
[b,c,d]$P<.01$.