1996

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SDSU CATTLE 96-2

Summary

A trial was conducted as a randomized block design to assess the effects of condensed corn distillers solubles (CCDS) on performance of steer calves (n = 200) fed 40% concentrate, dry rolled corn-hay based growing diets. CCDS was included at 0 (MSBM), 5 (5CCDS), 10 (10CCDS), or 20% (20CCDS) of diet DM, replacing soybean meal, molasses, and corn. A corn silage/supplement diet was also included (SIL). Dry matter intakes at higher CCDS levels were lower than that of MSBM ($P < .05$). Average daily gain was not affected ($P > .20$) and, as a result, feed efficiency (F/G) tended to improve ($P = .14$). Steers fed SIL consumed less DM ($P < .05$), gained faster ($P < .01$), and were more efficient ($P < .01$) than all other treatments. Ruminal fluid was collected by stomach tube from steers (n = 90) at -.5, +1, +4, and +7 hours from feeding. Values reported are means across sampling times. Ruminal NH_3N and molar proportions of acetate decreased ($P < .05$) and propionate increased ($P < .05$) with increasing CCDS level. Despite significance, no discernable pattern was observed for ruminal fluid pH. CCDS was an effective protein and energy source in 40% concentrate corn-hay growing diets. Based on performance, maximum inclusion rate is at least 20% of diet DM.

Key Words: Condensed Corn Distillers Solubles, Growing 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 of steer calves fed growing diets and (2) effects of CCDS level on rumen function.

Materials and Methods

Two hundred crossbred steer calves (initial weight 553 lb) were randomly allotted within breed type to 20 pens (10 steers/pen, 4 pens/treatment) and fed 40% concentrate diets (Table 1) containing either CCDS[3] at 0 (MSBM), 5 (5CCDS), 10 (10CCDS), or 20% (20CCDS) of the diet DM or a predominantly corn silage diet (SIL).

Diets were mixed and fed once daily at 8:30 a.m. Steers were allowed to consume feed ad libitum during the trial. The diets were formulated to contain 11.5% protein, .75% Ca, .64% P, and 1.48% K. Diets also contained 22 grams monensin per ton of diet DM. Feed ingredients were sampled weekly and stored frozen for later analysis for DM and Kjeldahl N. All steers were fed a common diet during the final 5 days of the 84-day study.

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Table 1. Grower trial diet composition (% DM)

Ingredient	MSBM	5CCDS	10CCDS	20CCDS	SIL
Dry rolled corn	25.12	26.94	23.71	17.06	—
Grass hay	30.00	30.00	30.00	30.00	—
Oat hay	30.00	30.00	30.00	30.00	—
Soybean meal	6.16	4.75	3.38	.84	11.87
Molasses	5.00	—	—	—	—
CCDS	—	5.00	10.00	20.00	—
Limestone	.54	.83	1.05	1.50	.18
Dical phosphorus	1.70	1.20	.80	—	1.78
Potassium chloride	.88	.68	.46	—	.45
Trace mineral salt	.50	.50	.50	.50	.50
Premix	.10	.10	.10	.10	.10
Corn silage	—	—	—	—	85.12
Chemical analysis					
DM, %	85.84	78.65	71.86	61.80	55.49
CP, %	10.78	10.70	10.57	10.40	11.57

Initial and final shrunk weights were determined after withholding feed and water overnight. All steers were vaccinated for IBR, BVD, PI3, BRSV, and black leg and received ivermectin and an estradiol implant. One steer died 37 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 23 and day 58 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. Means reported are across sampling times.

Performance 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.

Results and Discussion

Dry matter intake at higher CCDS levels were lower than that of the MSBM diet ($P<.05$; Table 2). Average daily gain was not affected and, as a result, feed efficiency (F/G) tended to improve with increasing CCDS level ($P=.14$). Steers fed SIL consumed less DM ($P<.05$), gained faster ($P<.01$), and were more efficient ($P<.01$) than all other treatments.

Despite statistical differences ($P<.05$) between growing diets (Table 3), there was no discernable pattern in mean ruminal fluid pH. However, ruminal NH_3N and molar proportions of acetate decreased ($P<.05$) and propionate increased ($P<.05$) with increasing CCDS level when averaged across sampling times.

CCDS used in this study was an effective protein and energy source in a 40% concentrate growing diet. When replacing soybean meal, molasses and corn, CCDS apparently results in similar gain, lower intake, and a trend toward improved feed efficiency. Based on performance, maximum inclusion rate of CCDS is at least 20% of DM in a dry rolled corn-hay based growing diet.

Table 2. Performance data

Item	MSBM	5CCDS	10CCDS	20CCDS	SIL
DMI, lb/day	16.67[a]	15.94[ab]	15.08[bc]	15.06[bc]	13.89[c]
CPI, lb/day	1.79	1.70	1.59	1.57	1.61
ADG, lb/day	2.09[d]	2.14[d]	2.03[d]	2.09[d]	2.38[e]
F/G	7.94[d]	7.52[d]	7.46[d]	7.25[d]	5.81[e]

[a,b,c]P<.05; [d,e]P<.01.

Table 3. Rumen fermentation data[a]

Item	MSBM	5CCDS	10CCDS	20CCDS	SIL
pH	6.68[de]	6.74[de]	6.62[ef]	6.81[d]	6.54[f]
NH_3N[b]	4.99[e]	3.80[e]	4.71[e]	2.26[d]	4.06[e]
Acetate[c]	64.87[e]	64.20[e]	61.97[d]	61.17[d]	63.61[e]
Propionate[c]	21.22[de]	20.87[d]	21.59[de]	24.15[f]	22.35[e]
Butyrate[c]	10.76[d]	11.55[d]	13.00[e]	11.70[d]	10.74[d]

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