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Abstract

Previous research has shown that finishing cattle fed Enogen Feed corn are able to utilize more starch from the corn grain. It is not known if the same response will occur in growing cattle. In order to determine the growing calf response, seven ruminally cannulated Holstein steers were fed four diets consisting of two varieties of corn (Enogen vs. yellow) and two methods of corn processing (dry-rolled vs. whole-corn). The study consisted of four consecutive 15-day periods. There were 10 days for adaptation to diet changes, fecal samples were collected on days 11 through 14, and ruminal fluid was sampled on day 15. Overall, total tract ruminal organic matter and dry matter digestibility improved by 8% and 9%, respectively, when feeding Enogen Feed corn. Digestibility parameters reveal that feeding whole Enogen Feed corn results in equal or improved digestion as opposed to feeding dry-rolled corn from either corn source.

Introduction

Recent studies conducted to evaluate the alpha amylase enzyme expression trait in Enogen Feed corn (Syngenta) found improvements in feed efficiency of growing and finishing cattle when fed wet corn gluten feed or wet distillers grains. Metabolism work with finishing cattle has shown that cattle fed Enogen Feed corn are able to utilize more starch from the corn grain, thus providing more available energy for gain. The objectives of this study were to evaluate digestibility parameters of growing cattle when fed Enogen Feed corn.

Experimental Procedures

Seven ruminally cannulated Holstein steers (body weight = 437 ± 22 lb) were used in an incomplete 4×4 Latin rectangle design to determine diet digestibility and digestion characteristics. The study consisted of four consecutive 15-day periods. There were 10 days for adaptation to diet changes, fecal samples were collected on d 11 through d 14, and ruminal fluid was sampled on d 15. The four experimental diets were formulated to provide 51 Mcal net energy for gain/100 lb dry matter and included two varieties of corn, Enogen versus yellow; and two methods of corn processing, dry-rolled

¹ Eileen D. Watson, Syngenta Crop Protection, LLC.

versus whole-corn. Animals were housed in individual outdoor pens with ad libitum access to water. Steers were fed their respective diets once daily at approximately 1000 hours to ensure ad libitum intakes. Total mixed ration samples were collected on days 10 through 14 and composited for each period for analysis. On days 4 through 14, 10 g chromium (III) oxide was top-dressed and hand mixed into each animal's ration as a marker to calculate digestibility. Refusals were collected on days 11 through 15 and composited for each animal for each period. Fecal samples were also collected on days 11 through 14, taken from the rectum of the steers every 8 hours with the sampling time increasing by 2 hours each day so that every 2-hour interval after feeding was represented over 24 hours. On day 15 of each period, ruminal fluid samples were sampled at four different locations in the rumen at 0, 2, 4, 6, 8, 12, 18, and 24 hours after feeding. Following the 0 hour sampling, 3 g of cobalt-ethylenediamine tetraacetic acid (0.4 g cobalt) dissolved in 200 mL of deionized water, was dosed into the rumen to determine liquid passage rate.

Results and Discussion

There was no effect for corn processing other than a small tendency for pH to be lower for dry-rolled corn ($P < 0.15$). Liquid passage rate was higher for yellow corn-fed calves ($P < 0.01$), which explains the tendency for dry matter intake to be highest for yellow/dry-rolled corn ($P < 0.11$). Total tract ruminal organic matter and dry matter digestibility were higher for Enogen-fed calves ($P < 0.04$). Ruminal acetate concentration was lower for Enogen-fed calves ($P < 0.05$) and as a percent of total volatile fatty acids, valerate tended to increase for Enogen treatments ($P < 0.10$). A tendency was observed for total volatile fatty acids to be greatest for yellow/dry-rolled corn and Enogen/whole-corn ($P < 0.14$). There was also a tendency for ruminal acetate concentration to be least for Enogen/dry-rolled corn and greatest for yellow/dry-rolled corn ($P < 0.06$). A corn $\times$ processing interaction revealed a tendency for Enogen/dry-rolled corn to have the highest percent isobutyrate ($P < 0.07$) and valerate ($P < 0.09$) and for yellow/dry-rolled corn to have the least. Overall, total tract ruminal organic matter and dry matter digestibility improved by 8% and 9%, respectively, when feeding Enogen Feed corn. Digestibility parameters reveal that feeding Enogen/whole-corn results in equal or improved digestion as opposed to feeding dry-rolled corn. For growing calves, processing Enogen corn might not be necessary to improve digestion.

Implications

When fed in an ad libitum fashion to growing steers, Enogen Feed corn improves total tract ruminal organic matter and dry matter digestibility by 8% and 9%, respectively. There were no negative observations regarding cattle health or behavior with the feeding of Enogen Feed corn. Based on the results of this study, dry matter and organic matter of Enogen Feed corn are digested to a greater extent, thereby improving feed efficiency in growing calves.

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Table 1. Experimental diets

Ingredient	Dry matter %
Corn (variety × processing) ¹	28.57
Supplement	6.43
Alfalfa hay	17.50
Prairie hay	17.50
Wet distillers grains	30.00
Total	100.00

Composition	100% Dry matter basis
Dry matter, %	60.30
Protein, %	16.08
Calcium, %	0.85
Phosphorus, %	0.41
Salt, %	0.32
Potassium, %	1.09
Magnesium, %	0.22
Fat, %	4.72
Acid detergent fiber, %	20.59
Net energy for maintenance, Mcal/100 lb	78.81
Net energy for gain, Mcal/100 lb	51.13

¹Corn type: Enogen Feed (Syngenta) corn versus yellow; and fed as either whole-corn or dry-rolled.

Table 2. Effects of Enogen Feed corn and processing on digestibility and ruminal characteristics

Item	Corn source				Standard error of the mean ²	<i>P</i> -value		
	Enogen ¹		Yellow			Process	Source	Process × source
	Corn process							
	Dry- rolled	Whole	Dry- rolled	Whole				
Number of observations	6	7	7	7				
Dry matter intake, lb/day	17.09	17.95	18.10	16.93	0.43	0.80	0.99	0.11
Ruminal								
pH ³	5.84	5.87	5.81	5.93	0.06	0.15	0.82	0.37
Ammonia, mM ³	3.63	2.80	2.79	2.38	0.73	0.32	0.30	0.73
Total volatile fatty acids, mM ³	102.1	109.5	109.4	107.0	5.27	0.45	0.45	0.14
Acetate, mM ³	60.6	65.8	66.6	65.9	3.01	0.16	0.05	0.06
Propionate, mM ³	26.3	28.9	28.1	26.7	2.68	0.73	0.90	0.29
Butyrate, mM ³	10.9	10.4	10.6	10.2	0.72	0.28	0.52	0.86
Isobutyrate, mM ³	1.40	1.41	1.31	1.47	0.12	0.29	0.82	0.38
Valerate, mM ³	1.77	1.64	1.57	1.59	0.15	0.64	0.28	0.48
Isovalerate, mM ³	1.15	1.17	1.19	1.21	0.14	0.82	0.68	0.97
Liquid passage rate, %/hour ⁴	7.43	8.38	9.52	8.84	0.67	0.77	0.01	0.09
Digestibility, % (total tract)								
Dry matter	62.05	63.17	58.41	56.21	2.53	0.83	0.04	0.50
Organic matter	64.84	66.02	61.51	59.28	2.45	0.82	0.04	0.46
Neutral detergent fiber	51.52	53.51	51.14	46.96	4.18	0.79	0.41	0.46
Acid detergent fiber	50.01	54.52	48.49	42.05	5.20	0.85	0.17	0.28
Starch	86.43	90.43	84.66	85.14	2.90	0.37	0.16	0.47
Ruminal volatile fatty acids, % of total								
Acetate ⁵	60.8	60.3	62.0	61.4	1.33	0.68	0.34	0.95
Propionate ⁵	24.4	26.4	24.5	25.1	1.38	0.33	0.65	0.60
Butyrate ⁵	10.6	9.50	9.66	9.51	0.60	0.24	0.41	0.36
Isobutyrate ⁵	1.40	1.30	1.22	1.38	0.07	0.62	0.47	0.07
Valerate ⁵	1.69	1.44	1.42	1.45	0.09	0.18	0.10	0.09
Isovalerate ⁵	1.17	1.06	1.11	1.13	0.12	0.65	0.99	0.52

¹Enogen Feed corn, Syngenta.²Largest value among treatments reported.³Average of values collected at 0, 2, 4, 6, 8, 12, 18, and 24 hours after feeding.⁴Calculated values from samples collected at 2, 4, 6, 8, 12, and 18 hours after feeding.⁵Average of values collected at 0, 2, 4, 6, 8, 12, 18, and 24 hours after feeding expressed as a percentage of total volatile fatty acids.