Methane Fermenter Residue or Decoquinate for Feedlot Steers

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Story in Brief

Ninety-six steers (578 lb initially) were divided into 12 pens and fed a steam flaked corn-corn silage diet containing 0 or 6 percent residue from a methane generation plant for 153 days. Half of the cattle received Decoquinate (0.5 mg/kg body weight) for the first 29 days of the trial. Monensin and Tylosin were included in the diet from day 30 until cattle were slaughtered. Overall, rate of gain was not altered by either methane fermenter residue or Decoquinate, but feed intake was increased by about 3 percent with either material. This decreased efficiency of feed use by about 3 percent.

For the first 57 days of the test, cattle receiving Decoquinate consumed slightly more feed (16.1 vs 15.1) and tended to gain slightly more rapidly (3.12 vs 2.89), but by the end of the 153-day test, this advantage had disappeared. Monensin, which was fed at 26 g per ton of dry matter, may have replaced the need for a coccidiostat.

Cal-II, a by-product of methane production from feedlot manure, replaced portions of the corn and dehydrated alfalfa of the control diet to form a test diet containing 6 percent Cal-II. Rate of gain of cattle fed the control and Cal-III diets were similar (2.89 vs 2.87 lb per day), but feed efficiency favored the control diet (5.93 vs 6.12 lb of feed per lb of gain). This indicates that the available energy content of the Cal-II did not equal that of the mixture of corn and dehydrated alfalfa it replaced. Based on feed intake and performance of steers, the added methane fermenter residue had a metabolizable energy value of 0.6 to 1.2 mcal/kg for an NE_m of 27 to 36 mcal per hundred lb and an NE_g of -69 to -23 mcal per hundred lb. The large variation in these estimates is due to the low level of Cal-II used in the diet.

Introduction

Some groups of newly arrived stressed cattle may respond to treatment with a drug to control coccidiosis (Rust et al., 1981). Decoquinate is approved as a coccidiostat for cattle. While ionophores such as monensin are effective coccidiostats (Horton and Brandt, 1981), they are frequently either not fed during the receiving period, since they suppress feed intake, or they are included in the diet at a level too low to be effective. The degree of reduction in animal performance during and after coccidial infections may be considerable.

Production of methane from feedlot waste yields a by-product which may be an economical ingredient for feedlot cattle. Cal-II is the trade name for the byproduct of a methane generation plant in Oklahoma. This byproduct con-

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tains over 15 percent protein and is high in calcium, potassium, phosphorus and salt. Routine chemical analysis suggests that it could substitute for dehydrated alfalfa in supplements for cattle through digestibilities of protein and dry matter appeared low in one earlier trial (Zinn et al, 1979). The objective of this trial was to establish the value of this product at low levels in a feeding trial with finishing steers.

Experimental Procedures

Ninety-six yearling steers (578 lb) were assembled by a cattle dealer in the Southeast U.S. and shipped to Goodwell, OK in September 1981 for feeding. Cattle were processed following normal processing procedures (OSU RP-9104)and randomly assigned to one of 12 pens. Six pens selected at random received Cal-II supplement, while 6 pens received the control supplement. Three of each of these pens also received Decoquinate in their supplement for the first 29 days of the trial. Experimental diets are presented in Table 1. Cattle received ration 1 for 11 days, ration 2 for the next 18 days and ration 3 thereafter. Feed intake was very low for the first few days of the trial so that a high percentage of the total ration was supplement. On day 29, cattle were switched to the lower roughage diet and Decoquinate was removed from the diet. Monensin and Tylosin were added after day 29 at rates of 26 and 8.38 grams per ton of dry matter, respectively. Rations were formulated to provide similar amounts of protein and calcium with Cal-II displacing both corn and alfalfa meal in the diet.

To ensure precise control of the administration of decoquinate, a fixed amount of supplement was fed each day for the first 11 days. Subsequently, diets were mixed on a percentage basis. During the first 11 days, cattle receiv-

Table 1. Ingredient composition of experimental diets.

Ration Number	1		2		3	
Item	Cal-II	Cont	Cal-II	Cont	Cal-II	Cont
Corn Silage	37.00	37.00	24.00	24.00	11.00	11.00
S.F. Corn	46.94	50.15	62.10	64.90	79.65	81.51
Cal-II	9.00	— —	7.79	— —	6.00	— —
De Hy Alfa.	— —	3.83	— —	3.31	— —	3.00
Cotton Meal	5.66	6.51	4.89	5.62	1.54	1.19
Meat Meal	— —	.50	— —	.43	— —	.40
Limestone	.35	.64	.30	.55	.84	1.00
Dical. Phos.	— —	.33	— —	.28	.09	.31
Urea	.19	.19	.16	.16	.47	.47
KCL	.42	.37	.36	.32	.26	.21
Amon. Sulf.	.17	.17	.15	.15	.17	.17
Salt	.25	.29	.22	.25	.28	.33
Misc.[a]	.02	.02	.03	.03	.05	.06

[a]Contains; all rations, vitamin A; rations 1 & 2 had either Decoquinate or none; ration 3 Monensin 26 grams per ton and Tylosin 8.38 grams per ton of dry matter.

ing the Cal-II supplement were fed 2.5 lb of supplement per day while control cattle were fed 1.77 lb. These amounts differ because the pelleted supplement carried the Cal-II.

Fecal samples were obtained from seven of the cattle on arrival for examination for internal parasites using both direct and flotation methods. The direct technique involved visually examining the feces for blood and mucus. Blood and mucus flecks were smeared onto glass slides with 1 N saline and examined at 400 X for parasitic oocysts. Only samples with blood and mucus flecks were examined using the direct technique. The flotation technique was conducted by mixing one to two grams of feces with 7 ml of concentrated sugar solution and placing a glass slide on top of the mixture. The solution was allowed to maintain contact with the slide for 30 minutes after which the slide was examined for coccidia oocysts at 400X.

Cattle were weighed full at 28-day intervals and fed a total of 153 days. For slaughter, cattle were trucked 50 miles to Liberal, KS and carcass data were obtained. Final shrunk weights were calculated by dividing the hot carcass weight by .62. Live weights, with the exception of the initial weight, were gross weights although all daily gains and feed efficiencies were expressed using gross weights less 5 percent, an estimate of live weight loss due to shrinkage.

Results and Discussion

Rate of weight gain was not significantly altered by the coccidiostat or Cal-II feeding (Table 2). Effects of treatments on carcass measurements are shown in Table 3. Marbling score and federal grade tended to be lower for the steers fed Cal-II. The high incidence of flukes may have reduced overall performance, but appeared equally distributed among treatments.

Per pound of weight gain, more feed was required for steers fed the Cal-II diet than for steers fed the control diet. This indicates that the Cal-II had an available energy value lower than the feed ingredients which it replaced in the control diet. To calculate the energy value for Cal-II, several different methods can be used. The first involves calculating the amount of feed required per unit of weight gain with the two diets as shown in Table 4. This comparison suggests that 38 kg of Cal-II plus 5 kg of corn, 1 kg of corn silage and 1 kg of cottonseed meal provided an amount of energy equal to 18 kg of alfalfa meal plus 2 kg meat meal. Using the metabolizable energy (ME) value of the other feeds as listed by the NRC (1976) tables, one can calcuate the ME value of Cal-II. The value by this calculation was .65 mcal/kg which is equal to a NE for maintenance of 27 mcal/100 lb and a NE for gain of minus 69 mcal/100 lb of dry Cal-II. This estimate has a standard deviation of 61 percent indicating the probable range of ME is .25 to 1.06 mcal/kg. This is equal to an NE for maintenance of 22 to 33 and an NE for gain of -112 to -35 mcal/cwt.

Similar calculations may be made using efficiency of gain on a liveweight basis. The calculated ME value is slightly higher than that estimated based on carcass weight giving NE values of 30 and -52 mcal/cwt for maintenance and gain respectively. This value has a standard deviation of 49 percent giving a probably range of ME of .43 to 1.27 mcal/kg for NE range estimates of 24 to 37 and -92 to -20 mcal/cwt for maintenance and gain, respectively.

Another method of estimating the value of Cal-II is based on calculating ME of both diets based on feed intake and cattle performance (Owens & Gills,

Table 2. Steer Performance

Weights	Cal-II	Control	Decox[a]	Control
Initial	577	579	583	572
29 Days	678	678	587	567
57 Days	784	792	801	776
85 Days	880	884	894	870
113 Days	968	973	980	961
153 Days	1058	1062	1068	1052
Adjusted	1016	1020	1023	1014
Daily Gain				
0-57 Days	2.95	3.05	3.12	2.98
58-153 Days	2.71	2.67	2.64	2.74
0-153 Live	2.80	2.81	2.82	2.79
0-153 Adj.	2.87	2.89	2.87	2.89
Daily Feed				
0-57 Days	15.5	15.7	16.1	15.1
58-153 Days	18.8	18.0	18.5	18.2
0-153 Live	17.6	17.1	17.6	17.0
0-153 Adj.	17.6	17.1	17.6	17.0
+ Weighback	17.9	17.4	17.9	17.4
Feed / Gain				
0-57 Days	5.25	5.16	5.16	5.25
58-153 Days	6.94	6.76	7.02	6.67
0-153 Live	6.27	6.10	6.25	6.11
0-153 Adj.	6.12	5.93	6.14[b]	5.91[c]
Met. Energy				
Adjusted Wts.	2.93[c]	2.99[b]	2.94	2.99

[a]Decoquinate
[bc]Means in a row with different superscript differ statistically ($P<.10$).

1980). The ME of replaced feeds is then deducted from the ME of the control ration (Table 5). The difference between the control and test diet remaining is due to the test ingredient, Cal-II. Since this is present at 6.29 percent of the ration, the difference is all attributable to this fraction. Using this method of calculation, the ME of Cal-II in this trial was 1.22 mcal/kg. This equates to a NE for maintenance of 36 mcal/cwt and a NE for gain of negative 23 mcal/100 lb of dry Cal-II. This estimate has a standard deviation of 51 percent for a ME range of .59 to 1.84 mcal/kg dry matter which gives probability ranges in NE of 26 to 49 and -76 to +14 mcal/cwt for maintenance and gain, respectively.

By all calculations the available energy content of Cal-II is below that of low quality forages and is near that expected for a feed with a dry matter digestibility of 30 percent as reported previously for methane fermenter residue (Zinn et al, 1979). A report from Florida (Harris et al, 1981) also suggested that residue remaining from cattle waste after methane production was very low. In this trial, the accuracy of these estimates is limited by the level of Cal-II which was included in the diet.

Table 3. Carcass Measurements

	Cal-II		Deccox[1]	
	Present	Absent	Present	Absent
Carcass Weight Lbs.	630	633	629	634
Dressing Percent	59.5	59.6	59.7	59.4
Fluke Incidence %	29.2	29.2	22.9	35.4
Rib Eye Area				
Sq. Inches	11.3	11.4	11.4	11.3
Sq. In. / Cwt.	1.80	1.81	1.81	1.80
Fat Thickness, in	.44	.51	.47	.48
KHP, %	2.60	2.59	2.49[a]	2.70[b]
Cutability, %	50.1	49.7	50.0	49.8
Federal Grade	12.2	12.6	12.3	12.5
Marbling score	12.6[d]	13.7[c]	13.0	13.3

[1]Decoquinate
[ab]P<.05
[cd]P<.10
[e]Closely trimmed lead cuts.
[f]Good plus = 12; Choice minus = 13.
[g]Slight plus = 12; Small minus = 13.

Table 4. Energy calculations, model 1. Feed required per 100 kg gain (adjusted weights)

	Diet		Difference	Feed ME	Difference
	Control	Cal-II	kg	mcal/kg	in ME, mcal
Total	593	612			
Corn, SF	465.0	469.6	+ 4.6	3.29	+ 15.13
Corn silage	79.9	80.9	+ 1.0	2.53	+ 2.53
Dehy alfalfa	18.2	0	− 18.2	2.24	- 40.77
Cal-II	0	38.5	+ 38.5	x	+ 38.5x
Cottonseed meal	11.2	12.4	+ 1.2	3.29	+ 3.95
Meat meal	2.4	0	− 2.4	2.54	- 6.10

$38.5x - 25.26 = 0$
x = ME of Cal-II = .656 mcal/kg.
NE_m = .59 kcal/g = 27 mcal/100 lb.
NE_g = -1.53 kcal/g = -69 mcal/100 lb.

The initial gain response of steers to Decoquinate diminished as the feeding trail progressed. This may have been due to anticoccidial action of monensin which was present in the ration after the first 29 days on feed. Initial examination of fecal material revealed that three of the seven samples contained mucus flecks though no coccidial oocysts were detected by either examination method. The correlation between subclinical coccidiosis and fecal egg count has been suggested to be poor. Additional investigation is needed to develop techniques to determine the degree of coccidial infection and to predict the response of stressed cattle to anticoccidial therapy.

Table 5. Energy calculations, model 2. ME of rations, calculated from feed intake and gain.

	Diet differences, %	Feed ME, kcal/g	Diet ME
Corn, SF	+1.69	3.29	+.056
Corn silage	+ .26	2.53	+.007
Dehy alfalfa	+3.07	2.24	+.069
Cotton meal	− .14	3.29	− .005
Meat meal	+ .41	2.54	+.010
Total			.126

Control diet ME = 2.99
Control diet minus ME of above feeds = 2.853
Cal-II diet ME = 2.93
Difference due to Cal-II = 2.93 - 2.853 = 0.077 mcal/kg

$$\text{ME of Cal-II} = \frac{0.077\text{ mcal}}{.0629\text{ kg}} = 1.22\text{ mcal /kg}$$

NE_m = .79 kcal/g = 36 mcal/100 lb.
NE_g = -.51 kcal/g = -23 mcal/100 lb.

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