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Effect of *DiaFil* (Diatomaceous Earth) Fed With or Without Rumensin® and Tylan®, on Performance, Internal Parasite and Coccidiosis Control in Finishing Cattle

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Effect of *DiaFil* (Diatomaceous Earth) Fed With or Without Rumensin® and Tylan®, on Performance, Internal Parasite and Coccidiosis Control in Finishing Cattle

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The addition of 3% diatomaceous earth, *DiaFil*, reduced dietary energy concentration of corn-based finishing diets.

Summary

One hundred seventy-nine steers were used in a 2 × 2 factorial experiment to determine if DiaFil, *diatomaceous earth, enhances finishing performance. Treatments were: control; 3%* DiaFil*; Rumensin® and Tylan® (**R/T**) fed at 25 and 10 g/ton, respectively; or* DiaFil + *R/T (DM basis). Feeding* DiaFil *alone reduced daily gain compared with control and* DiaFil+ *R/T, while gain of steers fed R/T was intermediate. Compared with control, efficiency was reduced 8% when steers were fed* DiaFil *alone. Steers fed R/T or* DiaFil+*R/T were 9% more efficient than those fed* DiaFil *alone. The addition of* DiaFil *alone reduces dietary energy concentration.*

Introduction

DiaFil, diatomaceous silica (CR Minerals Corporation), is thought to have potential benefits as a feed ingredient and/or additive for finishing cattle based on field observations. It has been suggested that inclusion of diatomaceous silica, also referred to as diatomite, into the ration enhances health status and increases weight gain. Diatomite can be used in the human food industries as anti-caking agents and as a mild abrasive in toothpaste. *DiaFil* is comprised of skeletal remains of single-cell aquatic plants consisting of a single size and shape known as *Melosira*, and contains less than .1% crystalline silica. Although informal reports are available, the effect of feeding *DiaFil* to finishing cattle has not been investigated in a controlled research setting. Rumensin®/Tylan® is a feed additive combination widely used in the feedlot industry for improved feed efficiency and control of liver abscesses and coccidiosis. Diatomaceous silica is known to kill insects, but its effects on internal parasites and coccidiosis have not been reported.

The objectives of this experiment were to evaluate the effects of *DiaFil* on performance and carcass characteristics of feedlot cattle fed a corn-based finishing diet with or without Rumensin/Tylan, and determine the effects of *DiaFil* on internal parasites and coccidiosis.

Procedure

One hundred seventy-nine yearling steers (838 lb) were stratified by weight to one of four treatments in a completely randomized design with a 2 × 2 factorial arrangement of treatments (4 pens per treatment, 11 or 12 steers per pen). Dietary treatments were: control (no *DiaFil* or Rumensin/Tylan); *DiaFil* fed at 3% of the dietary DM; Rumensin and Tylan (**R/T**) fed at 25 and 10 grams/ton of diet DM, respectively; or *DiaFil* and R/T fed in combination. Finishing diets

Table 1. Composition of experimental diets (100% dry matter basis).

Ingredients	Dietary Treatments[a]			
	Control	*DiaFil*	R/T	*DiaFil*+R/T
High-moisture corn	51.6	49.8	51.6	49.8
Dry-rolled corn	34.4	33.2	34.4	33.2
Corn silage	4.5	4.5	4.5	4.5
Alfalfa hay	4.5	4.5	4.5	4.5
DiaFil	—	3.0	—	3.0
Supplement	5.0	5.0	5.0	5.0
Supplement composition				
Fine ground corn	19.4	19.4	18.8	18.8
Limestone	31.9	31.9	31.9	31.9
Urea	26.3	26.3	26.3	26.3
Potassium chloride	8.2	8.2	8.2	8.2
Sodium chloride	6.0	6.0	6.0	6.0
Ammonium chloride	5.0	5.0	5.0	5.0
Tallow	2.0	2.0	2.0	2.0
Trace mineral premix	1.0	1.0	1.0	1.0
Vitamin premix	.2	.2	.2	.2
Rumensin-80	—	—	.3	.3
Tylan-40	—	—	.3	.3

[a]Control=no *DiaFil* (diatomaceous earth) or Rumensin and Tylan; R/T=25 and 10 g/t Rumensin and Tylan, respectively.

Table 2. Effect of *DiaFil* with or without Rumensin/Tylan on performance of feedlot steers fed corn-based finishing diets.

Ingredients	Dietary Treatments[a]				SEM[c]	Contrasts[b]		
	Control	*DiaFil*	R/T	*DiaFil*+R/T		*DiaFil*	R/T	Dia×R/T
Initial wt. lb	840	840	839	834	3.1			
Final wt.[d], lb	1213	1189	1203	1220	8.2			
DM intake, lb/d	22.4	22.7	21.9	23.0	.3	.11	.41	.13
Daily gain, lb	3.19[f]	2.98[g]	3.11[fg]	3.30[f]	.08	.86	.14	.02
Feed efficiency[e]	7.12[f]	7.66[g]	7.05[f]	6.99[f]	.11	.05	.01	.02

[a]Control=no *DiaFil* (diatomaceous earth) or Rumensin and Tylan; R/T=25 and 10 g/t Rumensin and Tylan, respectively.
[b]*DiaFil*=main effect of *DiaFil*; R/T=main effect of Rumensin and Tylan; Dia×R/T=interaction of DiaFil and Rumensin/Tylan.
[c]SEM=standard error of the mean.
[d]Calculated as hot carcass weight divided by .63.
[e]Analyzed as daily gain/DM intake and reported as DM intake/daily gain.
[f,g]Means in the same row not bearing a common superscript differ (P < .10).

were based on dry-rolled and high-moisture corn (60:40 combination), and contained similar proportions of corn silage, alfalfa hay, and supplement (Table 1). *DiaFil* replaced equal proportions of dry-rolled and high-moisture corn when added to the diet. Steers were adapted to finishing diets using transition diets consisting of 45, 35, 25 and 15% alfalfa hay (DM basis) fed for 3, 4, 7 and 7 days, respectively. *DiaFil* and Rumensin/Tylan were fed during the transition diets, and steers were fed for 117 days. Steers were implanted with Synovex® Plus™ on day 1, and were not treated for any internal parasites. Steers were weighed initially on two consecutive days after being limit-fed the first transition diet at 2% of body weight (DM basis) for five days to minimize gut fill differences. Final weights were calculated based on hot carcass weight adjusted to a common 63% dressing percentage. Hot carcass weight and liver abscess scores were taken at slaughter, and following a 24-hour chill, 12th rib fat depth, USDA quality grade, and yield grade were recorded. USDA quality grade and yield grade were determined by a USDA grader.

Fecal samples were taken on days 1 and 28 from all steers to determine internal parasite and coccidia prevalence. Fecal grab samples were sent to a separate laboratory for egg counts and oocyte analysis.

Performance and carcass data were analyzed as a completely randomized design with a 2×2 factorial arrangement of treatments using the General Liner Model of SAS. Pen was the experimental unit. Main effects of *DiaFil* and Rumensin/Tylan and the interaction of *DiaFil* and Rumensin/Tylan were included in the model. Main effects and interactions were considered significant when P < .05. If an interaction was significant, treatment effects were separated using a t-test with P < .10. Incidence of liver abscesses and the presence of internal parasites and coccidia were analyzed using the frequency distribution of SAS.

Results

Results of feedlot performance are presented in Table 2. No differences in dry matter intake were observed between treatments. Interactions between *DiaFil* and Rumensin/Tylan addition to the diet were observed (P < .05) for daily gain and feed efficiency; therefore, treatment rather than main effect means are reported. Daily gain was lower (P < .10) for steers fed the finishing diet containing only *DiaFil* compared with those fed the control diet or the diet containing both *DiaFil* and Rumensin/Tylan. Daily gains were similar when steers were fed diets containing only *DiaFil* or Rumensin/Tylan. Steers fed *DiaFil* alone were 8% (P < .10) less efficient compared with the control, Rumensin/Tylan, or *DiaFil*+Rumensin/Tylan diets. Feed efficiency was similar between steers fed the control, Rumensin/Tylan, and *DiaFil*+Rumensin/Tylan diets.

An interaction (P < .05) was observed for hot carcass weight similar to that for daily gain (Table 3). Steers fed the control or *DiaFil*+Rumensin/Tylan diets had heavier (P < .10) carcass weights compared with those fed *DiaFil* alone. Hot carcass weights were similar for steers fed *DiaFil* or Rumensin/Tylan alone. Twelfth rib fat thickness, yield grade, marbling score, percentage of carcasses grading USDA Choice, and the percentage of liver abscesses were similar among treatments. Additionally, distributions of yield grades and liver abscesses by

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Table 3. Effect of *DiaFil* with or without Rumensin/Tylan on carcass characteristics of feedlot steers fed corn-based finishing diets.

	Dietary Treatments[a]					Contrasts[b]		
Ingredients	Control	*DiaFil*	R/T	*DiaFil*+R/T	SEM[c]	*DiaFil*	R/T	DiaxR/T
Carcass weight lb	764[g]	749[h]	758[gh]	769[g]	5.2	.66	.23	.03
12th rib fat, in.	.42	.38	.38	.4	.02	.72	.83	.12
Yield grade	2.18	2.04	2.06	2.16	.08	.82	.98	.18
Yield grade distribution, %								
1	11.1	13.3	17.8	14.0				
2	60.0	68.9	57.8	55.8				
3	28.9	17.8	24.4	30.2				
Marbling score[d]	4.89	4.78	4.72	4.89	.08	.63	.75	.10
USDA Choice[e], %	42.2	37.8	33.3	43.2				
Liver abscesses[f], %	17.8	17.8	15.6	9.1				
Liver abscess distribution by severity, %								
Mild (A-)	6.8	2.3	9.0	4.6				
Moderate (A)	4.4	8.9	0	2.3				
Severe (A+)	4.4	2.2	4.4	0				
Adhered (B)	2.2	4.4	2.2	2.2				

[a]Control=no *DiaFil* (diatomaceous earth) or Rumensin and Tylan; R/T=25 and 10 g/t Rumensin and Tylan, respectively.
[b]*DiaFil*=main effect of *DiaFil*; R/T=main effect of Rumensin and Tylan; DiaxR/T=interaction of *DiaFil* and Rumensin/Tylan.
[c]SEM=standard error of the mean.
[d]4.0=Slight 0; 4.5=Slight 50; 5.0=Small 0, etc.
[e]Chi square statistic (P = .76).
[f]Chi square statistic (P = .62).
[g,h]Means in the same row not bearing a common superscript differ (P < .10).

Table 4. Effect of *DiaFil* with or without Rumensin/Tylan on carcass characteristics of feedlot steers fed corn-based finishing diets.

	Dietary Treatments[a]				
Ingredients	Control	*DiaFil*	R/T	*DiaFil*+R/T	P-value[b]
Percentage of steers with parasitic eggs present in the feces					
Day 0	11.1	20.0	13.6	13.6	.65
Day 28	0	2.2	0	0	.39
Percentage of steers with coccidia present in the feces					
Day 0	17.8	26.7	20.5	13.3	.45
Day 28	2.2	6.7	0	0	.11

[a]Control=no *DiaFil* (diatomaceous earth) or Rumensin and Tylan; R/T=25 and 10 g/t Rumensin and Tylan, respectively.
[b]Probability of the Chi square statistic.

severity were similar among treatments.

Averaged across treatments, 16% of the steers used in this experiment had parasitic eggs present in the feces on day 0 (Table 4). Following 28 days on feed, parasitic eggs were for the most part undetectable across treatments. Only 2.2% of the steers fed *DiaFil* alone were found to have parasitic eggs present in the feces at day 28. This small and insignificant incidence is most likely a function of these steers having the highest concentration of parasitic eggs on day 0. The higher numerical count of fecal egg counts at the beginning of the experiment is merely due to random chance since the cattle were allotted to treatments based on weight alone. Averaged across treatments, 20% of the steers used in this experiment had coccidia in the feces on day 0. By the conclusion of 28 days on feed, those steers fed diets containing Rumensin/Tylan had no detectable coccidia, whereas those steers fed the control diet or *DiaFil* alone did have detectable levels of coccidia present in the feces (2.2 and 6.7%, respectively). Although coccidia were present in all treatments on day 0 and a portion of the steers had coccidia in the feces on day 28, no clinical signs of coccidiosis were observed for any steer during the experimental period.

Although interactions between *DiaFil* and the combination of Rumensin/Tylan were observed for animal performance, feeding *DiaFil* alone does not appear to enhance performance of finishing cattle when compared to diets without the feed additives evaluated in this experiment. Based on the response observed in feed efficiency, steers fed diets containing *DiaFil* alone were 8% less efficient than those fed the control diet. Additionally, steers fed Rumensin and Tylan were 9% more efficient than those fed *DiaFil*. This would suggest that replacing 3% of the corn in a finishing diet with *DiaFil* decreased the energy concentration of the diet. Therefore, any benefit from *DiaFil* inclusion must be large enough to overcome this reduction in dietary energy concentration.

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