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Role of Supplement Form For Finishing Yearling Steers

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ROLE OF SUPPLEMENT FORM FOR FINISHING YEARLING STEERS

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Summary

The impact of liquid, meal, and pelleted supplements on feedlot performance and liver abscesses was evaluated in yearling steers. Steers were fed 90% concentrate diets and test supplement sources for 105 days. The control diet included all supplemental feed ingredients in pelleted form. Four other diets included a liquid supplement that contained supplemental vitamins, minerals, and monensin and a dry supplement providing protein and tylosin all equal to the control. The protein-tylosin component was fed in meal or pelleted form. Overall, steers fed liquid supplements outperformed steers fed dry pelleted supplements with higher average daily gain ($P=.05$) and dry matter intake ($P<.05$). Interim average daily gain was greater when liquid supplements were fed only through the initial 56 days of the feeding period. Dry matter intake responses occurred in three of the four interim periods. No benefit was noted for pelleting the protein-tylosin mix, except during the initial 28 days. Liver abscesses were higher (17.5% vs 8.8%, $P=.10$) when diets contained no liquid supplement. Results indicate that including liquid supplements may increase uniformity of nutrient and feed additive consumption and thereby enhance cattle performance.

Key Words: Feedlot, Beef, Supplement

Introduction

Many of the most expensive components of feedlot diets are added at parts per million rates. We formulate the diets assuming uniform dispersion and consumption of these micro-ingredients and tend to blame poor responses on failure of the ingredient. In practical situations, it seems equally plausible that failure of the ration mix is to blame. Identifying the source and extent of mix uniformity problems may help us to reduce inefficiencies in the feedlot.

Bunk sampling is not a good method for quantifying mix and consumption uniformity. Gross mixing errors are detectible, but variation due to cattle sorting and sifting through the feed cannot be discerned. Tylosin[2] is a micro-ingredient effective in the control of liver abscesses. We postulated that diet mixes that provided for consistent consumption of tylosin would be detectable as reducing liver abscesses. The following experiment outlines how various diet supplementation methods affected feedlot performance and liver abscess frequency in yearling steers.

Materials and Methods

Yearling steers were used to determine performance responses to various methods of micro-ingredient supplementation for high grain diets. The scheme involved using dry supplements in meal or pelleted forms and liquid supplements that contained 0 or 10% crude fat (Table 1). All dry supplements contained tylosin. Liquid supplements (LS) provided all supplemental vitamins, macro and trace minerals,

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Table 1. Dietary treatments

Diet	Supplementation
Pelleted	All supplemental crude protein and micro-ingredients in pelleted form. No liquid supplement included.
No fat meal	SDSU Custom R540 and soybean meal + tylosin fed in meal form.
Fat meal	SDSU Custom R540 with 10% fat and soybean meal + tylosin fed in meal form.
No fat-pellet	SDSU Custom R540 and soybean meal + tylosin in pelleted form.
Fat-pellet	SDSU Custom R540 with 10% fat and soybean meal + tylosin in pelleted form.

and monensin[3]. When no liquid supplement was fed, all micro-ingredients were included in a complete pelleted supplement.

Steers (237 head) were assembled at the SDSU Research Feedlot between June 6 and June 18, 1992. During the assembly and subsequent receiving period, steers were fed (as fed basis) 10 lb whole shelled corn, 2 lb ground prairie hay, and .8 lb liquid supplement R540[4] per head daily. Initial body weights were determined in the morning before feeding on two consecutive days (July 6 and 7). Each steer was uniquely identified and implanted with Ralgro[5] on the first weigh day. This body weight was used for the allotment process. Allotment included stratifying weight and origin across each treatment and then into five replicate pens of eight head within treatment. Thirty steers were eliminated from the population prior to allotment because of unacceptable body weight. Seven steers were deleted at random during the allotment process to provide the 200 test subjects. When the second initial body weight was determined, steers were vaccinated against IBR, BVD, PI_3, H Somnus[6] and 7 clostridia sp[7] and were treated with the anthelmintic oxfendazole[8]. They were subsequently sorted to test pens and began receiving experimental diets (Table 2).

Initial feed delivery was restricted to 12.5 lb per head (DM basis). The quantity of feed delivered was then increased over time until steers could be fed to appetite (21 days). Feed bunk conditions were noted daily. Feed ingredients were sampled weekly to determine DM, CP, ADF, and ash content. The original hay source was depleted after 35 days and was replaced with oat silage (Table 2).

Interim individual weights were determined in the morning before feeding after 28, 56, 84, 105, and 106 days. Steers were implanted with Synovex-S[9] during the weighing process at 56 days. The consecutive final weights (105 and 106) were averaged and used as the final weight for a 105-day feeding study. The afternoon

[3]Rumensin, Elanco, Indianapolis, IN.
[4]SDSU Custom Mix R540, Farmland Industries, Kansas City, MO.
[5]Pitman-Moore, Terre Haute, IN.
[6]Res Vac-4, SmithKline Beecham, Bristol, TN.
[7]Ultrabac-7, SmithKline Beecham, Bristol, TN.
[8]Synanthic, Syntex Animal Health, Des Moines, IA.
[9]Syntex Animal Health, Des Moines, IA.

Table 2. Diet formulations[ab]

Item	1 to 35 days		36 to 105 days		
	Pelleted	With liquid	Pelleted	With liquid	EMS
Hay	10.000	10.000			
Oat silage			10.000	10.000	
Whole shelled corn	55.222	53.610	41.014	40.208	
High moisture corn	26.805	26.805			
Rolled corn			41.013	40.207	
Soybean meal, 44%	6.000	5.925	6.000	5.925	
Limestone	1.192	.060	1.192	.060	
Dicalcium phosphate	.059		.059		
Potassium chloride	.722		.722		
Liquid supplement		3.6000		3.6000	
Dry matter	84.1	83.3	73.6	73.0	1.28
Crude protein	11.6	11.7	11.8	11.9	.32
Acid detergent fiber	6.9	6.8	5.8	5.7	.62
Neutral detergent fiber	14.9	14.8	12.6	12.5	.70
Ash	4.2	3.9	4.3	4.0	.30

[a]All diets were formulated to contain 10 grams tylosin per ton and 27 grams Monensin per ton.
[b]All values, dry matter basis.

after the final weight determination, the steers were loaded onto semi-trailers and shipped 70 miles to the slaughter plant. Live weight for each treatment group was determined when cattle were unloaded at the packing plant. Mean postfeeding transit shrink was 3.3% for the five treatment groups (range 2.90 to 3.59%). Steers stood overnight with access to water before slaughter. Individual carcass data collected included hot carcass weight, federally assigned Yield and Quality grades, and number of abscessed livers in each treatment group. Carcass data were recovered on 195 of the 200 steers used in the experiment.

Pen mean feedlot performance variables were used in the statistical analysis. All interim weight data were based on full weights. The cumulative 105-day data included shrink on initial weight (2.5%) and final weight (3.5%). Data were analyzed by procedures appropriate for a completely random designed experiment. Main effects of dry vs liquid supplement, meal vs pelleted protein + tylosin, and liquid without fat vs liquid with fat were tested by orthogonal contrast. Carcass traits other than hot carcass weight were tested for heterogeneity by Chi Square analysis.

Results and Discussion

When abruptly starting cattle on high grain diets, much of the variation in feed intake observed during the initial 21 days is dictated by the cattle manager. The difference ($P<.05$) in dry matter intake (DMI) observed through day 28 between dry and liquid supplements is small (<.1%) and represents the difference in DM between dry pelleted and liquid supplements (Table 3).

During this initial 28-day period, average daily gains (ADG) were greater when diets contained LS ($P<.05$) and when protein + tylosin

Table 3. Interim and cumulative feedlot performance of steers fed various forms of supplement

	Supplement treatment					P		
	Pelleted	No fat Meal	Fat Meal	No fat Pellet	Fat Pellet	Pelleted vs others	Meal vs pellet	No fat vs Fat
Initial wt	796	800	797	797	800	NS	NS	NS
1 to 28 Days								
Body wt (28)	955	958	965	971	975	.0051	.0070	.1447
ADG	5.65	5.66	6.01	6.20	6.25	.0151	.0070	.1330
DMI	19.56	19.39	19.37	19.37	19.38	.0001	.1435	NS
F/G	3.47	3.47	3.23	3.13	3.10	.0080	.0089	.1292
29 to 56 Days								
Body wt (56)	1062	1079	1079	1085	1098	.0010	.0315	NS
ADG	3.85	4.31	4.07	4.09	4.41	.0627	NS	NS
DMI	23.29	23.99	23.54	23.75	23.74	NS	NS	NS
F/G	6.06	5.58	5.80	5.90	5.41	.0972	NS	NS
57 to 84 Days								
Body wt (84)	1151	1164	1171	1175	1186	.0538	NS	NS
ADG	3.18	3.04	3.29	3.21	3.12	NS	NS	NS
DMI	23.27	25.58	25.43	24.98	25.44	.0287	NS	NS
F/G	7.33	8.76	7.89	7.79	8.56	NS	NS	NS
85 to 105 Days								
Body wt (105)	1228	1246	1260	1262	1272	.0415	NS	NS
ADG	3.63	3.88	4.23	4.14	4.11	NS	NS	NS
DMI	23.96	25.34	26.04	25.82	25.91	.0411	NS	NS
F/G	6.73	6.87	6.23	6.29	6.35	NS	NS	NS
Cumulative (105 days)*								
ADG	3.89	4.02	4.18	4.20	4.27	.0546	NS	NS
DMI	22.43	23.46	23.43	23.32	23.46	.0333	NS	NS
F/G	5.77	5.86	5.62	5.56	5.51	NS	.1184	NS

NS = P>.15.

* Shrunk BW basis.

was pelleted (P<.01). Feed required/unit gain was lower (P<.01) for these treatments reflecting ADG differences. In subsequent periods feeding a LS continued to cause higher (P<.07) ADG and in most periods caused higher (P<.05) DMI. The only period in which DMI was not increased by feeding LS coincided with a change from dry hay to oat silage as the diet roughage source and a severe heat stress that lasted 3 days. Feeding LS increased cumulative ADG (P=.0544) and cumulative DMI (P<.05) without affecting feed/gain.

When feeding a LS or molasses, we anticipate increases in DMI due to increased palatability of feed. The logic continues that this is advantageous because increasing DMI increases production rates and efficiencies. The increased ADG and lower feed/gain observed during the initial 56 days on feed occurred while there were no appreciable differences in DMI. The uniformity of dispersion of micro-ingredients in the diet may be most critical during the initial feeding period and may have caused this response.

Weekly feed summaries showed that LS increased (P<.05) DMI during the periods when oat silage was fed. These diets were 73% DM. As such, LS would have done little to control dust in the diets and there was litte noticeable evidence of sorting or settling out of diet ingredients. These circumstances preclude the most obvious reasons for enhanced feed intake. Monensin can affect DMI by its dosage and consistency of daily intake. Since efficiencies were not affected by supplement form, the possibility exists that providing monensin in a LS causes an increased uniformity of monensin dispersion in the feed and subsequently more uniform monensin consumption. Erratic monensin intake would decrease DMI and ADG which may or may not alter feed/gain ratios.

Including 10% fat in the LS did not affect feedlot performance. None of the dietary treatments affected carcass traits (Table 4). The incidences (%) of liver abscesses were dry pelleted, 17.5%; LS 8.8%; control LS 7.5%; fat added LS 10.1%; protein + tylosin-meal 8.7% and protein + tylosin-pelleted 8.9%. Tylosin present as a micro-ingredient reduces the incidence of liver abscesses. The higher incidence of liver abscesses occurring when no LS was fed supports the concept that LS increased the uniformity of micro-ingredient consumption.

In summary, these results showed no advantage to including fat as a component of liquid supplements as used in this experiment. Liquid supplement did enhance feedlot performance over pelleted supplementation and that response appears to involve factors other than the diet palatability.

Table 4. Carcass traits of steers fed various forms of supplement

	Supplement treatment					P		
	Pelleted	No fat Meal	Fat Meal	No fat Pellet	Fat Pellet	Pelleted vs others	Meal vs pellet	No fat vs Fat
Dressing, %[a]	60.6	61.7	60.7	61.4	61.1			
Hot carcass wt	720	743	737	745	756	.0062	NS	NS
Yield grade 1, %	10	2.5	0	8.1	7.7			
Yield grade 2, %	62.5	55.0	66.7	56.8	53.9			
Yield grade 3, %	27.5	42.5	33.3	35.1	38.4			
Select, %[b]	55	37.5	35.9	51.3	48.7			
Choice, %[b]	45	62.5	64.1	48.7	51.3			
Liver abscesses, %[c]	17.5	5.0	12.5	10.0	7.7			

[a]Based on packing plant arrival weights.
[b]LS with meal vs pellet Chi square test (P=.1040).
[c]Significant pelleted vs others in Chi square test (P<.05).