Effect of Trace Mineral Injection and Optaflexx on Growth Performance and Carcass Characteristics of Finishing Cattle

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Summary and Implications

Utilizing a trace mineral (TM) injection approximately 90 d prior to harvest may improve growth performance and carcass characteristics when the β-agonist Optaflexx is not used. This may provide a unique opportunity for TM injection to be used in natural programs, to avoid the use of β-agonists, but still maintain high rates of growth. However, using a TM-injection only 28 d prior to harvest appears to have no additional benefit, and may decrease carcass quality.

Introduction

Trace minerals (TM) are essential for healthy and productive beef cattle. Trace minerals are found in common feedstuffs, but variability in TM concentrations and dietary TM antagonists can decrease TM availability for cattle. Trace mineral injection is an alternative method to supplement TM, and can bypass the gastrointestinal tract where most antagonist interactions occur. Previous research has indicated that providing a TM injection to steers 90 d prior to finishing can improve marbling scores and ribeye area, particularly in cattle with mild trace mineral deficiencies. Additionally, supplementing trace minerals, specifically Zn, to finishing cattle may improve the growth response to Optaflexx. Our objective was to determine how trace mineral injection, 90 and 28 d prior to harvest, and Optaflexx supplementation, impact growth performance and carcass characteristics of finishing beef cattle housed in large feedlot pens.

Materials and Methods

Pre-Optaflexx period. This experiment was conducted at the Armstrong Memorial Research and Demonstration Farm in Lewis, IA. Two hundred sixty-four Angus crossbred steers (428 ± 29.6 kg) were assigned randomly to six pens with 44 steers per pen. Steers were weighed on two consecutive days at the beginning of the trial, and randomly assigned to receive a 5 mL injection of either Multimin90 (**MM**) or physiological saline (**SAL**; n = 132 per treatment; 22 per pen), and all steers were implanted with Revalor-S on d 0. All steers were fed the same corn and modified distillers grain finishing diet. Steers were weighed on d 0, 28 and 68 of the pre-Optaflexx period.

Optaflexx period. Twenty-nine days prior to harvest (d 68), steers were again randomly assigned within their previous treatment groupings to receive a second 5 mL injection of either MM or SAL and three of the six pens were randomly assigned to be supplemented with Optaflexx (**OPT**) at a rate of 300 mg/steer/day. The other three pens remained on the same diet without Optaflexx (**CON**), creating a 2 × 2 × 2 factorial of initial injection, second injection, and Optaflexx supplementation. Steers were weighed on d 96 (after 28 d of Optaflexx), and on d 97 steers were shipped to Tyson Fresh Meats in Denison, IA and harvested. Carcass data were collected at the plant after a 24-h chill by representatives of Tri-Country Carcass Futurity (Iowa State University Beef Extension, Lewis, IA). Steers were weighed on d 68 and 96 of the Optaflexx period

ADG was calculated from weights at the beginning and end of each period. Steer was considered the experimental unit for both the pre-Optaflexx and Optaflexx periods. Data were analyzed as two separate periods, the pre-Optaflexx period (d 0 through d 68) and the Optaflexx supplementation period (d 68 through d 97). Data for the pre-Optaflexx period included the fixed effect of initial injection, and the repeated effect of day, and d 0 bodyweight (BW) was used as a covariate in the analysis of d 68 BW. Data from the Optaflexx period were also analyzed using the MIXED procedure of SAS, using the fixed effects of initial injection, second injection, and Optaflexx supplementation and the interactions, the random effect of pen within Optaflexx supplementation. Day 69 values were used as covariates in analyses. Steer was considered the experimental unit for all data analysis.

Results and Discussion

Pre-Optaflexx period. There was no difference due to initial injection of MM on ADG (Table 1; $P = 0.99$) or BW ($P = 0.78$) during the initial 68 d (Pre-Optaflexx period). Previous research has indicated that a TM-injection 90 d prior to harvest can improve ADG in steers with a mild TM deficiency, but does not alter growth in steers with adequate TM status. Results of the present study support that TM injection may not alter growth performance in steers with adequate TM status.

Optaflexx period. Inclusion of Optaflexx increased ADG and final BW ($P < 0.0001$; Table 2). There was a consistent interaction between the first injection treatment, and dietary supplementation of the β-agonist, Optaflexx on ADG ($P = 0.0003$) and final BW ($P = 0.0002$). When steers received SAL, and received OPT, they had greater ADG and final BW than other treatments ($P < 0.001$). Steers that received MM as the initial injection had similar final BW and ADG regardless of Optaflexx supplementation ($P = 0.15$). However, when steers received SAL and were not fed Optaflexx, they had lower ADG and final BW than other treatments ($P < 0.03$). Overall, when steers were not fed Optaflexx, if they received MM as the initial injection they had greater ADG and final BW than steers that received SAL as the initial injection ($P = 0.04$). These results suggest that when steers are not supplemented with Optaflexx, MM may improve ADG during the last 28 d of the finishing period. However, cattle that receive Optaflexx may not receive any additional benefit from a trace mineral injection. Additionally, the second injection did not influence growth performance in the final 28 d.

Carcass Characteristics. There was no effect of first injection, second injection, or Optaflexx on hot carcass weight ($P > 0.16$; Table 3). Ribeye area was smaller in animals that received MM as their second injection, but there was no interaction between the first injection and the second injection. However, there was an interaction between OPT and first injection ($P = 0.03$) where SAL steers not supplemented with Optaflexx had the lowest REA compared to other treatments ($P < 0.08$), while steer REA did not differ ($P > 0.46$) among SAL steers fed Optaflexx or MM steers fed or not fed Optaflexx.

There was also an interaction between the first injection and Optaflexx on marbling score ($P = 0.03$), where SAL+CON and MM+OPT steers had greater MS, likely related to the greater REA in these steers.

There was again an interaction between initial injection and Optaflexx in both 12th rib backfat and yield grade ($P = 0.10$, and $P = 0.01$, respectively) where when steers received SAL as the first injection, and received Optaflexx, they tended to have a lower yield grade ($P = 0.07$) than if the initial injection was SAL and the steers did not receive Optaflexx. However, when MM was the initial injection and those steers received Optaflexx, they tended to have a greater YG ($P = 0.09$) than those that did not receive Optaflexx.

Within marbling score there was also an interaction between the first and second injection ($P = 0.01$), where steers that received SAL at both injection time points, or MM at both injection time points had greater marbling scores than steers that initially received SAL, and received MM as a second injection ($P = 0.003$). There was a tendency for an overall second injection effect where steers that received MM as the second injection had lower marbling scores than SAL steers ($P = 0.10$), mainly driven by the low MS of the SAL + MM steers

There was a similar tendency for an interaction between initial and second injection ($P \leq 0.06$), where steers that received SAL initially and then MM 28 d prior to harvest had fewer carcasses that graded USDA Average Choice ($P = 0.03$), and more steers that graded USDA Select ($P = 0.02$). This is likely reflective of the lesser marbling scores in SAL + MM steers. The lesser marbling score, ribeye area, and quality grade of steers that received MM approximately 30 d prior to harvest, and the lack of positive influences on growth performance and other carcass characteristics would suggest that TM injection timing is important, and may not be beneficial 30 d prior to harvest.

In conclusion, when steers were supplemented with Optaflexx, steers that received MM had lesser growth response than steers receiving SAL. However, when steers were not supplemented with Optaflexx, steers receiving MM as the initial injection had improved growth response and carcass characteristics than SAL steers. A TM injection approximately 90 d prior to harvest may be advantageous for cattle that do not receive Optaflexx.

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Table 1. Pre-Optaflexx performance

	Initial Injection			*P*-value[1]		
	Saline	Multimin	SEM	Initial injection	Day	Initial injection × Day
Weight[2], lb						
Initial (d 0)	986	984	6.3	0.78	-	-
d 68[3]	1249	1249	4.3	0.99	-	-
Repeated measures[4]						
BW, lb	1069	1066	6.4	0.78	<0.0001	0.87
ADG, lb/d	3.77	3.77	0.029	0.99	<0.0001	0.61

Table 2. Optaflexx period performance and (d 68 through 96)

Initial Inj	Saline				Multimin									
Second Inj	Saline		Multimin		Saline		Multimin			*P*-value[1]				
Optaflexx	-	+	-	+	-	+	-	+	SEM	Inj1	Inj2	Opt	1 × 2	1 × Opt
Live weight[2] (lb)														
d 86	1241	1264	1243	1252	1252	1253	1234	1255	16.0	0.88	0.57	0.24	0.89	0.82
d 96[3]	1341	1374	1348	1382	1352	1363	1358	1362	5.0	0.49	0.14	<0.001	0.44	0.0002
ADG[4], lb/d	3.10	4.29	3.37	4.55	3.53	3.89	3.68	3.86	0.175	0.48	0.18	<0.001	0.43	0.0003

Table 3. Carcass characteristics

Initial Inj	Saline				Multimin									
Second Inj	Saline		Multimin		Saline		Multimin			*P*-value[1]				
Optaflexx	-	+	-	+	-	+	-	+	SEM	Inj1	Inj2	Opt	1 × 2	1 × Opt
HCW[2], lb	829	848	819	843	831	837	823	846	12.2	0.93	0.66	0.16	0.59	0.62
REA[3], in²	13.0	13.5	12.5	13.3	13.5	13.3	13.1	13.2	0.22	0.22	0.04	0.19	0.85	0.03
MS[4]	432	405	389	391	396	408	402	415	9.6	0.90	0.10	0.97	0.01	0.07
BF[5], in	0.52	0.48	0.48	0.47	0.47	0.50	0.48	0.51	0.023	0.89	0.62	0.86	0.23	0.10
KPH[6], %	2.42	2.44	4.42	2.36	2.36	2.53	2.45	2.45	0.080	0.42	0.74	0.71	0.61	0.22
YG[7]	3.26	3.10	3.28	3.09	2.99	3.16	3.13	3.26	0.092	0.48	0.34	0.91	0.38	0.01

[1]Inj1 = Initial injection; Inj2 = second injection; Opt = Optaflexx; 1 × 2 = interaction between Inj1 and Inj2; 1 × Opt: interaction between Inj1 and Optaflexx.
[2]Inj2×Opt: $P \geq 0.22$; Inj1×Inj2×Opt: $P \geq 0.32$.
[2]HCW = hot carcass weight.
[3]REA = ribeye area.
[4]MS = marbling score; slight: 300, small: 400, modest: 500.
[5]BF = 12th rib backfat.
[6]KPH = kidney, pelvic and heart fat percent.
[7]YG = yield grade.