Effect of Zinc Amino-Acid Complex and Optaflexx Feeding Duration on Growth Performance and Carcass Characteristics of Finishing Cattle

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Summary and Implications

Supplementation of a zinc-amino acid complex (**ZnAA**) at 60 ppm increased carcass-adjusted final BW, ADG, and improved F:G of cattle fed Optaflexx (**OPT**) when compared with cattle fed OPT alone. Under the conditions of this study, steers fed OPT for 28 days had a 0.9% increase in HCW relative to non-OPT cattle that was improved to 2.1% greater in steers supplemented with ZnAA and OPT. Zinc supplementation without OPT did not affect performance. In addition, ZnAA supplementation did not extend the response to OPT, as the performance of steers receiving OPT for 28 or 42 d was not different in Zn supplemented steers. There appears to be a synergy between Zn and OPT supplementation that leads to improved finishing steer performance, although the mechanism is currently unknown.

Introduction

Zinc is required for the growth and development of animals, and research data have demonstrated that dietary Zn concentrations above NRC recommendations can improve performance of livestock. Recently researchers have noted that Zn supplementation in pigs receiving the β-agonist Paylean can increase overall performance response, relative to pigs fed Paylean alone. Previous cattle research has also indicated that increasing ZnAA supplementation of 0, 30, 60, and 90 ppm Zn of cattle fed OPT linearly increases live performance. Although the mechanism for this potential synergy is unknown, it is possible that Zn may interfere with the diminishing response to OPT, commonly noted as days on OPT increases. Therefore it is possible that ZnAA supplementation may extend the response to OPT as days on OPT increases. Our objective was to determine the influence of supplemental ZnAA on growth performance and carcass characteristics of finishing steers fed OPT for 0, 28, or 42 d prior to harvest.

Materials and Methods

Pre-Optaflexx period. Three-hundred twenty four Angus-cross steers (1023 ± 51.6 lb) were utilized in a finishing study to evaluate the influence of supplemental ZnAA on growth performance and carcass characteristics. Steers were purchased from 3 sources, and sources were balanced among pens. Steers were housed in pens of 6 head. Steers were fed the same finishing diet that included 60 mg supplemental Zn/kg DM from $ZnSO_4$ (Table 1). Due to the size of the experiment, one group (**GRP**) of 144 steers (GRP 1) were started 2 weeks prior to the second group of 180 steers (GRP 2). Within group, steers were blocked by BW into 4 or 5 blocks, of 6 pens each, and pens within blocks were randomly assigned to dietary treatments at the beginning of the finishing period, supplemented with either 0 (**CON**; analyzed total diet Zn concentration = 85 ppm DM) or 60 (**ZN**; analyzed total diet Zn concentration = 150 ppm) ppm DM from ZnAA (Availa-Zn). Steers were implanted with Component TE-IS with Tylan on d 0. Weights were taken on days 0 and 1, and day 35 for each group, and the decision to begin OPT supplementation was made at that time based on BW and visual appraisal. Steers from GRP 1 started the OPT period 14 d after d 35, and steers from GRP 2 started the OPT period 7 d after day 35, so GRP 1 and GRP 2 had 91 and 84 d finishing periods, respectively.

Forty-two days prior to slaughter (day 49 and 42 of the experiment for GRP 1 and 2 respectively), pens within dietary treatments were randomly selected to receive OPT at 300 mg/steer/day for 0, 28 or 42 d prior to slaughter (n = 9 pens per dietary treatment and OPT duration combination), and were stagger-started on OPT such that all steers within GRP completed the experiment on the same day. Steers were weighed on day -43, -42, -29, -28, -14, and -1 and 0 prior to harvest. All steers within GRP were harvested on the same day at Tyson Fresh Meats, and HCW data were collected. After a 24-h chill, carcasses were graded according to USDA standards by representatives of the Tri-County Carcass Futurity (Iowa State University Beef Extension, Lewis, IA). Carcass-adjusted performance variables were calculated by dividing individual HCW with the average dressing percentage (63.6%). A 4% pencil shrink was applied to all live BW measures as well as in the calculation of ADG and F:G.

Data were analyzed as a randomized complete block design using the MIXED procedure of SAS 9.2. Pen was the experimental unit (n = 9 pens per treatment). The statistical model included the fixed effect of dietary Zn treatment, OPT feeding duration, and block nested within GRP, and the random effect of pen nested within diet, OPT, block and GRP. Five *a priori* individual degree of freedom contrasts were developed; 'OPT': the effect of OPT supplementation, 'ZN within NoOPT': the effect of Zn supplementation within the cattle not fed OPT, 'ZN within 28OPT': the effect of Zn supplementation within the cattle fed OPT for 28 d, 'ZN within 42OPT': the effect of Zn supplementation within the cattle fed OPT for 42 d and 'ZN × OPT duration': the interaction between CON and ZN within steers fed OPT for 28 or 42 days.

Results and Discussion

Optaflexx supplementation increased carcass-adjusted final BW (P = 0.004; Table 2), ADG (P = 0.004) and decreased F:G (P = 0.0002), and had no impact on DMI (P = 0.40). Zinc supplementation to steers that did not receive OPT had no effect on performance or DMI (P = 0.29). Interestingly, there was a clear effect of ZN where ZN+28OPT steers had greater carcass-adjusted ADG (P = 0.04), final BW (P = 0.04) and tended to have lesser F:G (P = 0.07) than CON+28OPT steers, and ZN+42OPT had greater carcass-adjusted final BW (P = 0.05) and tended to have greater overall carcass-adjusted ADG (P = 0.10) than CON+42OPT steers. However, supplementing 60 ppm of ZnAA/kg DM does not appear to be able to extend the response to OPT from 28 to 42 d, as there was no interaction in the performance between 28OPT and 42OPT when Zn was supplemented in carcass-adjusted final BW (P = 0.94), ADG (P = 0.80) or F:G (P = 0.71).

Overall, HCW (P = 0.004) and ribeye area (P = 0.007) were increased by OPT supplementation, and ZN increased HCW in both 28OPT (P = 0.04) and 42OPT (P = 0.05). Similar to carcass adjusted performance, ZnAA supplementation without OPT did not affect HCW (P = 0.78). In the present study, non-ZnAA supplemented steers had a HCW increase of 0.9% and 0.4% in response to OPT, for 28OPT and 42OPT steers, respectively. However, this response was increased to 2.1% and 1.6% greater HCW compared to NoOPT steers, for 28OPT and 42OPT, respectively, when ZnAA was supplemented to these treatments. Supplementation of ZnAA did not influence dressing percentage, ribeye area, backfat, kidney, pelvic and heart fat, marbling score, or yield grade ($P \geq 0.11$) regardless of OPT supplementation. Similar to carcass-adjusted performance, no difference was noted between 28OPT and 42OPT when Zn was supplemented on HCW or other carcass characteristics ($P \geq 0.13$). There was a tendency for CON+NoOPT steers to have greater quality grades (P = 0.08) than ZN+NoOPT steers, driven by a numerical difference in marbling scores (P = 0.11). There was also an interaction between ZN and OPT duration for quality grade (P = 0.05) where CON+28OPT were not different from CON+42OPT steers (P = 0.27), but ZN+28OPT steers tended to have greater QG than ZN+42OPT steers (P = 0.10).

Overall, ZnAA supplementation increased the carcass response of steers supplemented with OPT. However, 60 mg of Zn from ZnAA/kg DM did not extend the response to OPT as steers supplemented with ZnAA performed similarly whether they received OPT for 28 or 42 d. Supplementation with ZnAA did not affect growth in non-OPT supplemented steers. Overall, there appears to be a synergy between ZnAA and OPT that further increases performance of cattle during the final 28 d of the finishing period. The additional HCW in Zn-supplemented, OPT-fed cattle represents an economic opportunity for the cattle feeder to optimize cattle performance.

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Table 1. Diet composition

Ingredient	% of diet DM
Dry rolled corn	62.0
Corn modified distiller's grains	25.0
Bromegrass hay	8.0
Corn dried distiller's grains	2.74
Limestone	1.73
Salt	0.31
Vitamin A premix[1]	0.11
Trace mineral premix[2]	0.10
Rumensin90[3]	0.01
Calculated composition[4]	
CP	13.1
NDF	17.8
NE_g	1.35
Ether extract	4.5
Analyzed composition, ppm DM	
Cu	21
Fe	99
Mn	61
Zn	85

[1]Vitamin A premix contained 4,400,000 IU/kg.
[2]Provided per kg of diet: 60 mg Zn; 48 mg Mn; 0.75 mg I; 0.24 mg Se; 17.6 mg Cu; and 0.38 mg Co (all inorganic sources); concentrations from Vasconcelos and Galyean (2007). Provided either 0 or 60 mg Zn from a Zn-amino acid complex/kg diet DM.
[3]Provided at 27 g/ton of diet (Elanco Animal Health).
[4]Composition was calculated using values from the NRC (2000)

Table 2. Effect of a zinc-amino acid complex and ractopamine hydrochloride (OPT) feeding duration from on carcass characteristics of beef cattle[1]

	Dietary treatment[2]							Contrast *P*-values				
	CON			ZN					Effect of ZN within			
	OPT feeding duration[3]											
	NoOPT	28OPT	42OPT	NoOPT	28OPT	42OPT	SEM	OPT[4]	NoOPT[5]	28OPT[6]	42OPT[7]	ZN × OPT duration[8]
Pens	*n* = 9	*n* = 9	*n* = 9	*n* = 9	*n* = 9	*n* = 9						
Carcass adjusted[9]												
Final BW, lb	1410	1423	1417	1413	1443	1435	6.7	0.004	0.78	0.04	0.05	0.94
Overall ADG[10], lb/d	4.45	4.60	4.53	4.46	4.82	4.71	0.077	0.004	0.98	0.05	0.10	0.80
Overall DMI, lb/d	25.7	25.6	25.7	26.2	25.7	25.9	0.34	0.40	0.29	0.73	0.74	0.93
Overall F:G	5.77	5.56	5.68	5.88	5.34	5.49	0.084	0.0002	0.39	0.07	0.11	0.71
Carcass characteristics												
HCW, lb	897	905	901	899	918	913	4.3	0.004	0.78	0.04	0.05	0.94
Dress, %	63.6	63.6	63.2	63.7	63.9	63.5	0.22	0.63	0.79	0.40	0.29	0.88
Ribeye area, in^2	13.62	13.97	14.02	13.73	14.03	14.10	0.144	0.007	0.58	0.78	0.71	0.95
Backfat, in	0.60	0.59	0.59	0.61	0.61	0.60	0.022	0.62	0.66	0.40	0.99	0.54
KPH, %	2.31	2.35	2.31	2.39	2.39	2.32	0.045	0.80	0.18	0.60	0.87	0.80
Marbling score[11]	517	482	491	489	505	475	12.7	0.19	0.11	0.22	0.36	0.13
Yield grade	3.51	3.40	3.39	3.54	3.51	3.41	0.081	0.18	0.85	0.37	0.85	0.62
Quality grade[12]	3.84	3.29	3.53	3.45	3.65	3.29	0.154	0.13	0.08	0.10	0.27	0.05

[1]A 4% pencil shrink was applied to all live BW measures as well as in the calculation of ADG and F:G.
[2]Dietary treatments: a dry-rolled corn based diet including 60 mg Zn/kg from $ZnSO_4$ and no supplemental ZnAA (CON) or 60 mg Zn/kg diet DM from ZnAA (ZN).
[3]OPT feeding duration: 300 mg·$steer^{-1}d^{-1}$ OPT for 0 (NoOPT), 28 (28OPT) or 42 (42OPT) days.
[4]Contrast: OPT = NoOPT vs. 28OPT, 42OPT.
[5]Contrast: CON vs ZN within NoOPT = Con+NoOPT vs. ZN+NoOPT.
[6]Contrast: CON vs ZN within 28OPT = Con+28OPT vs. ZN+28OPT.
[7]Contrast: CON vs ZN within 42OPT = Con+42OPT vs. ZN+42OPT.
[8]ZN × OPT duration = the interaction between CON and ZN within steers fed OPT for 28 or 42 days.
[9]Carcass-adjusted performance was calculated by dividing HCW with the average dressing percentage (63.6%).
[10]Overall ADG = ADG calculated from day 0 through the end of the experiment
[11]Marbling scores: small = 400; modest = 500, moderate = 600.
[12]Quality grades: $Select^+$: 2, $Choice^-$:3, and Choice:4.