EFFECT OF CHELATED MANGANESE ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING PIGS[1]

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Summary

A total of 80 medium-lean growth cross-bred barrows (initially 77 lb) was used in a study to evaluate the effect of manganese level (24, 44, or 88 ppm) and source (inorganic vs chelated manganese) on growth performance and carcass characteristics of finishing pigs. Barrows were allotted by weight to pens containing two pigs per pen in a randomized complete block design. Pigs were assigned to one of four dietary treatments with 10 replications per treatment. Pigs were housed in pens (5 ft x 5 ft) in an environmentally regulated finishing barn and allowed ad libitum access to feed and water. Pigs were fed a corn-soybean meal-based diet formulated to contain .8% lysine and providing 24 ppm of inorganic Mn supplied from manganese oxide (control). Additional treatments included the control diet plus 20 ppm of a chelated form of Mn (a total of 44 ppm dietary Mn); control diet plus 20 ppm of inorganic Mn (manganese oxide; a total of 44 ppm dietary Mn); and the control diet plus 64 ppm of inorganic Mn (manganese oxide; a total of 88 ppm dietary Mn). Pigs were fed their respective experimental diet for the entire study. Pigs and feeders were weighed every 2 weeks to measure Average daily gain (ADG), average daily feed intake (ADFI), and feed conversion (F/G) until the mean weight of pigs in a pen averaged 225 lb. At this time, both pigs in the pens were slaughtered, and standard carcass measurements were recorded. For the overall trial, no differences occurred in growth performance among pigs fed any of the experimental treatments. Pigs had mean ADG, ADFI, and F/G of 2.10 lb, 6.88lb, and 3.24, respectively. No differences occurred in carcass traits, with all pigs having approximately 1.20 inches of backfat and between 4.50 and 5.0 square inches of longissimus muscle area. In conclusion, additional manganese above 24 ppm from an inorganic or chelated source had no effect on growth performance or carcass characteristics of medium-lean growth finishing pigs.

(Key Words: G/F, Pig, Manganese, Performance.)

Introduction

Research from Louisiana State University has found improvements in longissimus muscle area when the trace mineral, chromium picolinolate, was added to finishing pig diets. Chromium picolinate seems to have insulin-like properties that assist the pig's ability to deposit lean tissue. This is speculated to be the predominant mechanism for the increase in longissimus muscle area. Chelated manganese is similar in chemical structure to chromium picolinate. Therefore, the objective of this experiment was to evaluate effects of increasing dietary manganese from either a chelated manganese product or an inorganic form of manganese (manganese oxide) on growth performance and carcass characteristics of finishing pigs.

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Procedures

Eighty crossbred barrows (initially 77 lb) were allotted by weight to each of four experimental treatments. There were 2 pigs per pen and 10 pens per treatment. Pigs were housed in an environmentally regulated finishing barn and had ad libitum access to feed and water. Pigs were fed a corn-soybean meal-based diet that was supplemented with additional manganese from either inorganic manganese or from chelated manganese (Table 1). Diets were formulated to contain .8% lysine and were fed for the entire experimental period. The four experimental diets included a control diet containing 24 ppm of manganese from manganese oxide; control plus 20 ppm of chelated manganese (44 ppm dietary manganese); control plus 20 ppm of manganese from inorganic manganese oxide (44 ppm total dietary manganese); and the control diet plus 64 ppm manganese from manganese oxide (88 ppm total dietary manganese). Supplemental manganese was added to the diets in a corn-based premix (Table 1) with or without added soy protein isolate to ensure similar crude protein content of all diets. Pigs and feeders were weighed every 2 weeks to record ADG, ADFI, and F/G until the mean weight of pigs in a pen was 225 pounds. Then pigs were slaughtered, and standard carcass characteristics were recorded.

Table 1. Diet Composition[ab]

Item	Control
Corn	76.86
Soybean meal, (48% CP)	19.48
Monocalcium phosphate, (18% P)	1.47
Limestone	.94
Corn premix	.50
Salt	.35
Vitamin premix	.20
Trace mineral premix	.10
Antibiotic	.10
Total	100.00

[a]Diets were formulated to contain .8% lysine and were fed for the entire experiment. Analyzed composition of 6 samples of each diet were: CP 15.0, 14.8, 14.7, and 14.9 and Mn: 59.2, 76.8, 78.3, and 104.8 ppm for the control, 44 ppm chelated Mn, 44 ppm inorganic Mn, and 88 ppm Mn diets, respectively.

[b]Corn, Mn oxide, and soy protein isolate or corn and chelated Mn were used in the premix to provide the respective added Mn treatments.

Results and Discussion

During d 0 to 28 of the experiment, no differences occurred in ADG or ADFI of pigs fed additional manganese (Table 2). However, F/G was poorer for pigs fed 44 or 88 ppm inorganic manganese compared with those pigs fed either the control diet (24 ppm inorganic manganese) or the chelated manganese. However, for all other growth performance criteria for any phase of the experiment, no differences occurred in ADG, ADFI, or F/G.

No differences in carcass traits or organ weights were observed (Table 3). A trend ($P<.06$) occurred for pigs fed chelated manganese to have slightly greater last lumbar backfat depth; however, no differences were observed for average backfat thickness. Therefore, with the growth rate and lean tissue deposition of the pigs used in this study, additional manganese from either chelated or inorganic sources gave no improvements in growth performance or carcass characteristics.

Table 2. Growth Performance of Finishing Pigs Fed Added Manganese[a]

Item	Inorganic Mn, 24 ppm	Chelated Mn, 44 ppm	Inorganic Mn, 44 ppm	Inorganic Mn, 88 ppm	CV	P value
Day 0 to 28						
ADG, lb	2.15	2.13	2.05	2.13	8.1	.62
ADFI, lb	5.71	5.65	5.89	5.81	6.7	.52
F/G[b]	2.66	2.65	2.88	2.73	6.9	.04
Day 0 to 56						
ADG, lb	2.09	2.17	2.05	2.12	8.0	.44
ADFI, lb	6.41	6.55	6.54	6.59	6.8	.81
F/G	3.07	3.02	3.20	3.10	6.4	.23
Overall						
ADG, lb	2.12	2.17	2.08	2.13	7.4	.66
ADFI, lb	6.76	6.90	6.90	6.95	6.4	.78
F/G	3.19	3.18	3.32	3.27	6.3	.39
Days on test	71.4	70.0	73.5	72.1	7.6	.55

[a]A total of 80 barrows were used (initially 77 lb) with 2 pigs/pen and 10 pens/treatment.
[b]Mean of 24 ppm inorganic and 44 ppm chelated Mn vs 44 and 88 ppm inorganic Mn ($P < .04$).

Table 3. Carcass Characteristics and Organ Weights of Finishing Pigs Fed Added Manganese[a]

Item	Inorganic Mn, 24 ppm	Chelated Mn, 44 ppm	Inorganic Mn, 44 ppm	Inorganic Mn, 88 ppm	CV	P value
Final weight, lb[a]	223	220	220	225	4.4	.40
Hot carcass weight, lb	167.3	165.7	167.8	169.1	2.0	.15
Cold carcass weight, lb	164.7	163.1	165.1	166.2	2.0	.16
Dressing %	73.7	72.9	73.8	74.3	2.0	.17
First rib backfat, in.	1.45	1.63	1.59	1.54	13.0	.23
Last rib backfat, in.	.99	1.01	.94	.94	13.2	.39
Last lumbar backfat, in.	1.00	1.11	.97	.97	14.4	.06
Average backfat, in.	1.15	1.25	1.16	1.15	10.6	.16
Tenth rib backfat, in.	1.14	1.23	1.20	1.18	16.0	.76
Longissimus muscle area, $in.^2$	5.08	4.58	4.75	4.83	10.3	.15
Carcass length, in.	30.6	30.9	30.8	30.7	1.7	.45
Kidney fat, g	1,222	1,327	1,282	1,431	20.6	.39
Organ weights, g						
Heart	356	341	333	336	10.5	.66
Liver	1,521	1,518	1,522	1,456	9.4	.67
Kidney	350	341	333	336	10.3	.74

[a]A total of 80 barrows (initially 77 lb) with 2 pigs/pen and 10 pens/treatment. Final weight was used as a covariate for statistical analysis.