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Supplemental Copper for Growing-Finishing Swine^{1,2,3}

Gary L. Allee and R. H. Hines

Summary

One hundred forty-four pigs averaging 61 pounds were used to determine the influence of copper level on performance, copper storage in the liver, and to determine the influence of withdrawing during the finishing phase. Pigs fed 125, 187, or 250 ppm copper gained significantly faster ($P < .05$) than those on the basal diet containing no copper. Responses to copper and to an antibiotic were similar. Most of the growth response from the added copper occurred during the first 8 weeks of the experiment. Withdrawing copper the latter part of the finishing phase influenced neither gain nor efficiency of feed conversion but significantly ($P < .05$) reduced copper stored in the liver.

Procedures

One hundred forty-four pigs averaging 61 pounds were used to determine the effect of copper level on performance and copper accumulation in the liver. Pigs were randomly assigned from outcome group based on litter, sex and initial weight to these treatments.

1. Control (Basal diet, no added copper)
2. 125 ppm copper to market weight
3. 187 ppm copper to market weight
4. 250 ppm copper to market weight
5. 125 ppm copper for 8 weeks only
6. 187 ppm copper for 8 weeks only
7. 250 ppm copper for 8 weeks only
8. Control diet plus an antibiotic (Aureo SP - 250)

¹Part of a cooperative study with other experiment stations of the North Central Region (NCR-42).

²Copper sulfate supplied by Phelps Dodge Refining Corp., New York, N. Y.

³The Food and Drug Administration recently denied approval of copper sulfate in swine rations.

Composition of the basal diet is shown in Table 20. Copper was added as copper sulfate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$). All diets were fed in pellet form. Liver samples were taken from the end of the liver lobe adjacent to the bile duct for copper analysis.

Table 20. Composition of Basal Diet

Ingredient	%
Corn, ground	81.90
Soybean meal (49% protein)	15.00
Ground limestone	0.75
Dicalcium phosphate	0.85
Iodized salt	0.50
Vitamin and trace mineral premix ^{a,b}	1.00
	100.00

^aTrace mineral mix supplied the following ppm: Fe, 50; Zn, 100; Mn, 27.5; I, 0.75; and Co, 0.5.

^bVitamin mix supplied these amounts per pound:
Vitamin A, 1000 I.U.; Vitamin D₃ 200 I.U.; Riboflavin, 2.0 mg.; Pantothenic acid, 5 mg.; Niacin, 10 mg.; Vitamin B₁₂, 5 mg.

Results and Discussion

The influence of copper level on performance the first 8 weeks is shown in Table 21. Adding copper significantly ($P < .05$) increased daily gain. No differences were observed in daily gain between pigs fed 125, 187, or 250 ppm copper or an antibiotic. Feed intake was increased by adding copper or an antibiotic to the basal diet. There were no differences in feed efficiency between pigs fed 187 or 250 ppm copper and those fed the antibiotic.

Influences of copper level and withdrawing copper during the finishing phase are presented in Table 22. Withdrawing copper after 8 weeks did not significantly reduce daily gain or feed required per pound of gain. Feeding 250 ppm copper the entire finishing period markedly increased copper accumulation in the liver. Withdrawing copper after 8 weeks reduced copper stored in the liver.

Table 21. Influence of Copper Level on Performance of Growing-Finishing Pigs (First 8 weeks)

Copper, ppm	0	125	187	250	Antibiotic
Number of pigs	18	35	36	36	18
Initial weight, lb.	59.2	60.6	60.2	62.6	60.5
Average daily gain, lb.	1.36 ^a	1.56 ^b	1.61 ^b	1.59 ^b	1.63 ^b
Average daily feed, lb.	4.25	4.68	4.51	4.45	4.55
Feed/gain	3.14 ^a	3.00 ^{a,b}	2.80 ^b	2.80 ^b	2.80 ^b

^{a,b} Means on the same line with different superscripts differ significantly ($P < .05$).

Table 22. Influence of Copper Levels and Withdrawing Copper on Performance and Copper Stored in the Liver (Beginning to Market)

Added Copper								
First 8 weeks, ppm	0	125	187	250	125	187	250	Antibiotic
8 weeks to market, ppm	0	125	187	250	0	0	0	Antibiotic
Average daily gain, lbs.	1.46 ^a	1.64 ^b	1.63 ^b	1.62 ^b	1.57 ^b	1.59 ^b	1.59 ^b	1.66 ^b
Average daily feed, lbs.	4.48	5.08	4.55	4.68	4.76	4.56	4.52	5.03
Feed/gain	3.07	3.10	2.79	2.89	3.03	2.87	2.93	3.03
Liver copper, ppm (dry matter basis)	14.90	25.60	47.55	312.20	13.80	44.50	65.60	----

a,b Means on the same line with different superscript differ significantly ($P < .05$).