Growing - Finishing Rations Supplemented with Zinc - Proteinate

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The need for zinc in swine rations has been firmly established. Likewise the inter-relationships between dietary zinc and other minerals, especially calcium, have been well authenticated. However, there are still many unanswered questions concerning zinc and its place in the swine diet.

At no time have funds or facilities been adequate to do an "in depth" study of dietary zinc here at Kansas State but feeding trials involving zinc have been carried on whenever possible. This report covers three such trials using a commercial product called zinc proteinate.[1]

PROCEDURE

I. Sixteen Duroc pigs averaging near 50 pounds in weight were divided into four groups of four pigs each. Two groups received the control ration and two groups received the same ration supplemented with zinc proteinate (see Table 1). These rations were calculated to contain near 20% crude protein. They also contained added methionine.

The test was initiated on February 7 in an unheated barn. It was necessary to hand-water the pigs. They were maintained on a concrete floor without bedding. Each group of four ate from a two-hole self feeder.

The pigs were individually weighed biweekly. Feed consumption was also measured. The pigs were taken off test at approximately 200 pounds body weight and slaughtered in the Animal Science and Industry Department meat laboratory so carcass data could be collected. Performance data is summarized in Table 3.

I and III. Trial II and trial III differed from each other only in the time at which each was initiated. Pigs in trial II were put on test on June 7 and pigs in trial III were put on test on August 30. Trials I, II, and III were all conducted in the same building.

[1] Zinc proteinate is an organic zinc compound manufactured for Zinpro Corporation, Des Moines, Iowa. It contains a minimum of 9.00% zinc. Fed at the rate of two pounds per ton of complete ration, it supplies 81.7 gms. of Zn per ton feed or 90 ppm.

Table 1. Growing-finishing rations supplemented with zinc-proteinate. Composition of Rations in Trial I.

(Approximately 20% Crude Protein)

	Control	Control + Zinc Proteinate
Sorghum Grain[1]	670 lb.	670 lb.
Soybean Meal (44%)	300 "	300 "
Dicalcium Phosphate	6 "	6 "
Limestone	11 "	11 "
Salt	5 "	5 "
Trace Minerals (5% ZN)	0.5"	0.5"
Vitamin D (15,000)	10 gms.	10 gms
Vitamin A (10,000)	150 "	150 "
B-Vitamins (Merck 1233)	150 "	150 "
B_{12} (Proferm 20)	100 "	100 "
Aurofac 10	454 "	454 "
Methionine	646 "	646 "
Zn Proteinate		454 "
Sorghum Grain	2122 "	1668 "
TOTAL	1000 lbs.	1000 lbs.

[1]Approximately four weeks after the start of the feeding trial 5% dehydrated alfalfa replaced sorghum grain in an effort to stop excessive chewing of teeth, salivation and scouring.

Table 2. Growing - finishing rations supplemented with zinc-proteinate. Composition of Rations in Trial I and II.

	Approximately 13% Crude Protein			
	Control	+Alfalfa	+Zinc Prot.	+Zinc Prot. + alfalfa
Sorghum Grain	870 lb.	820 lb.	870 lb.	820 lb.
Soybean Meal (44%)	100 "	100 "	100 "	100 "
Dicalcium Phosphate	10 "	10 "	10 "	10 "
Limestone	10 "	10 "	10 "	10 "
Salt	5 "	5 "	5 "	5 "
Trace Minerals (5% ZN)	0.5"	0.5"	0.5"	0.5"
Alfalfa (17%)	---	50 "	---	50 "
Zn Proteinate	---	---	1.0"	1.0"
Vitamin D (15,000)	10 gm.	10 gm.	10 gm.	10 gm.
Vitamin A (10,000)	150 "	150 "	150 "	150 gm.
B Vitamins (Merck 1233)	150 "	150 "	150 "	150 gm.
B_{12} (Proferm 20)	100 "	100 "	100 "	100 gm.
Aurofac 10	454 "	454 "	454 "	454 gm.
Sorghum grain	1180 "	1180 "	726 "	726 gm.
	1000 lb.	1000 lb.	1000 lb.	1000 lb.

	Approximately 16% Crude Protein			
	Control	+Alfalfa	+Zinc Prot.	+Zinc Prot. + alfalfa
Sorghum Grain	770 lb.	720 lb.	770 lb.	720 lb.
Soybean Meal	200 "	200 "	200 "	200 "
Dicalcium Phosphate	8 "	8 "	8 "	8 "
Limestone	10 "	10 "	10 "	10 "
Salt	5 "	5 "	5 "	5 "
Trace Minerals (5% Zn)	0.5"	0.5"	0.5"	0.5"
Alfalfa (17%)	---	50 "	---	50 "
Zn Proteinate	---	---	1.0"	1.0"
Vitamin D (15,000)	10 gm.	10 gm.	10 gm.	10 gm.
Vitamin A (10,000)	150 "	150 "	150 "	150 "
B Vitamins (Merck 1233)	150 "	150 "	150 "	150 "
B_{12} (Proferm 20)	100 "	100 "	100 "	100 "
Aurofac 10	454 "	454 "	454 "	454 "
Sorghum grain	2087 "	2087 "	1633 "	1633 "
	1000 lb.	1000 lb.	1000 lb.	1000 lb.

Table 3. Growing-finishing rations supplemented with zinc-proteinate. Performance of Pigs in Trial I.

Diet	Control	+Zinc Prot.
Av. Initial Weight (lbs.)		
Rep. 1 (Barrows)	65.5	63.2
Rep. 2 (Gilts)	65.5	64.8
AV.	65.5	64.0
Av. Final Weight (lbs.)		
Rep. 1 (Barrows)	203.0	205.0
Rep. 2 (Gilts	204.0	203.0
AV.	203.5	204.0
Av. Daily Gain (lbs.)		
Rep. 1 (Barrows)	1.41	1.45
Rep. 2 (Gilts)	1.30	1.18
AV.	1.36	1.32
Av. lbs. of Feed Per lb. of Gain		
Rep. 1 (Barrows)	3.43	3.78
Rep. 2 (Gilts)	3.35	3.59
AV.	3.39	3.68

Table 4. Growing-finishing rations supplemented with zinc-proteinate. Carcass Data of Pigs in Trial I.

Diet	Control	+Zinc Prot.
Av. Carcass Length (in.)		
Rep. 1 (Barrows)	28.6	27.8
Rep. 2 (Gilts)	28.8	28.9
AV.	28.7	28.3
Av. Carcass Backfat (in.)		
Rep. 1 (Barrows)	1.25	1.16
Rep. 2 (Gilts)	1.04	1.07
AV.	1.14	1.12
Av. Carcass Loin Eye Area (Sq. in.)		
Rep. 1 (Barrows)	3.68	3.80
Rep. 2 (Gilts)	4.61	4.37
AV.	4.14	4.08

In trial II 40 Duroc and eight Yorkshire pigs averaging near 50 pounds in weight were divided into eight groups of six pigs each. Each group was fed free-choice at either the 13% or the 16% crude protein level. Within each protein level 5% alfalfa meal and 0.1% Zn proteinate were fed both separately and in combination. Alfalfa was tested in trials II and III because it seemed to be of value in trial I.

In trial III 16 Duroc and 16 Duroc by Yorkshire crossbred pigs were divided into 8 similar groups of 4 pigs each. They were put on the same feeding regime as the pigs in trial II.

Both groups had access to automatic waterers. On warm days the pigs were cooled by fog nozzles. They ate from 2-hole self feeders. All rations were mixed in the Grain Science and Industry Department. They were fed in the pelleted form. Ration formulations for trials I and II are shown in table 2.

In both trials pigs were taken off test at approximately 210 pounds body weight. They were slaughtered in the Department of Animal Science and Industry meat laboratory where carcass cata was collected.

RESULTS AND DISCUSSION

Pigs in trial I apparently did not respond to the added zinc material either in terms of increased gain or improved feed utilization. Performance data are summarized in Table 3 while carcass data is summarized in Table 4. These pigs were on a rather high stress level. They were housed in rather poor winter quarters. They were hand watered and they were eating a ration that was rather high in crude protein. You will note from the footnote in table 1 that they did have problems.

Trials II and III were factorially designed. Thus data can be summarized in several different ways. In table 5 they are summarized by protein level and by season. The 13% diet did give a bit slower growth rate. It also required a bit more feed to produce 100 pounds of gain.

It is interesting to note that feed efficiency was about the same for both groups of pigs whether started in June or August. This is partly explained by differences in starting weights of the two groups.

Table 6 summarizes performance in trials II and III of those pigs receiving either no alfalfa or 5% alfalfa. In the low protein rations alfalfa apparently increased average daily gain somewhat. It also improved feed efficiency. However, in the rations carrying approximately 16% crude protein, alfalfa apparently had no effect either on feed efficiency or average daily gain.

In table 7 zinc proteinate is compared to no zinc proteinate in trials II and III. At the lower protein level (approximately 13% C.P.) there was apparently no response to the feeding of the zinc compound. However, when approximately 16% crude protein was carried in the rations the zinc proteinate appeared to increase average daily gain slightly and also to improve overall feed efficiency slightly.

Table 5. Growing-finishing rations supplemented with zinc-proteinate. Summary Trials II and III. Effect of Protein Level and Season on Daily Gain and Feed to Gain Ratio.

Calculated Protein level	13%	16%
Av. Daily gain, lbs.	1.61	1.76
Av. lbs. feed per 100 lb. of gain -	326.2	312.3

Feeding Period	Initial Wt.	A.D.G.	Feed Eff.
Initiated in early June	71.0	1.55	319.8
Initiated in early August	77.2	1.83	318.8

Table 6. Growing-finishing rations supplemented with zinc-proteinate. Summary - Alfalfa Effects in Trials II and III.

Approximately 13% Crude Protein

Av. Daily Gain, Lbs.	No Alfalfa	+Alfalfa
Trial II	1.36	1.58
Trial III	1.68	1.82
AV.	1.52	1.70
Av. Lbs. feed per lb. of gain		
Trial II	334.3	324.0
Trial III	334.2	314.4
AV.	334.2	319.2

Approximately 16% Crude Protein

Av. Daily Gain, lbs.		
Trial II	1.58	1.67
Trial III	1.98	1.84
AV.	1.78	1.76
Av. lbs. feed per lb. of gain		
Trial II	318.8	302.0
Trial III	315.0	313.2
AV.	316.9	307.6

Table 7. Growing-finishing rations supplemented with zinc-proteinate. Summary - Zinc Effects in Trials II and III.

	No Zinc	+Zinc
Approximately 13% Crude Protein		
AV. Daily Gain, lbs.		
Trial II	1.52	1.44
Trial III	1.78	1.72
AV.	1.65	1.58
AV. lbs. feed per lb. of gain		
Trial II	338.6	319.7
Trial III	312.2	334.4
AV.	325.4	327.5
Approximately 16% Crude Protein		
AV. Daily Gain, lbs.		
Trial II	1.58	1.66
Trial III	1.80	2.01
AV.	1.69	1.84
AV. lbs. feed per lb. of gain		
Trial II	304.4	316.4
Trial III	303.2	325.2
AV.	303.8	320.8

SUMMARY

Growing-finishing pigs appeared to respond to dietary zinc proteinate with increased daily gain and improved feed efficiency when they were eating a diet approximating 16% in crude protein content. There was no measurable response when the diet contained either approximately 13% or approximately 20% crude protein.

In trials II and III the addition of 5% alfalfa meal to diets approximating 13% crude protein appeared to increase average daily gain and improve feed efficiency. There was no such effect when the diets contained approximately 16% crude protein.

Pigs fed diets approximating 13% crude protein gained slower and were somewhat less efficient than pigs fed at a protein level of approximately 16% crude protein.