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## CALCIUM AND PHOSPHORUS FOR CROWING-FINISHING SPECIFIC-PATHOGEN-FREE PIGS

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Since the introduction of SPF pigs on farms, nutritionists have wondered if the nutrient requirements of the pigs are similar to non-SPF pigs. Theoretically if the animal does not have a physiological stress, such as disease, and a good environment is provided, he should gain faster and thereby need more daily nutrients. However, the healthy, fast gaining pig will normally eat more feed in order to meet his nutrient requirements. Consequently, the nutrient requirements in terms of amount of nutrient per pound of total feed should generally be the same for SPF and non-SPF pigs. The word generally is emphasized because a specific requirement of a microingredient(s) might be slightly different. Already a few swine producers of SPF pigs have questioned the calcium and phosphorus requirements. Their concern logically developed from observations of stiff legs and more feet and leg trouble with the SPF pigs than was observed in the herd before repopulating with SPF pigs. With these observations in mind, two field trials with various levels of calcium and phosphorus in the ration were initiated at the Eureka Experiment Station.

### Experimental Procedure

Two hundred one crossbred specific-pathogen-free pigs have been used in two trials. The experiment treatments were:

Trial 1	Lots 1 and 3	Calcium (Ca) and phosphorus (P) at NRC recommended level (calculated)
	Lots 2 and 4	Ca and P each between 0.2 and 0.3% above NRC recommended level (calculated)
Trial 2	Lots 1 and 5	Ca and P below NRC recommended level
	Lots 2 and 6	Ca and P at NRC recommended level
	Lots 3 and 7	Ca and P each 0.3% above NRC recommended level
	Lots 4 and 8	Ca and P each 0.6% above NRC recommended level

Corn-soybean meal rations were used in both trials. At approximately 110 pounds body weight, the percent crude protein in the rations was decreased and the calcium and phosphorus were changed to comply with NRC's recommended levels. The rations are shown in tables 1 and 2. Zinc was added to the ration as a part of the salt mixture and provided 40 parts per million of zinc. Feed and water were provided ad libitum. The pigs were confined in dirt lots for both trials. Trial 1 was conducted during the winter months of 1962-63 and trial 2 was conducted during the summer months of 1963.

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Appreciation is expressed to personnel at the station for their cooperation and assistance on this project.

Table 1. Composition of Rations Used in Trial 1

	Ca and P at recommended level		High Ca and P	
	To 110 lb.	110 to 200 lb.	To 110 lb.	110 to 200 lb.
	lb.	lb.	lb.	lb.
Gr. yellow shelled corn	780.0	859.0	759.0	848.0
Soybean meal (44%)	144.0	70.0	155.0	71.0
Dehydrated alfalfa meal (17%)	50.0	50.0	50.0	50.0
Dicalcium phosphate	11.0	7.0	21.0	18.0
Limestone	6.0	6.0	6.0	5.0
T.M. salt	5.0	5.0	5.0	5.0
Vitamin-antibiotic premix <sup>1</sup>	4.50	3.75	4.50	3.75
	1000.5	999.75	1000.5	999.75
<u>Calculated analysis</u>				
Crude protein, %	15.13	12.50	15.15	12.53
Calcium, %	0.65	0.52	0.91	0.79
Phosphorus, %	0.51	0.40	0.69	0.61
<u>Chemical analysis</u>				
Crude protein, %	15.74	--	16.20	--
Calcium, %	.56	--	.89	--
Phosphorus, %	.50	--	.68	--

<sup>1</sup> Vitamins provided in the premix were: 1 mg. riboflavin, 2 mg. pantothenic acid, 4.5 mg. niacin, 5 mg. choline, 5 mcg. B<sub>12</sub>, 300 I.U. vitamin A and 70 I.U. vitamin D per pound of ration. Two mg. of tylosin and 1.0 mg. of tylosin per pound of ration was provided in the grower and finisher rations, respectively.

Table 2. Composition of Rations Used in Trial 2

C and P Treatment	Below NRC		NRC		0.3% Above NRC		0.6% Above NRC	
	To 110 lb.	110 to 200 lb.	To 110 lb.	110 to 200 lb.	To 110 lb.	110 to 200 lb.	To 110 lb.	110 to 200 lb.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Gr. yellow shelled corn	787	881	779	872	761	856	744	839
Soybean meal (44%)	170	80	170	82	175	85	180	90
Dehydrated alfalfa meal (1.7%)	25	25	25	25	25	25	25	25
Dicalcium phosphate	0	0	10	7	27	23	43	40
Limestone	10	7	8	7	4	4	0	0
T.M. salt	5	5	5	5	5	5	5	5
Vitamin-antibiotic premix <sup>1</sup>	3	2	3	2	3	2	3	2
<u>Calculated analysis</u>								
Crude protein, %	15.19	11.96	15.15	11.97	15.18	11.96	15.23	12.00
Calcium, %	0.47	0.30	0.65	0.52	0.95	0.82	1.22	1.11
Phosphorus, %	0.32	0.28	0.50	0.41	0.80	0.70	1.09	1.00
<u>Chemical Analysis</u>								
Crude protein, %	15.35	11.98	15.49	11.61	14.97	12.27	17.15	11.50
Calcium, %	0.55	0.44	0.66	0.68	0.81	0.76	1.11	1.03
Phosphorus, %	0.36	0.34	0.55	0.43	0.79	0.65	1.17	1.02

<sup>1</sup> Vitamins provided in the premix were 1 mg. riboflavin, 2 mg. pantothenic acid, 4.5 mg. niacin, 5 mg. choline, 5 mcg. B<sub>12</sub>, 1000 I.U. vitamin A and 200 I.U. vitamin D per pound of ration. One mg. of chlortetracycline and 0.5 mg. of chlortetracycline were provided in the grower and finisher rations, respectively.

### Results

The results of these trials indicate the levels of calcium (Ca) and phosphorus (P) as recommended by the National Research Council are adequate for normal daily gains and feed conversion. All pigs on the experiment appeared normal and healthy. In trial 2, pigs fed less than the established Ca and P requirements did not have any apparent deficiency symptoms, while the pigs fed high calcium levels did not have any evidence of parakeratosis.

In trial 1, average daily gains of the control pigs and pigs fed more Ca and P were essentially the same for both groups. Feed consumption by the two treatment groups did not follow a consistent pattern between the two replications, but all values for both treatments indicated good feed consumption. Pigs fed more Ca and P required approximately 0.28 pound (7.6%) more feed per pound of gain than the control pigs.

In trial 2, pigs fed the recommended levels of Ca and P had the best performance. These pigs gained 6.6%, 2.3% and 3.5% faster than pigs fed less than or approximately 0.3% or 0.6% more Ca and P than recommended, respectively. On the basis of daily gains, the low levels of Ca and P probably were not adequate for optimum gains, however, a more detailed study would be necessary for complete clarification.

Feed consumption was good for all groups. Pigs given the higher Ca and P rations actually ate more feed per day than pigs fed the lower Ca and P rations. The reason for this is not known. Perhaps the energy in the rations was lowered sufficiently by the substitution of corn so that the pigs ate more in order to meet their energy requirement. Another possibility is the palatability of the rations was improved, but the former possibility seems more logical than the latter.

Feed required per pound of gain was adversely affected by inadequate or excessive quantities of Ca and P in the rations. Both trials suggested high Ca and P levels in the ration will cause poorer feed utilization by the growing-finishing pig.

### Summary

1. The results of two field trials indicate the current recommended levels of calcium and phosphorus are adequate for growing-finishing specific-pathogen-free pigs.
2. Pigs fed high levels of Ca did not have parakeratosis.
3. Feed efficiency was adversely affected by either inadequate or excessive Ca and P in the ration.

Table 3. Results of Trial 1

	Calcium and Phosphorus at Recommended Level	High Levels of Calcium and Phosphorus
Total no. pigs (both reps)	22	23
Av. days on experiment		
Rep 1	77.8	76.7
Rep 2	81.0	76.5
Av. final wt., lb.		
Rep 1	214.4	211.1
Rep 2	211.6	206.0
Av. daily gain, lb.		
Rep 1	1.83	1.81
Rep 2	<u>1.74</u>	<u>1.76</u>
Av.	1.78	1.79
Av. daily feed, lb.		
Rep 1	7.13	6.62
Rep 2	<u>6.14</u>	<u>6.85</u>
Av.	6.62	6.73
Av. feed/lb. gain, lb.		
Rep 1	3.95	4.01
Rep 2	<u>3.42</u>	<u>3.91</u>
Av.	3.68	3.96

The range in average initial weights for all lots was 70.7 to 72.9 lb.

Table 4. Results of Trial 2

Calcium and Phosphorus Levels	Below NRC	Recommended NRC	Approx. 0.3% Above NRC	Approx. 0.6% Above NRC
Total no. pigs <sup>1</sup>	40	40	37	39
Av. initial wt., lb.				
Group 1	70.5	70.7	70.7	70.6
Group 2	43.0	42.5	42.7	42.7
Av. final wt., lb.				
Group 1	220	225	219	222
Group 2	210	214	218	208
Av. daily gain, lb.				
Group 1	1.74	1.83	1.75	1.81
Group 2	<u>1.63</u>	<u>1.76</u>	<u>1.74</u>	<u>1.68</u>
Av.	1.67	1.78	1.74	1.72
Av. daily feed, lb.				
Group 1	6.84	6.71	7.07	7.15
Group 2	<u>5.82</u>	<u>5.80</u>	<u>6.06</u>	<u>6.12</u>
Av.	6.28	6.22	6.53	6.58
Av. feed/lb. gain, lb.				
Group 1	3.95	3.67	4.05	3.96
Group 2	<u>3.59</u>	<u>3.33</u>	<u>3.51</u>	<u>3.69</u>
Av.	3.76	3.49	3.76	3.81

<sup>1</sup> Twenty pigs per pen were initially started in each group. Four pigs were removed from the experiment for reasons unrelated to the treatments.