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Antibiotics in Growing and Fattening Pig Rations

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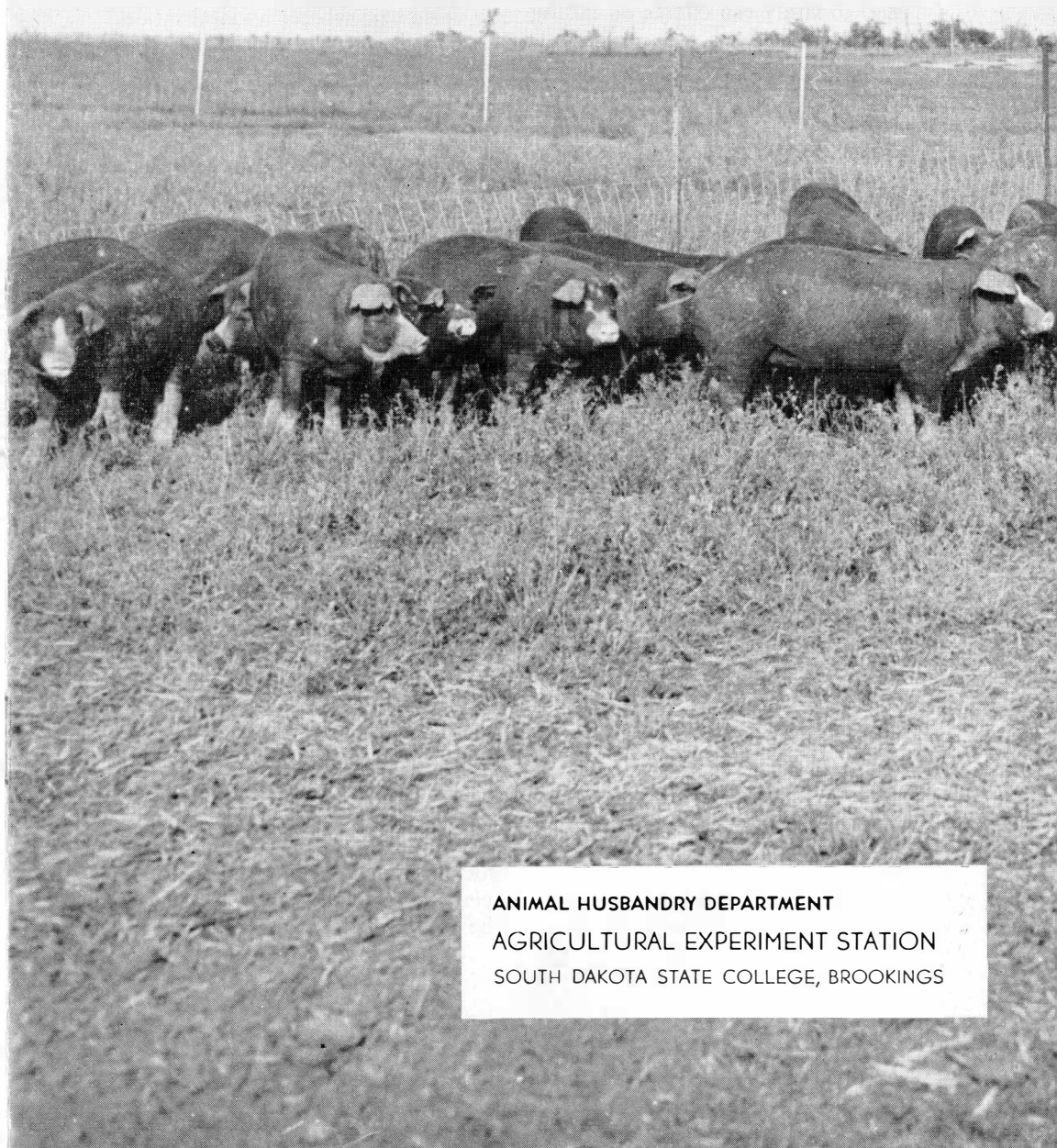
IN GROWING AND FATTENING PIG RATIONS



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Summary

Five feeding trials are reported in which 327 weanling pigs were used to study the effects of adding various antibiotics to growing-fattening pig rations.

Aureomycin and terramycin increased rate of gain significantly when added to the protein supplement of growing-fattening pigs. When the antibiotics were removed at 135 pounds, the pigs made gains comparable to the control group. Pigs fed antibiotics for the entire feeding period made faster and more efficient gains than the controls or those which received antibiotics up to 135 pounds. It appears that the antibiotic should not be withdrawn from the ration at any time during the growing-fattening period.

In two dry-lot trials and one pasture trial there was no marked advantage when combinations of antibiotics were used compared to the use of aureomycin alone. Slight but insignificant increases in rate of gain were shown by combinations of aureomycin and penicillin, penicillin and streptomycin, and penicillin and terramycin. A combination of aureomycin and terramycin did not result in any growth stimulation in two trials.

In one trial mixed rations were used. The addition of penicillin to this ration resulted in a significant increase in average daily gain. This was also true when the basal ration was supplemented with five B-vitamins. The vitamin supplemented basal was further improved by the addition of penicillin. The efficiency of feed utilization was very similar in this trial but favored the ration supplemented with B-vitamins and penicillin.

Rations containing 18-14, 16-12 or 14-10 percent protein were all improved by supplements of penicillin, B-vitamins, and a combination of B-vitamins and penicillin. The low protein ration appeared to be more deficient in B-vitamins than the rations of higher protein content. Faster and more efficient gains were obtained when pigs were fed the medium protein ration supplemented with both B-vitamins and penicillin.

It is concluded that aureomycin, terramycin, and penicillin are effective antibiotics for growing-fattening pigs. Although in the trials reported here they were all somewhat inconsistent in their effect on feed efficiency, similar results were obtained from each of these antibiotics in increasing rate of gain and feed consumption and decreasing the length of the feeding period.

Antibiotics

in Growing and Fatting Pig Rations

RICHARD C. WAHLSTROM[1]

Many South Dakota farmers depend upon swine production for a large portion of their yearly income. According to the South Dakota Crop and Livestock Reporting Service, approximately 19 percent of the total cash farm income of South Dakota is obtained from the marketing of hogs. This means a return of over 100 million dollars annually to South Dakota farmers.

A successful hog business is dependent upon good swine feeding, breeding, and management practices. This bulletin deals with only one of these practices—feeding—and with only one phase of feeding, the inclusion of antibiotics in growing and fattening pig rations.

Since 1949 when the first indications of the effects of antibiotics on the growth of pigs appeared, many workers have been engaged in this field of research. In order to obtain answers to some of the questions which might be asked by South Dakota swine producers, a series of trials were conducted at the South Dakota Agricultural Experiment Station beginning in 1951. The purposes of this experiment were to determine (1) the effects of discontinuing antibiotic supplementation during the growing-fattening period, (2) the value of combining more than one antibiotic in rations for growing-fattening pigs, and (3) the effect of an antibiotic and B-vitamins in rations of different protein content.

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Effects of Discontinuing Antibiotic Supplementation

The Trial

In this trial, conducted during the summer of 1951, 75 purebred pigs averaging almost 50 pounds were allotted according to litter, weight, breed, and sex into five comparable lots of 15 pigs each. The pigs were confined to concrete pens. Feed and water were offered free-choice.

The pigs in Lot 1 (control lot) were self-fed a basal ration free-choice consisting of the following ingredients: shelled No. 2 yellow corn; a protein supplement consisting of 42 pounds soybean oil meal, 30 pounds tankage (60 percent protein) and 28 pounds ground sun-cured alfalfa hay; and a simple mineral mixture consisting of 2 parts ground limestone, 2 parts steamed bone meal, and 1 part common salt.

Three pounds of alfalfa hay in the protein supplement were replaced by 3 pounds of an aureomycin supplement (Aurofac) in Lots 2 and 3. The pigs in Lot 2 received this supplement throughout the trial, while those in Lot 3 were fed this supplement only to a weight of approximately 135 pounds after which they received the basal ration.

For Lots 4 and 5, 1 pound of alfalfa hay in the protein supplement was replaced by 1 pound of a terramycin supplement (TM-5). The pigs in Lot 4 received the terramycin throughout the trial, while it was discontinued in Lot 5, and the pigs were fed the basal ration after reaching approximately 135 pounds.

Results and Discussion

The data from this trial are presented in Tables 1, 2, and 3. Table 1 summarizes the results of the first 49 days of the experiment. During this early part of the feeding period Lots 2, 3, 4, and 5, which were receiving aureomycin or terramycin, all gained much faster than did the control lot. This difference in rate of gain between Lot 1 and the other lots was highly significant.

The antibiotic-fed pigs consumed approximately 18 percent more feed per day than did the control group, Lot 1. This difference was due to a larger daily consumption of corn as they actually consumed less protein supplement daily. An improvement in feed efficiency of about 8 percent was shown by those pigs fed antibiotics. There was very little difference between lots in the amount of corn required per unit of gain but the pigs fed antibiotics consumed almost 20 pounds less protein supplement per 100 pounds of gain.

During the period from 135 pounds to market weight (Table 2) the pigs receiving aureomycin or terramycin, Lots 2 and 4, continued to gain faster than the control lot. However, this difference in rate of gain was not as great as during the initial growing-fattening period. Removing the antibiotic from the feed in Lots 3 and 5 when the pigs

weighed 135 pounds resulted in a slower rate of gain from this time to market weight than when the antibiotic was included in the ration. There was no significant difference in rate of gain between the control lot and Lots 3 and 5 during this period. Lot 1 gained 3 percent faster than did the pigs which received terramycin to 135 pounds (Lot 5) and 4 percent slower than those which received aureomycin

Table 1. Feeding an Antibiotic Supplement to Pigs During the Initial 49-Day Feeding Period (To Approximately 135 Pounds)

Items Compared	Lot 1 Basal	Lot 2 Aureomycin to 225 Lbs.	Lot 3 Aureomycin to 135 Lbs.	Lot 4 Terramycin to 225 Lbs.	Lot 5 Terramycin to 135 Lbs.
No. of pigs	15	15	15	15	15
Av. number days on feed	49	49	49	49	49
Av. initial weight, lbs.	49.7	49.5	50.5	50.1	50.5
Av. final weight, lbs.	116.1	136.7	134.5	136.9	132.7
Av. daily gain, lbs.	1.36	1.78*	1.71*	1.77*	1.68*
Av. daily feed consumed, lbs.					
Shelled corn	3.43	4.45	4.44	4.26	4.04
Protein supplement	0.96	0.92	0.86	0.92	0.84
Total feed	4.39	5.37	5.30	5.18	4.88
Feed consumed per 100 lbs. of gain, lbs.					
Shelled corn	252.9	250.3	258.8	240.5	241.3
Protein supplement†	71.0	51.9	50.4	52.2	50.2
Total feed‡	323.9	302.2	309.2	292.7	291.5
Antibiotics consumed per lb. of total feed					
Aureomycin, mg.	———	9.25	8.76	———	———
Terramycin, mg.	———	———	———	8.88	8.61

* Significantly greater at the 1 percent level than Lot 1.
†42 pounds soybean oil meal, 30 pounds tankage, 28 pounds ground sun-cured alfalfa hay.
‡Pigs in all lots had access to a mineral supplement. See Table 3 for total consumption.

Table 2. Results of Discontinuing Antibiotic Feeding to Pigs During the Growing-Fattening Period (Approximately 135-225 Pounds)

Items Compared	Lot 1 Basal	Lot 2 Aureomycin to 225 Lbs.	Lot 3 Aureomycin to 135 Lbs.	Lot 4 Terramycin to 225 Lbs.	Lot 5 Terramycin to 135 Lbs.
No. of pigs	15	15	15	14*	15
Av. number days on feed	62	45	48	45	53
Av. initial weight, lbs.	116.1	136.7	134.5	139.2	132.7
Av. final weight, lbs.	228.3	227.5	225.2	225.2	225.9
Av. daily gain, lbs.	1.81	2.02†	1.89	1.91	1.76
Av. daily feed consumed, lbs.					
Shelled corn	6.35	6.84	6.55	6.55	6.35
Protein supplement	0.78	0.80	0.80	0.95	0.82
Total feed	7.13	7.64	7.35	7.50	7.17
Feed consumed per 100 lbs. of gain, lbs.					
Shelled corn	350.3	339.1	347.4	342.7	361.0
Protein supplement‡	43.0	39.7	42.3	49.8	46.4
Total feed‡	393.3	378.8	389.7	392.5	407.4
Antibiotics consumed per lb. of total feed					
Aureomycin, mg.	———	5.65	———	———	———
Terramycin, mg.	———	———	———	6.33	———

*One pig died during this period. The data are not included.
†Significantly greater at the 1 percent level than Lots 1 and 5.
‡See footnotes Table 1.

during the initial phase (Lot 3).

As noted in the first period the pigs which received antibiotics from 135 pounds to market weight consumed more feed per day than did those which received the basal ration only. Feed efficiency was variable during this period but favored Lot 2 which received the aureomycin supplement.

The results for the entire feeding period from weaning to market weight are presented in Table 3. The lots receiving antibiotics during the entire feeding period had the fastest rate of gain, which accounted for a shorter feeding period, and they also required the least feed per 100 pounds gain. The lots receiving the antibiotic supplementation to 135 pounds ranked next in both rate and efficiency of gain and the control lot was the poorest.

From these results it is obvious that the feeding of aureomycin or terramycin produced very definite advantages as to rate of gain and feed efficiency. The results indicate that for the most rapid rate of gain the antibiotic should be included in the ration from weaning to market weight. If the antibiotic is removed during the growing-fattening period a reduction in rate of gain will occur. However, there is still an advantage of feeding the antibiotic during the early growth phase over not feeding an antibiotic at all. These results also show a reduction in protein intake which may be due to more efficient protein utilization by those pigs fed antibiotics.

Table 3. Summary of Results of Discontinuing Antibiotic Supplementation During the Growing-Fattening Period

Items Compared	Lot 1 Basal	Lot 2 Aureomycin to 225 Lbs.	Lot 3 Aureomycin to 125 Lbs.	Lot 4 Terramycin to 225 Lbs.	Lot 5 Terramycin to 125 Lbs.
Number of pigs	15	15	15	14	15
Av. number days on feed	111	94	97	94	102
Av. initial weight, lbs.	49.7	49.5	50.5	51.7	50.5
Av. final weight, lbs.	228.3	227.5	225.2	225.2	225.9
Av. daily gain, lbs.	1.61	1.89*	1.80*	1.85*	1.72
Av. daily feed consumed, lbs.					
Shelled corn	5.06	5.60	5.48	5.37	5.24
Protein supplement	0.86	0.87	0.83	0.94	0.83
Mineral mixture	0.03	0.04	0.03	0.03	0.03
Total feed	5.95	6.51	6.34	6.34	6.10
Feed consumed per 100 lbs. of gain, lbs.					
Shelled corn	314.2	295.6	304.8	291.2	304.9
Protein supplement†	53.4	45.7	46.2	51.0	48.2
Mineral mixture‡	2.1	1.9	1.9	1.8	1.7
Total feed	369.7	343.2	352.9	344.0	354.8

*Significantly greater at the 1 percent level than Lot 1.

†See Table 1 footnote.

‡2 parts ground limestone, 2 parts steamed bone meal, 1 part salt.

Antibiotic Combinations

The Trial

A total of 156 weanling pigs were used in the three trials involving antibiotic combinations during the summer and fall of 1953. The pigs were allotted as equally as possible into four lots of 12 pigs each in two dry lot trials, and four lots of 15 pigs each in one trial conducted on pasture.

In all three trials (Tables 4, 5, and 6) the pigs were fed free-choice shelled yellow corn, a protein supplement, and a simple mineral mixture. For the pigs in dry lot the protein supplement was made up of 2 parts by weight soybean meal, 2 parts tankage, and 1 part ground alfalfa hay. In the pasture trial the alfalfa hay was omitted from the protein supplement.

The antibiotics were added to the protein supplement in all trials. Where two antibiotics were used each was included at a level of one-half of the amount which would have been used had that antibiotic been fed alone. The antibiotic and combinations used were aureomycin, aureomycin and penicillin, aureomycin and terramycin, penicillin and terramycin, and penicillin and streptomycin.

Results and Discussion

Results from the first trial of feeding antibiotic combinations in dry lot are summarized in Table 4. The pigs fed aureomycin (Lot 2) and those fed a combination of aureomycin and penicillin (Lot 3) gained slightly faster than those in the control lot. Lot 4, which received a combination of aureomycin and terramycin, gained slower than Lot 1. None of the slight differences are statistically significant at the 5 percent level.

The amount of feed required to produce each 100 pounds of gain was satisfactory in all lots though there appears to be a slight difference in favor of the pigs receiving the aureomycin supplementation.

The data for these same antibiotic combinations in rations for pigs on pasture are shown in Table 5. The differences in rate of gain by the pigs fed aureomycin (Lot 2) or aureomycin and penicillin (Lot 3) compared to the controls are similar to those in the previous dry-lot trial. However, due to more uniform performance in this trial, the differences were statistically significant.

As in the dry-lot trial, the pigs receiving a combination of aureomycin and terramycin did not exhibit any growth response over the control group. The failure of this combination to produce a growth response is rather surprising since each antibiotic will generally cause a growth response when fed alone. It appears likely that the levels of the individual antibiotics were too low to produce any growth response.

In Table 6 is a summary of the average performance of the pigs

Table 4. Results of Feeding Antibiotic Combinations to Growing-Fattening Pigs in Dry Lot, First Trial

Items Compared	Lot 1 Basal	Lot 2 Aureomycin*	Lot 3 Aureomycin+ Penicillin†	Lot 4 Aureomycin+ Terramycin†
Number of pigs	12	12	11‡	12
Average number of days on feed	116	112	114	124
Average initial weight, lbs.	39.3	39.2	40.2	39.2
Average final weight, lbs.	199.5	203.8	205.3	202.2
Average daily gain, lbs.	1.38	1.47	1.44	1.31
Av. daily feed consumed, lbs.				
Shelled corn	4.33	4.50	4.69	4.33
Protein supplement	0.65	0.71	0.63	0.56
Mineral mixture	0.04	0.04	0.05	0.06
Total feed	5.02	5.25	5.37	4.95
Feed consumed per 100 lbs. of gain, lbs.				
Shelled corn	314.6	305.2	325.0	330.4
Protein supplement§	47.5	47.8	43.7	42.9
Mineral mixture‖	3.2	2.5	3.3	4.6
Total feed	365.2	355.5	372.0	377.9
Antibiotics consumed per lb. of total feed, mg.	———	3.66	3.17	3.05

*Added to protein supplement at level of 54 grams per ton.

†Equal parts of the antibiotics supplying 54 grams per ton of supplement.

‡One unthrifty pig removed and not included in results.

§40 pounds soybean oil meal, 40 pounds tankage, 20 pounds sun-cured alfalfa hay.

‖2 parts steamed bone meal, 2 parts ground limestone, 1 part trace mineralized salt.

Table 5. Effects of Antibiotic Combinations Fed to Growing-Fattening Pigs on Pasture.

Items Compared	Lot 1 Basal	Lot 2 Aureomycin*	Lot 3 Aureomycin+ Penicillin†	Lot 4 Aureomycin+ Terramycin‡
Number of pigs	15	15	13§	15
Average number days on feed	108	102	101	110
Average initial weight, lbs.	43.6	43.4	43.9	43.4
Average final weight, lbs.	203.1	201.7	204.8	201.6
Average daily gain, lbs.	1.47	1.56‖	1.59‖	1.44
Average daily feed consumed, lbs.				
Shelled corn	4.32	4.56	4.66	3.81
Protein supplement	0.79	0.95	0.91	0.86
Mineral mixture	0.02	0.02	0.03	0.02
Total feed	5.13	5.53	5.60	4.69
Feed consumed per 100 lbs. of gain, lbs.				
Shelled corn	293.8	293.1	293.0	264.2
Protein supplement#	53.5	61.1	57.4	59.4
Mineral mixture**	1.5	1.5	1.7	1.5
Total feed	348.8	355.7	352.1	325.1
Antibiotics consumed per lb. of total feed, mg.	———	5.15	4.10	5.5

*Added to protein supplement at level of 60 grams per ton.

†Thirty grams of aureomycin and 20 grams of penicillin added to each ton of supplement,

‡Equal parts of aureomycin and terramycin supplying 60 grams of antibiotics per ton of supplement.

§Two pigs died from non-nutritional causes. The data from these pigs are not included.

‖Significantly greater at the 5 percent level than Lot 1.

#Equal parts soybean oil meal and tankage.

**Same as in Table 4.

in the second dry-lot trial conducted during the fall of 1953. Again no significant differences in daily gains resulted from the feeding of any of the antibiotics. However, all lots receiving antibiotics gained slightly faster than did the controls. The pigs in all lots gained considerably faster than did the pigs in the other two trials. This may have been due in part to the heavier initial weight of the pigs used in this trial and to the more favorable weather conditions.

Very little difference in feed efficency was noted between Lots 1, 2, and 3. However, Lot 4, receiving the penicillin and streptomycin combination, required 6.7 percent (23.1 pounds) less feed per 100 pounds of gain than did the control lot. This difference in feed saving was mainly a saving of protein supplement. A similar reduction in protein consumption was noted in Lot 2 to which aureomycin was fed.

The data indicate that an increase in average daily gain continues to be realized when a effective antibiotic, or combination of antibiotics is added to the ration. That the increase in average daily gain was less during these trials in 1953 than those conducted in 1951 is consistent with the finding of other experiment stations. It is possible that the use of antibiotics has improved the general health of the herd so that the average growth was better than in previous years.

Results obtained from these trials do not indicate that a combination of antibiotics is any better than a single one when the total amount fed is the same.

Table 6. Results of Feeding Antibiotic Combinations to Growing-Fattening Pigs in Dry Lot, Second Trial

Items Compared	Lot 1 Basal	Lot 2 Aureomycin*	Lot 3 Penicillin+ Terramycin†	Lot 4 Penicillin+ Streptomycin‡
Number of pigs	12	12	12	12
Average number days on feed	94	87	89	88
Average initial weight, lbs.	49.5	49.8	49.8	49.7
Average final weight, lbs.	204.9	202.0	199.3	204.3
Average daily gain, lbs.	1.65	1.75	1.69	1.77
Average daily feed consumed, lbs.				
Shelled corn	4.71	5.18	4.72	4.81
Protein supplement	0.90	0.80	0.89	0.77
Mineral mixture	0.04	0.05	0.05	0.05
Total feed	5.64	6.03	5.66	5.63
Feed consumed per 100 lbs. of gain, lbs.				
Shelled corn	284.8	295.8	279.9	272.0
Protein supplement§	54.4	45.4	53.0	43.6
Mineral mixture§	2.7	2.6	2.9	3.0
Total feed	341.9	343.8	335.8	318.8
Antibiotics consumed per lb. of total feed, mg.	.....	5.3	5.7	4.9

*Added to the protein supplement at a level of 80 grams per ton.

†Thirty-two grams of penicillin and 40 grams of terramycin added to each ton of supplement.

‡Thirty-two grams of penicillin and 40 grams of streptomycin added to each ton of supplement.

§Same as in Table 4.

Penicillin and B-Vitamins for Pigs Fed Different Levels of Protein

The Trial

Twenty-four lots of four Duroc pigs each received 18, 16, and 14 percent protein rations from weaning to 100 pounds at which time the protein content was reduced to 14, 12, and 10 percent respectively. On each protein level two lots of pigs were fed the basal ration alone, two lots received a B-vitamin supplement, two lots were given a penicillin supplement and two lots received a supplement containing both B-vitamins and penicillin.

The mixed basal ration was composed of ground yellow corn, solvent soybean oil meal, 60 percent digester tankage, steamed bone meal, trace mineralized salt, and a vitamin A and D supplement. The soybean meal and tankage were mixed in a 2:1 ratio.

Penicillin was added at a level of 10 grams per ton of feed and the B-vitamin supplement supplied the following per ton of feed: 12 grams niacin, 10 grams pantothenic acid, 2 grams riboflavin, 500 grams choline, and 8 milligrams vitamin B_{12}.

Results and Discussions

The results of this trial are presented in Table 7 and 8. In Table 7 is shown the effects of penicillin supplementation of rations varying in vitamin content. The pigs fed the penicillin supplement (Lot 2) gained 13.6 percent faster, reached market weight 11 days sooner, and ate 14.9 percent more feed daily than pigs fed the basal ration only (Lot 1). A similar increase in rate of gain and feed consumption was produced when the basal ration was supplemented with B-vitamins (Lot 3 compared to Lot 1).

In Lot 4 the addition of penicillin to the vitamin supplemented basal also resulted in increased gains and feed consumption when compared with Lot 3. The percentage increase in this instance was 8.7 and 5.7 percent in rate of gain and feed consumption respectively. Approximately 5 percent less feed was required by the pigs in Lot 4 than by those in the other three lots.

The type of ration often influences the degree of response obtained from feeding antibiotics. Also, it has been shown that in most cases pigs fed the more nutritionally adequate ration will respond less to antibiotic supplementation than those on a poorer ration. Although poor rations may be improved considerably by antibiotics, they are still incapable of top performance as a comparison of Lots 2 and 4 indicates.

A possible explanation for the greater growth response to penicillin on the poor ration used in this experiment may be that the basal ration fed to Lot 1 was deficient in some of the B-vitamins. This appears very likely since Lot 3, which

was given the same ration except it included a B-vitamin supplement, gained 0.2 pounds per day faster than Lot 1. It is possible then that the penicillin may have had a "sparing effect" on the pigs' requirements for certain vitamins and therefore would result in a greater growth response when added to the basal ration than when added to the vitamin supplemented basal ration which should have contained adequate amounts of the B-vitamins.

The results of supplementing rations varying in protein content with penicillin and/or B-vitamins are shown in Table 8. The rate of gain of the pigs fed the control, or unsupplemented, ration was about equal on the high and medium protein rations but considerably less on the low protein ration. When these rations were supplemented with penicillin there was a marked response at all protein levels but the low protein ration again produced the slowest rate of gain.

Supplementing the rations with B-vitamins resulted in essentially equal growth rates at all protein

Table 7. Results of Penicillin Supplementation to Mixed Rations Fed to Growing-Fattening Pigs in Dry Lot

Items Compared	Lot 1 Basal	Lot 2 Basal + Penicillin*	Lot 3 Vitamin Supplemented Basal†	Lot 4 Basal + Vitamin + Penicillin
Number of pigs	24	24	22‡	24
Average number days on feed	121	110	110	102
Average initial weight, lbs.	29.5	29.6	29.4	29.6
Average final weight, lbs.	199.2	204.7	206.1	206.7
Average daily gain, lbs.	1.40	1.59§	1.60	1.74§
Average daily feed consumption, lbs.	4.7	5.4	5.3	5.6
Feed consumed per 100 lbs. gain, lbs.	336	338	333	321

*10 gms. per ton of total feed.
†12 gms. niacin, 10 gms. pantothenic acid, 2 gms. riboflavin, 500 gms. choline, and 8 mg. B_{12} per ton of total feed.
‡Two pigs died from poisoning.
§Lot 2 significantly greater than Lot 1; and Lot 4 significantly greater than Lot 3, both at the 1 percent level.

Table 8. Results of Penicillin and B-Vitamin Supplementation of Rations Varying in Protein Content*

Treatment	Control	Penicillin†	B-Vitamins†	B-Vitamins and Penicillin
Protein Level (%)		**Average Daily Gain (Lbs.)‡**		
18-14	1.43	1.70	1.62	1.76
16-12	1.46	1.60	1.59	1.78
14-10	1.33	1.49	1.60	1.67
		Average Daily Feed (Lbs.)		
18-14	4.9	5.9	5.6	5.4
16-12	4.8	5.2	5.0	5.4
14-10	4.4	5.0	5.4	5.9
		Feed Consumed Per 100 Pounds Gain (Lbs.)		
18-14	340	350	348	309
16-12	333	328	316	302
14-10	336	337	335	353

*Two lots of 4 pigs each per treatment.
†Same as Table 7.
‡Average initial weight 30 lb.

levels. This indicates that the low protein ration was probably lacking in some of the B-vitamins and not necessarily deficient in amount or quality of protein for gains of this magnitude. The best performance was exhibited by those pigs fed the B-vitamin and penicillin supplement. Again this supplement caused a growth response at all protein levels although the magnitude of the response was less. The smaller response and lower rate of gain at the lowest protein level when supplemented with B-vitamins and penicillin indicates that the 14-10 percent protein level is too low for maximum gains.

Each of the supplements fed resulted in increased feed consumption over the control pigs. Feed required per 100 pounds gain was variable between groups. It was noted that some lots persisted in wasting more feed than others and since no attempt was made to determine wastage this may account for some of the variation. All lots were quite efficient with the high and medium protein lots supplemented with both B-vitamins and penicillin being particularly efficient in feed conversion.

The most economical ration fed in this experiment was the medium protein ration supplemented with B-vitamins and penicillin. The pigs fed this ration also had the fastest and most efficient rate of gain.

An adequate explanation as to why the antibiotics stimulate growth cannot be given. It appears likely that at least two factors are involved. It is believed that antibiotics aid in reducing disease and scouring difficulties and bring about improvement in rate of gain. This is known as the "disease level" theory.

The second factor which has been proposed is the "nutrient sparing" theory. This has been discussed in this bulletin in regards to a vitamin sparing action.

Others have also proposed that antibiotics spare protein. The trials reported here in which less protein supplement was consumed by the pigs receiving an antibiotic in their rations would tend to support that theory; however, the last trial with different levels of protein in a mixed ration indicated little if any protein "sparing effect" due to the penicillin.