3. For 100 pounds gain, Lot 1 required 311 pounds of shelled old corn and 66 pounds of protein supplement. Lot 2 required 349 pounds of ground old corn and 74 pounds of supplement. Lot 3 required 354 pounds of new corn and 61 pounds of supplement. All three lots of pigs made excellent use of their corn in making gains. The shelled old corn lot was a little more efficient, although, as noted above, they consumed less feed daily.

It may be concluded from this experiment that old government-stored corn may be expected to produce pork in the feed lot as efficiently as a new crop, when both have similar quality.

The Maximum Use of Alfalfa Meal in Protein Supplemental Mixtures for Fattening Fall Pigs in the Dry Lot.

PROJECT 110

C. E. Aubel

This experiment was designed to secure information on maximum use of alfalfa meal in protein supplemental mixtures for pigs in dry lot. The experiment on next page reports similar information from pigs on alfalfa pasture.

In this 1954-55 test four lots of fall-farrowed pigs were self-fed corn in dry lot. Each lot received different amounts of alfalfa meal in protein supplements. Lot 1 received an animal plant protein mixed supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal. Lot 2 received one of 4 parts tankage, 4 parts soybean meal, and 2 parts alfalfa meal. Lot 3 received one of 4 parts tankage, 4 parts soybean meal, and 3 parts alfalfa meal; and Lot 4 received one of equal parts tankage and alfalfa meal.

Results are given in Table 25.

Table 25.—Maximum use of alfalfa meal in protein supplemental mixtures for fattening fall pigs in the dry lot.

(December 7, 1954, to March 15, 1955—98 days)

	Shelled corn, self-fed			
Protein mixed supplement fed	4 parts tankage, 4 parts S.B.M., 1 part C.S.M., 1 part alf. meal	4 parts tankage, 4 parts S.B.M., 2 parts alf. meal	4 parts tankage, 4 parts S.B.M., 3 parts alf. meal	5 parts tankage, 5 parts alf. meal
Lot number	1	2	3	4
Number pigs in lot	9	9	9	9
Av. initial wt. per pig	53.88	55.36	53.11	52.77
Av. final wt. per pig	205.88	208.37	198.33	203.66
Av. total gain per pig	152.00	153.01	145.22	150.89
Av. daily gain per pig	1.55	1.56	1.47	1.53
Av. daily ration per pig:				
Corn	5.49	5.13	4.75	5.76
Protein supplement	.95	.88	.78	.70
Feed per 100 lbs. gain per pig:				
Corn	354.53	369.66	373.94	374.44
Protein supplement	61.40	56.77	53.58	46.02

Observations

1. Daily gains varied little. Lot 3 had the smallest daily gain—1.47 pounds per day. Other daily gains were: Lot 1, 1.55 pounds; Lot 2, 1.56 pounds; and Lot 4, 1.53 pounds. This indicates that the rations were efficient.

2. Lot 4 pigs consumed the most corn and the least supplement. This probably was because the high percentage of alfalfa meal in the supplement made them prefer shelled corn. The Lot 1 pigs consumed both the most corn and the most supplement daily. The extra consumption of corn required more protein to balance it nutritionally.

3. Most efficient utilization of corn was in Lot 1, the lot that ate the most each day. Lot 1 required more protein supplement per 100 pounds gain. There was little difference in the corn requirements among the other three lots. Lot 4 used the least protein supplement.

4. Results of this test indicate that increased amounts of alfalfa meal in the ration of pigs being fattened in dry lot are desirable and tend to produce more profitable gains.

Metabolism of Carotenoid Pigments and Vitamin A in Swine

Relative Value of Vitamin A and Carotenoids of Alfalfa Meal and of Corn in Supplying Vitamin A Requirements of Swine for Reproduction.

PROJECT 311

D. B. Parrish and C. E. Aubel

Swine commonly obtain vitamin A from feed in the form of the provitamins—carotene and cryptoxanthin—of alfalfa and yellow corn. Swine are able to convert these provitamins to vitamin A, probably in their intestinal walls. Some commercial swine feeds contain true vitamin A, especially feeds recommended for young pigs.

Nearly all the information available on the relative effectiveness of the forms of provitamin A in natural feedstuffs to supply vitamin A requirements of swine was obtained on young growing pigs. The requirements for, and metabolism of, vitamin A may differ in growing pigs and sows. A study of this problem, therefore, was undertaken.

Duroc gilts were placed in dry lot late in the fall. Feeding of experimental rations was begun one month before the gilts were bred. The experimental diets were composed of white corn, soybean oil meal, brewer's yeast, skimmilk powder, iodized salt, bone meal, limestone, and vitamins. The amount of various vitamin A supplements that each gilt received daily is shown for the various experiments in Tables 26, 27, and 28.

The amounts of supplement given were such that the vitamin A intake would be near marginal levels so that if differences in the values of the supplements existed they would likely show up. The experiments continued varying lengths of time after farrowing. Since only a limited number of comparisons could be made at any one time, the studies were continued several years, using essentially the same experimental conditions each time, but varying the supplemental sources of vitamin A. Each test was made twice. The criteria used for judging relative effectiveness of the various sources of vitamin A were: vitamin A levels in blood serum and colostrum of the gilts at farrowing and vitamin A levels in blood serum and livers of new-born pigs. Other analyses and observations made varied somewhat from one study to another.

In the first trial, vitamin A or carotene was added to the diet so each gilt received 6500 units of vitamin A activity daily. In the second trial the work was repeated but the supplemental provitamin A was fed at 7100 units daily. In each trial, the results were compared with those obtained on another lot of gilts fed the common yellow corn-tankage diet, plus leafy alfalfa hay, **ad lib.** The data from Trials 1 and 2 are presented in Table 26.

In Trials 3 and 4, the relative vitamin A values of carotene in oil and

Table 26.—Concentrations of vitamin A in blood serum and colostrum of gilts at time of farrowing and in blood serum and livers of new-born and 4-day-old pigs.

Trial	1			2		
Lot[1]	1	2	3	1	2	3
Ration supplement	Check[2]	Vitamin A	Carotene	Check	Vitamin A	Carotene
Vitamin A in gilt's blood serum, µg./100 ml.	17.7	20.0	10.3	19.2	16.2	7.2
Vitamin A in colostrum, µg./100 ml.	221	191	103	162	196	123
Vitamin A in new-born pig's blood serum, µg./100 ml.	12.5	11.9	6.7	13.7	12.6	5.1
Vitamin A in 4-day-old pig's blood serum, µg./100 ml.	33.4	30.5	17.7	36.4	26.0[3]	14.5
Vitamin A in new-born pig's liver, µg./g.	10.7	6.8	1.6	10.8	8.9	1.1
µg./liver	373	211	45	363	288	14.9
Vitamin A in 4-day-old pig's liver, µg./g.	18.9	18.3	3.8	20.9	14.7[3]	3.9
µg./liver	821	808	163	798	594[3]	189

1. Five animals per lot, except that Lot 3 contained only 4 animals by farrowing time in each trial.
2. A practical yellow corn-tankage ration, plus good leafy alfalfa hay fed free choice.
3. One gilt refused to care for her pigs; only 4 pigs available at this stage.

Table 27.—Concentrations of vitamin A in blood serum and colostrum of gilts at time of farrowing and in blood serum and livers of new-born pigs.

Trial	3			4		
Lot[1]	1	2	3	1	2	3
Source vit. A	Car. oil	Car. oil	Dehy. alf.	Car. oil	Car. oil	Dehy. alf.
Units vit. A fed daily	23,000	7,800	7,800	20,000	6,500	6,500
Sow's serum, µg./100 ml.	13.9	12.2	18.3	19.7	11.5	19.3
Colostrum, µg./100 ml.	174	128	177	125	117	160
New-born pig's serum, µg./100 ml.	11.1	7.4	9.2	11.7	6.3	11.0
New-born pig's liver, µg./gm.	7.3	3.1	4.6	3.9	0.8	3.2
µg./liver	240	92	187	96	20	99

1. Five gilts per lot.

carotene in dehydrated alfalfa were compared. Since the results of Trials 1 and 2 indicated that carotene-in-oil was about ¼ to ½ less effective than vitamin A-in-oil, depending on the criteria used, carotene was given at two levels, one about three times higher than the other, as a further check on their relative effectiveness. Results are presented in Table 27. In these trials, data were not obtained on 4-day-old pigs, since in Trials 1 and 2 the trends at 4 days of age were similar to those at farrowing.

In Trials 5 and 6, comparisons were made of the relative vitamin A activity of carotene and cryptoxanthin of alfalfa and of yellow corn fed at 6500 units daily. When yellow corn was used, the required amount was substituted for an equal amount of white corn in the diet. The calculation of vitamin A potency was based on the crude carotene and crude cryptoxanthin contents as determined by separation of the non-saponifiable yellow pigments on an alumina chromatographic column, using 4 percent acetone in hexane for elution of carotene and 12 percent acetone in hexane for elution of crude cryptoxanthin. The latter was assigned 50 percent of the vitamin A value of carotene, which constituted the relative vitamin A activities found in rat experiments. The results are given in Table 28.

Table 28.—Concentrations of vitamin A in blood serum and colostrum of gilts at time of farrowing and in blood serum and livers of new-born pigs.

Trial	5		6	
Lot[1]	1	2	1	2
Source vit. A	Alfalfa	Yellow corn	Alfalfa	Yellow corn
Units vit. A fed daily	6,500	6,500	6,500	6,500
Sow's serum, µg./100 ml.	11.6	15.7	10.9	10.7
Colostrum, µg./100 ml.	96	120	92	86
New-born pig's serum, µg./100 ml.	7.8	6.7	4.4	5.5
New-born pig's liver, µg./gm.	1.4	0.8	0.29	0.25
µg./liver	43	31	10.5	8.2

1. Six gilts per lot

Observations

1. Vitamin A concentrations in blood serum of vitamin A supplemented (6500 units daily) fed gilts at time of farrowing, in their colostrum, and in the blood serum and livers of their new-born and 4-day-old pigs were similar to those in the same materials from animals of the check lot in which the gilts were fed the common yellow corn-tankage ration supplemented with alfalfa hay, free choice. On an equal unit basis, carotene was much less effective than vitamin A as a vitamin A feed supplement for gilts during gestation.

2. Vitamin A concentrations in blood serum of gilts decreased as farrowing approached and increased again during the days immediately following farrowing.

3. Crystalline carotene-in-oil fed at either 6500 or 7800 units daily was much less effective as a vitamin A source for gilts during gestation than was carotene or dehydrated alfalfa. When carotene-in-oil was fed at 20,000-23,000 units daily, it appeared to be about as effective as 6500-7800 units of carotene in alfalfa.

4. The provitamin A of alfalfa meal and of yellow corn fed at 6500 units daily were of similar value for supplying vitamin A requirements of gilts during gestation.

Effects of Bacitracin Pellets Implanted Subcutaneously in Pigs[1]

PROJECT 513

Melvin J. Swenson, Ralph G. Buckner, Dennis D. Goetsch, C. E. Aubel, and G. K. L. Underbjerg

Forty-seven new-born pigs from six gilts were randomized to three groups. The pigs in Group I were untreated and served as controls. Each pig in Group II was implanted subcutaneously, posterior to the right ear, with a bacitracin pellet 36 hours after birth. The pigs in Group III were implanted with a slow-absorbing, zinc-aluminum-bacitracin pellet in a similar manner. All pellets each contained 1,000 units of bacitracin.

Blood samples were taken from the anterior vena cava 36 hours after birth and at 1, 2, 3, 4, 5, 6, 7, and 8 weeks of age. At each bleeding time the pigs were weighed.

Results

The growth of the nursing pigs was not altered by the implanted antibiotic pellets as shown in Table 29.

From the standpoint of the blood picture, the values were not altered by the bacitracin pellets. Clinical cases of nutritional anemia were not observed. As a rule, such cases are seen when the pigs are 2 to 3 weeks of age. There was evidence, however, of subclinical anemia occurring at 2 to 3 weeks of age in all groups. This finding was revealed by studying the red blood cells and hemoglobin. At 4 weeks of age, the blood values had returned to normal.

Conclusions

1. Bacitracin pellets implanted subcutaneously in new-born pigs did not alter the weekly growth rate in 35 pigs as compared with 16 untreated pigs.
2. The blood picture was not affected by the implanted bacitracin pellets.

Table 29.—Effect on the weight of pigs when implanted with bacitracin pellets shortly after birth.

Group	No. pigs in group	36 hours	Age, weeks 1	2	3	4	5	6	7	8
		Average weight, pounds								
I, Cont.	16	2.7	4.7	7.8	10.0	11.7	14.4	17.6	21.3	25.6
II, Imp.	15	2.6	4.9	7.8	9.9	11.8	14.6	18.4	20.6	26.0
III, Imp.	16	2.7	4.5	7.6	9.8	11.4	14.2	17.2	20.6	24.6
Av.		2.6	4.7	7.7	9.9	11.6	14.4	17.8	20.8	25.4

Levels of Aureomycin and the Comparative Value of Dehydrated Alfalfa and Elodea canadensis Meals in Swine-fattening Rations.*

PROJECT 361

D. Richardson

The amount of antibiotic generally recommended in swine-fattening rations is 5 mg. per pound of total feed consumed. Some workers have felt that higher levels might produce more rapid and economical gains. One purpose of this test was to compare results with 5 and 20 mg. of aureomycin per pound of complete feed.

1. This project was supported by a grant-in-aid from Commercial Solvents Corporation, Terre Haute, Ind.

* The dehydrated Elodea canadensis meal was supplied by A. J. Stephens, Basswood Gardens, Kansas City, Mo., and the Aurofac 2A by Ralph Elliot, Lederle Laboratories, Pearl River, N.Y.

Elodea canadensis is a plant which grows in fresh-water lakes and ponds. Upon dehydration and grinding, it looks about the same as dehydrated alfalfa meal. The second purpose of this experiment was to compare the value of dehydrated alfalfa and Elodea canadensis meals in swine-fattening rations. Table 30 gives the chemical analysis of the Elodea canadensis meal used.

Experimental Procedure

Sixteen weanling pigs were divided as equally as possible into lots of four pigs each on the basis of weight, sex, and breed. The pigs were fed a complete ration, shown in Table 31. It contained about 18 percent protein and was fed till the pigs reached approximately 75 pounds body weight. The protein level of the ration was 15 percent from 75 to approximately 125 pounds body weight. It was then lowered to 12 percent protein for the remainder of the experiment. Adjustments in protein were made by adding corn and removing part of the tankage and soybean meal. Aureomycin was added in the form of Aurofac 2A. Elodea canadensis was substituted for equal amounts of alfalfa meal. Water was available at all times.

Results and Discussion

The results of the experiment are shown in Table 32. There was a difference in rate of gain of 0.08 pound in favor of the 20-milligram level of aureomycin, and essentially no difference in feed efficiency. There was 0.18 pound difference in daily gain in favor of the Elodea canadensis over alfalfa meal; however, there was no difference in feed efficiency.

It should be pointed out that Lot 1 pigs obviously did not do so well as they should have. Therefore, the differences observed are probably greater than they should be. The data indicate that: (1) there is no economic advantage to feeding high levels of aureomycin to fattening pigs; (2) Elodea canadensis is equal or superior to alfalfa meal in pig fattening rations when fed at levels used in this experiment.

Table 30.—Chemical analysis of dehydrated Elodea canadensis.

	%
Moisture	9.38
Crude protein	12.31
Ether extract	1.69
Crude fiber	15.00
Nitrogen-free extract	41.27
Ash	20.35
Calcium	3.72
Phosphorus	0.20
Carotene	48.0 mg. per lb.

Table 31.—Composition of experimental ration.

Ingredient	%
Yellow corn	73.5
Soybean oil meal	12.0
Tankage, 60% protein	10.0
Dehydrated alfalfa meal*	3.0
Steamed bone meal	0.5
Ground limestone	0.5
Salt	0.5
	100.0

* Lots 2 and 4 received dehydrated Elodea canadensis meal instead of alfalfa meal.