| | | | | | |
|---|---|---|---|---|---|
| Rambouillets (Finewools) ..... | 8.5 | Jan. 31 | 10.1 | 8.4 | 58.5 |
| Whiteface crossbreds .. | 10.0 | Feb. 3 | 10.6 | 10.5 | 51.9 |

**Table 6.—Comparative Lamb Production of Rams of Different Breeds**

| Breed of sire of lambs ..... | Birth weight | | Average weight of lambs on April 8 |
|---|---|---|---|
| | Single | Twins | |
| Hampshire ..... | 11.1 | 7.9 | 60.3 |
| Suffolk ..... | 10.8 | 9.0 | 58.2 |
| Southdown ..... | 9.3 | —— | 53.6 |
| Shropshire ..... | 10.1 | 8.1 | 40.5 |

## Project 110: Swine Feeding Investigations

### EXPERIMENT I

### The Effect of Antibiotics (Aureomycin-$B_{12}$ Supplement) on Weanling Pigs in the Dry Lot

C. E. Aubel

The use of antibiotics in swine nutrition has received much attention the last few years. Research has shown that different vitamin $B_{12}$-antibiotic supplements stimulate gains and improve feed efficiency in growing and fattening swine. One problem arising from its use is the relative efficiency of the $B_{12}$-antibiotic supplement in plant protein supplement diets and in mixed plant and animal protein supplement diets.

An experiment was recently conducted at this station to supply information on two points. First, how much does the addition of an antibiotic improve an all-plant protein supplement or diet, and how much does it improve a mixed protein supplement of plant and animal protein for weanling pigs? The second point to get information on was whether it was necessary to feed the antibiotics to pigs after they weighed 100 pounds.

The antibiotic used in this experiment was aureomycin fed as Aurofac and it was mixed in the protein supplements at the rate of 3 pounds to 100 pounds. Six lots of 42-pound fall pigs were fed in the dry lot. They were self-fed free choice on shelled corn, a protein supplement, and a mineral mixture. The mineral mixture was made up of equal parts ground limestone, steamed bonemeal, and salt.

Lots 1, 2, and 3 received only soybean meal as a protein supplement; Lot 2 received aureomycin in the supplement until the pigs reached 100 pounds in weight and then they were fed only the soybean meal. Lot 3 received aureomycin in their protein supplement throughout the experiment, until the pigs were finished at a weight of 200 pounds.

Lots 4, 5, and 6 received as a protein supplement a mixture of 4 parts tankage, 4 parts soybean meal, 1 part linseed meal, and 1 part alfalfa meal. Lot 5 received aureomycin in the supplement until the pigs reached 100 pounds in weight, and then they were fed only the mixed protein supplement; Lot 6 received aureomycin in their protein supplement throughout the experiment until the pigs were finished.

The following table gives a summary of the results of this experiment:



**Table 7.—The Effect of Antibiotics (Aureomycin-$B_{12}$ Supplement) on Weanling Pigs in the Drylot**

| Ration fed ..... | (self-fed) Shelled corn, alfalfa hay, mineral mixture | | | | | |
|---|---|---|---|---|---|---|
| | Soybean oil meal | Soybean oil meal, aureo-$B_{12}$ to 100 lbs. | Soybean oil meal, aureo-$B_{12}$ to finish | Protein mixed supplt. | Protein mixed supplt., aureo-$B_{12}$ to 100 lbs. | Protein mixed supplt., aureo-$B_{12}$ to finish |
| Lot number ..... | 1 | 2 | 3 | 4 | 5 | 6 |
| No. pigs in lot .... | 9 | 10 | 10 | 10 | 10 | 10 |
| Av. initial wt./pig ..... | Lbs. 43.95 | Lbs. 42.85 | Lbs. 43.00 | Lbs. 42.35 | Lbs. 42.65 | Lbs. 42.50 |
| Av. final wt./pig | 179.88 | 200.30 | 205.00 | 196.90 | 196.60 | 210.30 |
| Av. total gain per pig ..... | 135.96 | 157.45 | 162.00 | 154.55 | 153.95 | 167.80 |
| Av. daily gain per pig ..... | 1.40 | 1.62 | 1.67 | 1.59 | 1.58 | 1.72 |
| Av. daily ration per pig: | | | | | | |
| Corn ..... | 3.55 | 4.78 | 4.72 | 5.20 | 4.98 | 5.34 |
| Alfalfa hay .... | .05 | .03 | .05 | .03 | .04 | .04 |
| Protein supplt. | 1.03 | 1.15 | 1.12 | .85 | .80 | .82 |
| Feed consumed per 100 lbs. gain: | | | | | | |
| Corn ..... | 253.33 | 294.69 | 283.02 | 326.43 | 314.38 | 308.99 |
| Alfalfa hay .... | .36 | .21 | .32 | .22 | .25 | .23 |
| Protein supplt. | 73.95 | 71.45 | 67.28 | 53.38 | 50.99 | 47.67 |
| Mineral mix .. | .13 | .12 | .08 | .06 | .05 | .05 |
| Feed cost per 100 lbs. gain .... | $11.60 | $13.22 | $13.01 | $13.24 | $13.05 | $12.94 |

Feed prices charged: Shelled corn, $1.86 per bushel; soybean meal, $86 per ton; soybean oil meal with Aurofac, $110 per ton; alfalfa hay, $50 per ton; mixed protein supplement in Lots 5 and 6, $90.80 per ton; mineral mixture, 3c per lb.; mixed protein supplement with Aurofac in Lots 5 and 6, $112.20 per ton; Aurofac, 43c per lb.

#### Observations

When aureomycin was added to a soybean meal protein supplement ration and fed to pigs only until they reached a weight of 100 pounds, the rate of gain was increased, as was also the feed required per 100 pounds gain. When the antibiotic was fed in the supplement throughout the experiment, it further increased the gains and slightly lowered the feed requirements. The gains were satisfactory in both lots receiving the antibiotics.

The mixed plant and animal protein supplement without an antibiotic as fed in Lot 4 produced more rapid daily gains than did the plant protein supplement alone, soybean meal, as fed in Lot 1.

When the antibiotic was added to the mixed protein supplement in Lot 5, until the pigs reached 100 pounds, the rate of gain was unchanged but the feed requirements were slightly lowered. When the antibiotic was fed in the supplement throughout the experiment, the rate of gain was markedly increased and the feed requirements decreased.

It is evident from these results that aureomycin added to the ration,

either for a limited time or for the duration of the feeding period, increased the rate of gain, and this was therefore its chief effect; the effect of the antibiotic was most marked when it was fed throughout the experiment.

The effect of the antibiotic was more apparent in the all-plant protein-fed pigs and not so effective where a mixed protein supplement was fed.

## EXPERIMENT II—Summer, 1952

### The Effect of Varying Amounts of Antibiotics (Aureomycin-$B_{12}$ Supplement) in the Protein Supplement for Swine on Sudan Pasture

C. E. Aubel

Antibiotics have been shown to be effective in stimulating rate of gain as much as 18 percent and improving the feed efficiency up to 10 percent when fed in the rations of swine. Not as conclusive evidence has been obtained, however, to show that mere inclusion of an antibiotic in a feed insures this improvement in the well-doing of the pig unless the antibiotic is fed in adequate amounts, which is from 5.0-7.5 mg. per pound of total feed.

Most swine feeders self-feed grain and a supplement which contains the rest of the feed, such as protein, vitamins, and minerals. The ratio of corn to protein supplement consumed becomes wider as the pigs mature; therefore, the amount of antibiotic furnished daily by a protein supplement fed free choice with corn will be different from the amount supplied by feeding an antibiotic in a complete ration. Usually pigs will eat daily a fairly constant amount of a protein supplement throughout the feeding period, but the amount of grain will increase in proportion to weight of the pigs.

This experiment was designed to determine the optimum level of antibiotic required in the protein supplement for growing and fattening pigs. Aurofac, the aureomycin-$B_{12}$ supplement manufactured by Lederle Laboratories, New York, was used as the source of antibiotic. This contained approximately 1.8 mg. of vitamin $B_{12}$ and 1.8 grams aureomycin hydrochloride per pound.

The problem in feeding the antibiotic in this manner is to determine how much antibiotic supplement to put in a ton of protein supplement to supply 5 milligrams per pound of total feed consumed, as has been recommended from nutrition studies with swine. If we assume that pigs eat their feed at a ratio of 1 pound of protein supplement to 3.5 pounds of grain, then 27 pounds of Aurofac per ton of supplement should supply approximately 5 milligrams of aureomycin hydrochloride per pound of feed consumed.

Five lots of 10 pigs each were started on Sudan grass pasture at a weight of about 56 pounds and fed free choice on shelled corn and a protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part cottonseed meal, and 1 part alfalfa meal. This had a protein content of about 50 percent. A mineral mixture was also supplied which was made up of equal parts ground limestone, steamed bonemeal, and salt.

The following levels of Aurofac were added to the protein supplement:

Lot I—no Aurofac
Lot II—15 pounds/ton
Lot III—25 pounds/ton
Lot IV—35 pounds/ton
Lot V—45 pounds/ton

The following table gives a summary of the results of this experiment.



**Table 8.—The Effect of Varying Amounts of Antibiotics (Aureomycin-$B_{12}$ Supplement) in the Protein Supplement on Weanling Pigs on Sudan Pasture**

(June 11, 1952, to Sept. 10, 1952—91 days)

| Ration fed | (self-fed) Protein mixed supplt. | Shelled corn, sudan grass pasture, min. mixture— Protein mixed supplt., 15 lbs. aureo-$B_{12}$ to 1 ton | Protein mixed supplt., 25 lbs. aureo-$B_{12}$ to 1 ton | Protein mixed supplt., 35 lbs. aureo-$B_{12}$ to 1 ton | Protein mixed supplt., 45 lbs. aureo-$B_{12}$ to 1 ton |
|---|---|---|---|---|---|
| Lot number | 1 | 2 | 3 | 4 | 5 |
| No. pigs in lot | 10 | 10 | 10 | 9 | 10 |
| Av. initial wt./pig | 57.70 | 56.40 | 63.90 | 56.00 | 57.85 |
| Av. final wt./pig | 194.00 | 195.30 | 209.50 | 201.90 | 205.50 |
| Av. total gain/pig | 136.30 | 136.90 | 145.60 | 145.90 | 147.65 |
| Av. daily gain/pig | 1.49 | 1.50 | 1.60 | 1.60 | 1.62 |
| Av. daily ration/pig: | | | | | |
| Corn | 4.07 | 4.31 | 4.01 | 4.12 | 4.54 |
| Protein supplt. | 1.05 | 1.00 | 1.22 | 1.00 | 1.06 |
| Feed consumed/100 lbs. gain: | | | | | |
| Corn | 272.19 | 287.07 | 251.03 | 256.34 | 280.39 |
| Protein supplt. | 70.35 | 66.76 | 76.51 | 63.26 | 65.35 |
| Mineral mixture | .14 | .27 | .12 | .12 | .17 |
| Feed cost/100 lbs. gain | $11.32 | $11.78 | $11.27 | $10.75 | $11.86 |

Feed prices charged: Shelled corn, $1.68 per bu.; mixed protein supplements in Lot 1, $90 per ton; mixed protein supplements with Aurofac in Lot 2, $95.25, Lot 3, $98.75, Lot 4, $102.25, and Lot 5, $105.75 per ton; Aurofac, 35c per lb.; mineral mixture, 3c per lb.

### Observations

1. Feeding amounts of Aurofac at 15 pounds to the ton produced no better response with the pigs than where no antibiotic was fed.

2. If the antibiotic was fed at near the recommended level or over it, the daily gains were increased and the efficiency of the feed was increased except in Lot V where 45 pounds of antibiotic to the ton were fed. The amount of feed required per 100 pounds gain in this lot was about that when no antibiotic was fed, and only slightly higher than those getting nearer the recommended allowance.

3. The pigs receiving 25 pounds of Aurofac per ton of protein supplement consumed less corn and more protein supplement per 100 pounds gain than any other lot.

4. It would seem from this experiment that feeding the Aurofac mixed in the protein supplement and self-fed free choice with grain is a practical way to administer the antibiotic to growing fattening pigs.

5. It would seem from this experiment that about 25-35 pounds of Aurofac to a ton of mixed protein supplement is about right. This amount is consistent with that recommended put in a complete or total feed, namely 5 milligrams per pound of feed.

## EXPERIMENT III—Winter, 1953

### The Effect of Varying Amounts of Antibiotics (Aureomycin-$B_{12}$ Supplement) in the Protein Supplement for Swine in the Drylot

C. E. Aubel

The previous experiment, summer, 1952, showed that mixing the antibiotic in the protein supplement at the level of 25-35 pounds to a ton gave significant improvement in the well-doing of growing fattening swine on Sudan grass pasture, but when mixed at a lower level of 15 pounds, no improvement manifested itself over hogs that received no antibiotic in the protein supplement.

An experiment was conducted this past winter with fall pigs in the drylot. It was designed, as was the former experiment, to study the effect of varying amounts of antibiotic added to the protein supplement for pigs in the drylot.

The antibiotic used in this experiment of five lots was aureomycin fed as Aurofac and the following levels were added to the protein supplement:

Lot 1—no antibiotic
Lot 2—15 pounds/ton
Lot 3—25 pounds/ton
Lot 4—30 pounds/ton
Lot 5—40 pounds/ton

The pigs were started at an average weight of 33 pounds and fed free choice in drylot on shelled corn and the same protein supplement as the previous experiment and a similar mineral mixture.

The following table gives a summary of the results of this experiment.

**Table 9.—The Effect of Varying Amounts of Antibiotics (Aureomycin-$B_{12}$ Supplement) in the Protein Supplement for Swine in the Drylot**

(December 9, 1952, to March 23, 1953—104 days)

| Ration fed | Shelled corn, alfalfa hay, mineral mixture self-fed: Protein mixed supplt. | Protein mixed supplt., 15 lbs. aureo-$B_{12}$ to ton | Protein mixed supplt., 25 lbs. aureo-$B_{12}$ to ton | Protein mixed supplt., 30 lbs. aureo-$B_{12}$ to ton | Protein mixed supplt., 40 lbs. aureo-$B_{12}$ to ton |
|---|---|---|---|---|---|
| Lot number | 1 | 2 | 3 | 4 | 5 |
| No. pigs in lot | 10 | 10 | 10 | 10 | 10 |
| Av. initial wt./pig | 33.30 | 33.10 | 31.30 | 31.90 | 30.30 |
| Av. final wt./pig | 193.70 | 215.90 | 207.00 | 209.50 | 213.80 |
| Av. total gain/pig | 160.40 | 181.95 | 175.70 | 177.60 | 183.41 |
| Av. daily gain/pig | 1.54 | 1.74 | 1.72 | 1.70 | 1.75 |
| Av. daily ration/pig: | | | | | |
| Corn | 4.54 | 5.01 | 4.80 | 4.72 | 4.78 |
| Protein supplt. | .76 | .97 | 1.02 | .95 | .97 |
| Alfalfa hay | .12 | .11 | .12 | .14 | .12 |
| Feed consumed/100 lbs. gain: | | | | | |
| Corn | 294.57 | 286.89 | 284.57 | 276.46 | 271.25 |
| Protein supplt. | 49.87 | 55.78 | 60.61 | 55.74 | 55.07 |
| Alfalfa hay | .82 | .66 | .77 | .87 | .74 |
| Mineral mixture | .12 | .21 | .17 | .17 | .21 |
| Feed cost/100 lbs. gain | $11.08 | $11.12 | $11.26 | $10.80 | $10.62 |

Feed prices charged: Shelled corn, $1.68 per bu.; mixed protein supplements in Lot 1, $90 per ton; mixed protein supplements with Aurofac in Lot 2, $95.25, Lot 3, $98.75, Lot 4, $100.50 per ton, Lot 5, $104 per ton; alfalfa hay, $32 per ton; Aurofac, 35c per lb.; minerals, 3c per lb.

#### Observations

1. In each case where the antibiotic was added to the ration, a significant improvement in the well-doing of the pigs was observed both in rate of gain and saving of feed per 100 pounds gain, especially the former.
2. The costs of gains were lowest also where the antibiotic was fed at levels of 30 pounds and 40 pounds to the ton.
3. The rates of gain were exceedingly good in all the antibiotic-fed lots. This probably could be explained by the fact that the pigs were started at such an early weight (33 pounds).
4. The same explanation could account for the splendid gains by Lot 2, which received the low level 15 pounds per ton.
5. Again in this experiment, excellent results were obtained when the levels fed were close to the recommended amounts for inclusion in a total feed (5 mg. per pound of feed).

## Project 361: Comparison of Antibiotics Implanted Under the Skin and Fed in the Ration of Fattening Pigs

D. Richardson and M. J. Swenson

Certain antibiotics have generally been accepted as beneficial from the standpoint of increased rate of growth and feed efficiency when added to a ration for fattening pigs. The University of Arkansas reported that the subcutaneous implanting of bacitracin in newborn pigs increased their weaning weights. The purpose of this experiment was to observe the results on weaned pigs with antibiotic pellets implanted subcutaneously and to compare these results with pigs receiving a ration with and without antibiotics mixed in the ration.

#### Experimental Procedure

Twenty-five purebred female Poland-China pigs about 10 weeks of age were divided into five lots of five pigs each. The pigs were self-fed in pens having concrete floors. Water barrels with automatic watering cups were used. Since this experiment was conducted during the summer, the pigs were sprayed with water once a day. The basal ration consisted of 72.5 percent milo grain, 15 percent soybean oil meal, 5 percent alfalfa meal, 5 percent tankage, 2 percent steamed bonemeal, and 5 percent salt. All pigs received this ration. The difference in the various treatments was the kind of antibiotic and how it was given to the pigs. A summary of the treatments and the results is given in the accompanying table.

**Table 10.—Results with Antibiotics Implanted and Mixed in Ration**

| | Basal | Basal and 2000 units baci. implanted | Basal and 1000 units baci. and 10000 units penicillin implanted | Basal and 1 lb. penbac[1]/ ton feed | Basal and 3 lbs. Aurofac[2]2A/ ton feed |
|---|---|---|---|---|---|
| No. pigs per lot | 5 | 5 | 5 | 5 | 5 |
| No. days fed | 91 | 91 | 91 | 91 | 91 |