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Protein supplements and pastures for swine

Charles Iseard Bray

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PROTEIN SUPPLEMENTS AND
PASTURES FOR SWINE

AGRICULTURAL EXPERIMENT STATIONS
OF THE
LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE

C. T. DOWELL
Director
SUMMARY

1. Balanced rations are economical. Pigs fattening on corn, safflower, or rice products need protein supplements for economical gains. Thirty to 40 pounds of protein supplement may save 150 to 200 pounds of corn.

2. Swine producers have found that pigs require some animal protein in their rations, especially when fed corn in dry lots. Examples of animal protein are tankage, shrimp meal and separated milk. However, improved protein supplements, containing cottonseed meal and ground alfalfa, mixed with the animal protein supplements, produce cheaper and more efficient gains than do the high-priced animal proteins alone.

3. Shrimp meal has proved superior to tankage as a protein supplement, whether fed with or without other supplements, considering cheapness and rapidity of gains.

4. Pigs can balance their rations very satisfactorily when fed protein supplements in self-feeders. This saves considerable labor in feeding, especially when hogg ing-off crops in the field.

5. Cottonseed meal gives excellent results as a supplement when combined with tankage or shrimp bran, producing larger and cheaper gains than where tankage or shrimp bran are the only supplements. It is not entirely safe or satisfactory when used as the only supplement to corn.

6. Alfalfa meal, fine, well-cured alfalfa, or cut clover hay, or dehydrated alfalfa, supply some very necessary elements to a dry lot ration. Dehydrated alfalfa proved superior to cottonseed meal in supplementing a ration of corn, rice polish and shrimp bran fed in a dry lot.

7. Pastures supply an abundance of cheap protein. This is particularly true of the legume pastures, as clover and soybeans. Rape, sudan grass and winter oats are also valuable. The more protein that can be grown on the farm, the less will need to be purchased. An acre of white clover was worth $7.99 in 100 days for 10 pigs as measured by the results obtained in dry-lot feeding. As this acre would have been sufficient for 20 pigs, the value of the pasture would have been $15.98 per acre.

8. Dairy by-products are valuable sources of protein for swine. Separated milk showed a value of 15.2c per 100 pounds with corn at 42c a bushel. It was worth 20.6c per 100 the first month and only 9.2c per 100 pounds the third month of feeding, showing that young pigs make the most use of milk.

9. Sweet potatoes are very deficient in protein and should not be fed without a supplement. A field of soybeans planted near a sweet potato field and hogg ed-off with the potatoes will save considerable protein, but is not so efficient a supplement alone as tankage or shrimp meal.
PROTEIN SUPPLEMENTS AND PASTURES FOR SWINE

C. I. BRAY, J. B. FRANCIONI, JR.,
AND E. M. GREGORY*

INTRODUCTION

In presenting the results of these experiments, it should be understood that the Experiment Station is by no means recommending the growing and feeding of hogs entirely on purchased feeds fed in dry lots. At present hog prices, the only profitable method of producing pork is to make the greatest use of all waste feeds on the farm, pastures and home-grown feed crops. Hog men who are producing hogs cheaply on mast, or farmers who are raising their own pork on various waste materials around the farm, are using good business judgment in so doing.

Many hog men, however, have considerable corn or rice products to feed and must finish their hogs under what are practically dry lot conditions. Such men are likely to need any information available that will aid them in putting on gains at the lowest cost. The station worker must conduct most of his experiments under dry-lot conditions, not because this is the best way to raise hogs, but because it is the most accurate method for measuring the relative values of different rations or combinations of feed stuffs.

By observing the amounts of feed required for 100 pounds gain in these various experiments, it is possible for the hog man to figure fairly closely on the best rations for his particular use and what they will cost him at local prices for either the feeds he produces or for what he must buy. Any reduction in cost that can then be made by using the waste feeds of the farm and by the use of pasture crops, etc. will represent that much more profit.

IMPORTANCE OF PROTEIN

One most important point in feeding young swine especially, is that they must have enough protein. This is especially true where they are being fed for rapid gains in dry lots. Most of the common fattening feeds do not contain enough protein. Corn, the grain sorghums, sweet potatoes, brewers rice, and the small grains generally are not only low in protein, but the proteins they contain are not of high quality. Where swine are being fattened on these feeds, they do not make the most rapid and profitable gains unless some of the protein supplements are added in the right proportions. This is called balancing the ration.

Proteins are the nitrogen-containing substances that are a necessary part of living tissues such as muscles, nerves, internal organs, and glands. Lean meat is about one-third pure protein and two-thirds

*J. B. Francioni, Jr. was in charge of the experiments in 1928-1930 and E. M. Gregory was in charge for the season of 1930-1931.
water, with some mineral matter. Since the bodies of young animals are largely lean tissue, water and bones, it is important that growing animals have plenty of protein and mineral matter in their feed.

The necessity for protein supplements has not been so evident in Louisiana as has been the case in the Northern and Western states. The average Louisiana pig is grown largely on pasture or in the woods, where it gets not only grass and roots, but also grubs and insects, crawfish, and other animal matter, and in this way obtains enough protein for growth. In the dry lot, pigs do not have the same chance to get this necessary protein material so it must be supplied in some other way.

In 1931, M. M. LaCroix, swine specialist in Louisiana, made a study of rations fed, and gains produced by a number of Louisiana hog growers. On nine farms where comparable figures were secured, seven men were using satisfactory protein supplements. These averaged 1.5 pounds gain per day, and $4.65 profit per head. Two men who were feeding little or no protein supplement had made 0.8 pounds average gain per day and $1.12 profit per head. This was, however, on a 7c and 8c hog market with protein supplements costing $30 to $40 a ton.

To demonstrate the value of protein for growing pigs, two cross-bred pigs, weighing 32 pounds each, were fed as a demonstration for the annual Farmers' Short Course program at Louisiana State University in 1931. The white belted pig was fed corn and a protein supplement. The black pig received corn alone. At the end of 52 days this black pig had gained two pounds only and was almost dead. The protein-fed pig had gained 34 pounds or a little more than double his first weight. When the black pig was allowed a protein mixture of shrimp bran and cottonseed meal, he ate little else for several days and began to recover. Had these pigs been on pasture instead of on a concrete floor, both would have made better gains. Also, if these had been 100 pound pigs, instead of 32 pound pigs, the corn alone would have produced better gains.

At the Akron (Colo.) Experiment Station, Osland fed one group of pigs on corn and millet alone in dry lot and another group on corn, millet and tankage. The corn and millet lot gained only 28 pounds each in 89 days, while the pigs on millet and tankage gained 144 pounds each. The feeding of tankage saved $2.75 on each 100 pounds of pork produced. Much difficulty was experienced in keeping the corn and millet hogs alive till the end of the experiment.

It is not necessary that the protein supplement be a purchased concentrate. Legume pasture will show almost equally good results, though a little tankage is desirable even on pasture.

Walker in Mississippi fed one lot of pigs on corn alone in a dry lot and one lot with corn on alfalfa pasture. The corn lot gained only

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1 LaCroix, M. M. Unpublished data.
2 Osland, H. B. Colorado Experiment Station. The Balancer; Oct., 1931.
FIG. 1. One had protein, the other had none, and that's the way the trouble "began." Gained 2 pounds and 34 pounds in the same period.

one-third of a pound daily and weighed 77 pounds at the end of the test. The corn and alfalfa lot gained 1.22 pounds per day and weighed 167 pounds. The dry lot made a profit of 77c each and the pasture fed pigs made $5.69 each.

In a demonstration conducted by C. C. McCrory, County Agent, Caddo Parish, Louisiana, purebred Hampshire pigs were fed corn alone, corn and protein supplement; and corn, protein supplement and pasture. At the end of a 40-day feeding period, the pigs had made gains as follows:4

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>Results of Demonstration in Caddo Parish—1931</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Pigs</td>
<td>Ration</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Corn only—dry lot</td>
</tr>
<tr>
<td>2</td>
<td>Corn and Protein—dry lot</td>
</tr>
<tr>
<td>6</td>
<td>Corn—Protein Supplement on pasture</td>
</tr>
</tbody>
</table>

The protein supplement consisted of equal parts tankage and cottonseed meal. Restricting the corn ration on pasture reduced the gains as compared to Lot 2, fed in the dry lot, but resulted in a lower cost per pound gain.

COMMON PROTEIN SUPPLEMENTS

The feeds commonly used to balance swine rations are tankage, shrimp bran, cottonseed meal, separated milk and buttermilk, linseed meal, fish meals and alfalfa meal. Legume pastures, such as clover,

4 LaCroix, M. M. Value of Balanced Ration Shown by Feed Experiment. The Southwest Farmer, Nov., 1931.
alfalfa, soybeans, etc. supply valuable protein. While pastures do not entirely replace the protein concentrates, they reduce the amount of supplement necessary to feed which is the reason that pigs fed unbalanced rations grow better on pasture than in a dry lot.

Most of these high-protein feeds are valuable also for their mineral content. The legumes are high in lime; cottonseed meal, linseed meals and rice polish are high in phosphorus, and the dairy by-products are especially valued for the mineral matter they contain. Shrimp bran has a very high mineral content. Tankage, if it contains much bone material, is also valuable for this reason.

Table II taken from Henry & Morrison's Feeds and Feeding gives the percentage of digestible protein in common hog feeds, the total digestible nutrients, and the proportion of digestible protein to other digestible parts of the feed. This proportion is called the nutritive ratio. Feeds such as separated milk or green soybeans may not appear to contain much protein due to their high water content, but on examining the nutritive ratio, the proportion of protein is seen to be high.

**BALANCING RATIONS**

In ordinary practice, balancing the hog ration means the adding of one or more high protein feeds, such as tankage or shrimp meal, to the ordinary fattening feeds, like corn, sagrain, sweet potatoes, or

Fig. 2. When fed corn alone in dry lot these pigs gained only $13\frac{1}{2}$ pounds each in 40 days and it took 15.4 pounds corn to make one pound gain.

This demonstration was conducted by C. C. McCrory, Parish Agent, in Caddo Parish, La. The photos show the two groups of pigs as exhibited at the Louisiana State Fair at Shreveport, 1931.
brewers rice. A ration of 1 part of tankage to 8 or 9 parts of corn can be taken as a fairly good model to follow. Young pigs need more protein, probably 1 part tankage to 6 of grain, while hogs weighing over 150 pounds will use about 1 part of high protein supplement to 10 of grain. Pigs on pasture require less protein supplement than pigs in a dry lot.

![Image](image_url)

Fig. 3. The above pigs were fed a ration of corn and a protein supplement of equal parts tankage and cottonseed meal. Pigs gained 65 pounds each in 40 days and it took 3.3 pounds corn and 1.23 pounds protein supplement to make one pound gain.

**SELF-FEEDING OF PROTEIN SUPPLEMENTS IS USUALLY SATISFACTORY**

Evvard of Iowa was one of the first to discover that pigs would balance their rations correctly if given their protein supplement in self-feeders, and that they would make slightly larger and more economical gains by self-feeding than they would when hand fed. Robinson, Godbey and Starkey, McCampbell and others have demonstrated

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6 Robison, W. L. Self Feeding Swine, Ohio Experiment Station Bul. 355.
7 Godbey and Starkey, E. G. Dry Lot Rations for Fattening Hogs, S. Carolina Experiment Station Bul. 281, 1931.
8 McCampbell, C. W. Swine Feeding Investigations, Kansas Experiment Station Circ. 78, 1918-1919.
<table>
<thead>
<tr>
<th>Feeding Stuff</th>
<th>Digestible Protein in 100 lbs.</th>
<th>Total Digestible Nutrients in 100 lbs. (including Protein)</th>
<th>Proportion of Protein or Nutritive Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOW PROTEIN FEEDS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>0.9</td>
<td>25.8</td>
<td>1 to 27.7</td>
</tr>
<tr>
<td>Blackstrap molasses</td>
<td>1.0</td>
<td>59.5</td>
<td>1 to 58.5</td>
</tr>
<tr>
<td>Irish potatoes</td>
<td>1.1</td>
<td>17.1</td>
<td>1 to 14.5</td>
</tr>
<tr>
<td>*Brewers rice</td>
<td>4.6</td>
<td>78.3</td>
<td>1 to 16.0</td>
</tr>
<tr>
<td>Sudan grass pasture</td>
<td>0.8</td>
<td>13.5</td>
<td>1 to 15.9</td>
</tr>
<tr>
<td>Corn—No. 3</td>
<td>7.0</td>
<td>80.0</td>
<td>1 to 10.4</td>
</tr>
<tr>
<td>Rice bran</td>
<td>7.9</td>
<td>65.8</td>
<td>1 to 7.3</td>
</tr>
<tr>
<td>Rice polish</td>
<td>8.0</td>
<td>82.1</td>
<td>1 to 9.3</td>
</tr>
<tr>
<td>❍Grain sorghums</td>
<td>9.0</td>
<td>80.0</td>
<td>1 to 8.0</td>
</tr>
<tr>
<td><strong>BULKY PROTEIN FEEDS WITH HIGH PROPORTION OF PROTEIN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separated milk or buttermilk</td>
<td>3.6</td>
<td>9.1</td>
<td>1 to 1.5</td>
</tr>
<tr>
<td>Alfalfa meal</td>
<td>10.2</td>
<td>50.7</td>
<td>1 to 4.0</td>
</tr>
<tr>
<td>Green rape pasture</td>
<td>2.6</td>
<td>13.3</td>
<td>1 to 4.1</td>
</tr>
<tr>
<td>Green clover—white</td>
<td>3.1</td>
<td>13.8</td>
<td>1 to 3.5</td>
</tr>
<tr>
<td>Sweet clover</td>
<td>3.3</td>
<td>14.3</td>
<td>1 to 3.3</td>
</tr>
<tr>
<td>Green soybean pasture</td>
<td>3.0</td>
<td>12.2</td>
<td>1 to 3.1</td>
</tr>
<tr>
<td><strong>CONCENTRATED HIGH PROTEIN FEEDS—HIGH PERCENT PROTEIN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanuts—with shell</td>
<td>17.9</td>
<td>99.4</td>
<td>1 to 4.6</td>
</tr>
<tr>
<td>Wheat shorts</td>
<td>13.4</td>
<td>69.3</td>
<td>1 to 4.2</td>
</tr>
<tr>
<td>Soybeans</td>
<td>33.2</td>
<td>94.1</td>
<td>1 to 1.8</td>
</tr>
<tr>
<td>Linseed meal—O. P.</td>
<td>30.2</td>
<td>77.9</td>
<td>1 to 1.6</td>
</tr>
<tr>
<td>Cottonseed meal—prime</td>
<td>33.4</td>
<td>75.5</td>
<td>1 to 1.3</td>
</tr>
<tr>
<td>Soybean oil meal</td>
<td>39.7</td>
<td>84.5</td>
<td>1 to 1.1</td>
</tr>
<tr>
<td>Shrimp bran</td>
<td>43.8</td>
<td>...</td>
<td>1 to 0.7†</td>
</tr>
<tr>
<td>Tankage—40% grade</td>
<td>42.8</td>
<td>77.9</td>
<td>1 to 0.8</td>
</tr>
<tr>
<td>Tankage—60% grade</td>
<td>56.2</td>
<td>71.4</td>
<td>1 to 0.3</td>
</tr>
<tr>
<td>Fish meal</td>
<td>40.1</td>
<td>58.8</td>
<td>1 to 0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The growing hog needs a ratio of</td>
<td></td>
<td></td>
<td>1 to 5</td>
</tr>
<tr>
<td>The fattening hog needs a ratio of</td>
<td></td>
<td></td>
<td>1 to 7</td>
</tr>
</tbody>
</table>

*Using data for polished rice. †Estimated.

The same fact, providing that the feeds are equally well liked by the pigs. If the protein supplement is not palatable or is too bulky, the pigs may not eat enough of it to balance the ration. If the fattening feed is not palatable, the pigs may eat too much of the protein supplement, which makes the gains expensive. If pigs are eating too much of the protein feeds, the amount may be controlled by mixing with it some bulky material such as 25% ground alfalfa hay, alfalfa meal, clover leaves, ground finely enough so that it will feed down well in the self-feeder.
CORN ALONE COMPARED TO CORN AND TANKAGE

Until 1900 and later, the experiment stations had done little work with the animal proteins in hog feeding, other than the dairy by-products. In 1901, Plumb and Van Norman\(^9\) of the Indiana Experiment Station reported that two hog feeders in that state had used tankage in hog feeding and the packers were wondering whether this waste from the packing houses could not be used more generally. The first experiment at the Indiana Station showed the following results: Corn alone, .67 pounds gain per day at $5.20 cost per 100 pounds gain; Corn and tankage, 1.23 pounds gain per day at $4.00 per 100 pounds gain. Since that time, the feeding of tankage, or similar protein feeds, has become standard practice among hog-feeders in the corn-belt.

Tankage is a by-product of the packing industry and is made up of the lean part of the waste and inedible scraps from the packing house. These scraps and waste materials are thrown into a closed "tank" and cooked under steam pressure to extract the fats. Condemned carcasses go into the tank also. Since this material is cooked under pressure, all disease germs are destroyed. When dried and ground, the material is sold as tankage. It usually contains considerable mineral matter from bones.

ECONOMY IN USING TANKAGE

F. B. Morrison states—"No single fact in stock feeding is more clearly demonstrated by numerous feeding trials than that corn alone gives exceedingly poor results when fed to growing and fattening pigs."\(^{10}\) The following table adapted from Morrison's "Feeds and Feeding" shows an average result of seven different trials comparing corn and tankage with corn alone for fattening young hogs. The increase in gains per day and the reduction in feed requirement per 100 pounds pork shows clearly the advantage of feeding tankage with corn as compared to corn alone.

<table>
<thead>
<tr>
<th>TABLE III</th>
<th>Corn Alone Compared to Corn and Tankage for Swine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ration</td>
<td>Daily Gain Lbs.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn alone</td>
<td>.59</td>
</tr>
<tr>
<td>Corn and Tankage</td>
<td>1.18</td>
</tr>
</tbody>
</table>

With corn at 56c per bushel and tankage at $40.00 per ton the cost per 100 pounds gain would be $6.42 for corn alone and $5.13 for corn and tankage respectively, a saving of $1.29 per 100 pounds of pork.

\(^9\) Plumb, C. S. and Van Norman. Tankage as a Food for Pigs. Indiana Experiment Station Bul. 90, 1901.

from using tankage. As will be shown later, the Louisiana swine feeder can make up protein supplements that are cheaper and better than tankage alone.

In two experiments at the Montana Station Vinke and Morgan showed that feeding tankage to pigs hugging down corn made $5.21 to $5.44 more profit per acre of corn than corn hugg ed down without tankage. Many such illustrations can be given, not only with corn, but with all other similar feeds.

PROTEINS NEED TO BE BALANCED

In the early days of balancing rations, it was thought that all proteins had the same value and that a ration was balanced if it contained a certain total amount of protein from any source. With newer methods of chemical analysis, and with advancing knowledge in animal nutrition, it was found, particularly during the period from 1909 to 1915, that some proteins were of higher value than others. Proteins from meat, milk, and eggs were shown to be fairly complete and of high value while the proteins from grains and legume seeds were generally found to be incomplete and sometimes unable to support growth unless supplemented with other proteins. The animal proteins and the green leafy materials (as pasture, alfalfa meal, etc.) usually correct the deficiencies in the proteins of the cereals or grains. This requirement for animal protein applies particularly to animals that are accustomed to getting part of their food from animal matter when running under natural conditions, as do swine, poultry, etc.

WHY TWO PROTEINS MAY BE BETTER THAN ONE

Proteins are made up of at least 18 or more separate compounds called amino acids. Some are very necessary to life and growth, others do not appear to be so important. Many food proteins, especially from grains and seeds, do not have all of these amino acids in the right proportions for ideal growth, but they are not all deficient in the same way. One protein might have too small an amount of one amino-acid which we might call “A” but a large amount of another amino acid, “D”. A second protein might be low in “D” but high in “A”. By feeding two such proteins together better results can be obtained than from either one alone. For instance, one of the corn proteins, “zein”, appears to have no tryptophane or lysin, two very important amino acids, but these are both contained in the wheat by-products. This is one reason why wheat middlings used to be a favorite supplement to use with corn. Henry in 1885 showed a saving of nearly 100 pounds

11 Vinke, L. and Morgan, G. Use of Tankage and Alfalfa when Hogging Down Corn, Mont. Expt. Station Bul. 257.
of feed for each 100 pounds gain by combining equal parts of wheat middlings and corn in place of either one fed alone. The chemists have not yet made complete studies of all the proteins, but have been able to identify certain groups of proteins that supplement each other. Corn and tankage proteins aid each other in this way, also do milk and corn proteins, meat and wheat proteins, alfalfa hay and corn silage proteins, and others that might be named. Swine should have some form of animal protein, especially if they are not on pasture.

IMPORTANT OF FEEDING PLENTY OF PROTEIN

Since it is not known just how deficient some of these proteins are, it is advisable to feed a little more protein than necessary, rather than the bare amount recommended by the feeding standards. Pigs on pasture are less likely to suffer from protein deficiency than pigs fed in the dry lot.

IMPROVED PROTEIN COMBINATIONS FOR SWINE

From about 1916 to 1922, several of the experiment stations were working on the problem of improved protein supplements for swine. It was believed that tankage could be improved both in regard to feeding value and cost—tankage selling then at $80.00 to $100.00 a ton. Morrison, Bohstedt and Fargo of the Wisconsin Expt. Station reported in 1920 that equal parts of linseed meal and tankage had given more rapid and more economical gains than tankage alone as a supplement to corn in fattening hogs. They demonstrated also that 5% alfalfa meal added to a white corn and tankage ration improved it greatly, especially in preventing lameness and paralysis.

Adding alfalfa meal to the tankage and linseed meal mixture was next found to give results far better than those from tankage as a corn supplement. In three different tests reported in 1922, pigs fed corn and tankage made an average gain of .95 pounds per day and cost $6.37 per 100 pounds gain. Pigs getting tankage, linseed meal, and alfalfa meal with their corn in the same experiments gained 1.21 pounds a day, and cost only $5.91 per 100 pounds. The protein mixture used was two parts tankage, one part linseed meal, and one part alfalfa meal. Evvard of the Iowa Experiment Station, who had been working on similar mixtures, also proved the value of this trio-mixture, and gave it the popular name of “trinity” mixture.

In 1928, Evvard and Robison showed that cottonseed meal could be used successfully in the place of linseed meal. While cottonseed

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meal is sometimes a little below linseed meal in regard to total gains, it generally makes cheaper gains on account of being lower in price. These “trio” mixtures, are considered standard protein supplements for use with corn and similar feeds. One great advantage of the trio mixtures is that they use two cheaper feeds to replace one-half the amount of a high priced feed. In the South, cottonseed meal will always be used rather than linseed meal in these “trio” mixtures.

The following table, compiled from the results of several experiment stations shows the increased gains and lower costs made possible by the improved mixtures. The feed costs based on 1932 prices are given also for convenience.

### TABLE IV

**Tankage Compared to Improved Protein Mixtures at Various Experiment Stations**

<table>
<thead>
<tr>
<th></th>
<th>Lbs. Gain per Day</th>
<th>Lbs. Feed per 100 Lbs. Gain</th>
<th>Cost per 100 Lbs. Gain at Time of Experiment</th>
<th>Cost per 100 Lbs. Gain at 1932 Feed Prices in Louisiana*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wisconsin</strong>—10 trials <strong>17 18</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, tankage</td>
<td>.96</td>
<td>454.2</td>
<td>$7.69</td>
<td>$4.00</td>
</tr>
<tr>
<td>Corn, tankage, linseed meal, alfalfa</td>
<td>1.15</td>
<td>446.9</td>
<td>7.34</td>
<td>3.77†</td>
</tr>
<tr>
<td><strong>Iowa</strong>—1928 <strong>19</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, tankage</td>
<td>1.25</td>
<td>387</td>
<td>$6.21</td>
<td>$3.50</td>
</tr>
<tr>
<td>Corn, tankage, cottonseed meal, alfalfa</td>
<td>1.62</td>
<td>369</td>
<td>5.97</td>
<td>3.17</td>
</tr>
<tr>
<td>Corn, tankage, linseed meal, alfalfa</td>
<td>1.59</td>
<td>375</td>
<td>6.03</td>
<td>3.22</td>
</tr>
<tr>
<td><strong>Ohio</strong> <strong>20</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, tankage</td>
<td>1.23</td>
<td>413</td>
<td>$7.46</td>
<td>$3.52</td>
</tr>
<tr>
<td>Corn, tankage, cottonseed meal, alfalfa</td>
<td>1.30</td>
<td>401</td>
<td>7.13</td>
<td>3.36</td>
</tr>
<tr>
<td>Corn, tankage, linseed meal, alfalfa</td>
<td>1.38</td>
<td>397.2</td>
<td>7.11</td>
<td>3.43</td>
</tr>
<tr>
<td><strong>Louisiana</strong> <strong>21</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, tankage</td>
<td>1.09</td>
<td>407</td>
<td>$9.49</td>
<td>$3.62</td>
</tr>
<tr>
<td>Corn, shrimp meal</td>
<td>1.42</td>
<td>347</td>
<td>7.37</td>
<td>2.89</td>
</tr>
<tr>
<td>Corn, tankage, cottonseed meal</td>
<td>1.43</td>
<td>341</td>
<td>7.75</td>
<td>2.95</td>
</tr>
<tr>
<td>Corn, shrimp meal, cottonseed meal</td>
<td>1.51</td>
<td>326</td>
<td>6.84</td>
<td>2.69</td>
</tr>
</tbody>
</table>

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21 Francioni, J. B. and Bray, C. I. Louisiana Experiment Station Annual Report, 1930.
* Estimated on basis of data on 8 trials only.
† Calculated on basis of feed prices on page 23.
DEHYDRATED SHRIMP MEAL

A Louisiana product which is very valuable as a protein supplement is shrimp bran or shrimp meal. This by-product of the shrimp canning industry consists of the heads and hulls of the shrimp, which are dehydrated in a rotary drier and then ground into meal. Sundried shrimp meal is made by grinding the hulls which have been removed from the sundried shrimp by mechanical beaters after they have dried in the sun for three or four days. No definite information is available regarding the value of the sundried product compared to the dehydrated meal.

SHRIMP MEAL COMPARED TO TANKAGE

In tests conducted at this station in 1928, 1930, and 1931 shrimp bran has proved superior to standard tankage as a supplement to corn or to corn and rice polish. This has been true regardless of whether these supplements were fed alone with corn or in combination with cottonseed meal and other protein feeds. Shrimp meal does not contain so much crude protein as high grade tankage, but contains more mineral matter.

TABLE V
Shrimp Meal Compared to Tankage Alone or With Other Supplements, Average of Three Experiments, 1928-29-31, Louisiana State Experiment Station

<table>
<thead>
<tr>
<th></th>
<th>As Only Supplement</th>
<th>With Other Supplements*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shrimp Bran</td>
<td>Tankage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shrimp Bran</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tankage</td>
</tr>
<tr>
<td>Average gains per day</td>
<td>1.53</td>
<td>1.34</td>
</tr>
<tr>
<td>Feed per 100 lbs. gain, lbs.</td>
<td>384.8</td>
<td>395.3</td>
</tr>
<tr>
<td></td>
<td>350.3</td>
<td>363.4</td>
</tr>
<tr>
<td>Average cost per 100 lbs. gain at 1928-30 prices</td>
<td>$7.49</td>
<td>$8.22</td>
</tr>
<tr>
<td></td>
<td>$6.85</td>
<td>$7.34</td>
</tr>
<tr>
<td>†Estimated cost per 100 lbs. gain at 1932 feed prices</td>
<td>$3.21</td>
<td>$3.42</td>
</tr>
<tr>
<td></td>
<td>$2.85</td>
<td>$2.96</td>
</tr>
</tbody>
</table>

* Cottonseed meal was the additional protein supplement used in 1929 and 1931. In 1928, a mixture of cottonseed meal, ground soybeans and alfalfa meal was used. In calculating the above results only Part II of the 1931 experiment has been included.
† See prices on page 23.

Shrimp meal is presumably more palatable to the pigs than is tankage, since pigs always eat more of the shrimp bran when fed by the free choice system. In 15 out of 16 comparisons of tankage with shrimp meal, either with or without other supplements, the shrimp meal lots have made faster daily gains than have the tankage fed lots. The one exception in favor of tankage was in the 1928 test where there was only a slight difference, in favor of tankage.
Whether these increased gains are due to greater consumption of feed, or to a superior quality of proteins, or to unidentified mineral or vitamin factors in the shrimp meal will have to be determined by further investigation. These results obtained on shrimp meal are very similar to those obtained with fish meal by McCarty, Evvard, and Robinson, and others.

**COTTONSEED MEAL USED ECONOMICALLY IN PROTEIN MIXTURES**

Cottonseed meal is one of the cheapest sources of protein in the South. If used in amounts not over 9% of the ration there is little danger from its use. If used in larger amounts, it is likely to cause cottonseed meal poisoning. It is more satisfactory to use 50% cottonseed meal and 50% shrimp meal or tankage than cottonseed meal alone. Protein mixtures of 50% tankage, shrimp meal or fish meal 25% cottonseed meal and 25% alfalfa meal have proved practically as satisfactory in swine feeding as the mixtures of tankage, linseed meal, and alfalfa meal.

Cottonseed meal and tankage together are more satisfactory than tankage alone and make a cheaper supplement, as cottonseed meal usually sells for less than half the price of tankage. Cottonseed meal and shrimp meal mixtures have made larger and cheaper gains than shrimp bran alone in three tests at this station's experiments (see Table V): with the exception of one test where rice polish alone was the fattening feed. In this one test only the feeding of cottonseed meal gave unsatisfactory results.

**SEPARATED MILK AND BUTTERMILK**

Before the days of modern protein supplements, these dairy products had been recognized by swine men as being excellent feeds to combine with corn. The proteins in milk are of high value, likewise the calcium and phosphorus which are necessary in making bone.

A common rule for estimating the value of separated milk and buttermilk was to take the price of half a bushel of corn as very nearly the value of 100 pounds of separated milk as a supplement to corn. When corn is 42c per bushel, separated milk would be worth 21c per 100 pounds. This rule is not always correct, as the value of the milk will depend somewhat on the amount of milk fed, the age of the pigs and the cost of other protein supplements.

Small amounts of separated milk have a higher value per 100 pounds than do large amounts. In fact it does not seem necessary to

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feed large amounts of milk unless the milk costs little or nothing. If fed in equal amounts with corn, or not over 2 pounds of milk to 1 pound corn, the milk will show a higher value per pound than when fed in larger proportions.

Robison reported in 1917 that with corn at 42c per bushel and tankage at $50.00 per ton that separated milk was worth 34c per 100 pounds when fed with an equal weight of corn, 21.7c when fed in a ratio of 3 to 1 and 15.8c per 100 when fed in a ratio of 5 of milk to 1 of corn.26

Robison also called attention to the fact that the pigs gave better returns for the milk the first five weeks than they did later. The same fact is demonstrated in the Louisiana experiment reported on page 39. The average value for the separated milk in this Louisiana test was 15.3 per 100 pounds for the entire feeding period. However it was worth 20.6c per 100 during the first 28 days, and worth only 9.2c per 100 pounds the third 28 day period, showing that as the pigs grew older, they had less need for the milk.

Kuhlman and Wilson of South Dakota found that corn and buttermilk produced larger gains and cheaper gains than corn and tankage, but that corn, tankage, and buttermilk were still more efficient. With corn at 42 cents a bushel and tankage at $40.00 per ton, the value of the buttermilk would have been 19c per 100 when fed as the only supplement, and 24c per 100 when fed in combination with tankage.

In another test when feeding buttermilk in smaller quantities, slightly over one pound (pint) of buttermilk for each pound of corn, they produced 1.69 pounds gain per day on corn, buttermilk and tankage, and only 1.17 pounds per day on corn and tankage alone. In this test 100 pounds of buttermilk replaced 26.05 pounds corn and 7.2 pounds tankage, a value at the time of 77c per 100 pounds or about 34c per 100 pounds at present (1932) prices. This shows that a high protein supplement is advisable even with as valuable a protein feed as buttermilk. Separated milk and buttermilk have practically the same value.

Separated milk and buttermilk are somewhat deficient in Vitamin A, a vitamin found in butterfat and also in yellow corn. Young pigs fed on white corn and separated milk in dry lots will suffer from different forms of stiffness, lameness, partial paralysis or rheumatism while pigs on yellow corn and separated milk will make satisfactory gains. The remedy is to supply either pasture or about 5% of cut alfalfa hay, cut clover hay or clover or alfalfa leaves providing that these are of a good green color.28

Creameries often sell the dairy by-products at 10c per can. If a supply of this can be hauled home daily with little extra cost for hauling it will pay to do so, especially for pigs under 100 pounds weight. Such milk is usually pasteurized in the creamery, and is therefore

safe to feed. Unpasteurized milk from tubercular cows should not be fed. Whey from the cheese factory has just about half the feeding value of separated milk or buttermilk.

**SOYBEANS, COWPEAS, AND SOYBEAN MEAL**

Soybeans and cowpeas can be hogg‐off in the field along with corn or sweet potatoes, and make fairly good protein supplement. Some high protein feed as shrimp meal should be fed also. Soybeans tend to make soft pork and are objected to on this account. Soybean oil meal, after the oil has been extracted from the seed, makes a protein supplement equal to cottonseed meal, but this feed is not generally available at present.

**ALFALFA HAY, ALFALFA MEAL, AND CLOVER MEAL**

Alfalfa hay, alfalfa meal or cut clover hay are used successfully in supplementing corn and tankage rations for swine when not making up more than one‐fourth of the protein mixture. Alfalfa meal is not entirely satisfactory when used as the only supplement to corn, but when included with tankage and other protein feeds, the use of ground alfalfa usually results in larger and cheaper gains. At the Kansas station pigs having access to alfalfa hay along with corn and tankage gained ¾ pound more per day and used 10% less feed per pound gain than did pigs on corn and tankage alone. In this test 9.5 pounds of alfalfa hay replaced 37.1 pounds of corn for each 100 pounds gain.

Clover hay of good quality has proved satisfactory in place of alfalfa for dry‐lot feeding. In one Wisconsin test, clover was slightly better than alfalfa, and in an Ohio test only slightly less valuable. Where hogs are on pasture during a large part or all of the time, there is not the same need for alfalfa meal or cut clover hay, but in dry lot feeding, these prove to be valuable.

In an experiment recently completed at the Louisiana station (page 32) where rice polish made up part of the ration, dehydrated alfalfa meal was slightly superior to cottonseed meal as a part of the protein supplement.

It does not seem to make any great difference how this alfalfa or clover is fed. Hogs will eat a considerable amount of these hays if put out in a rack. The main advantages of grinding these hays into meal is that the meal can be mixed with other feeds and fed in self‐feeders, also the pigs can be made to eat parts of the stems that they would waste when fed hay. Coarse stemmy hay is not suitable for hogs and neither is hay that has lost color from rain or sun bleaching.

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PASTURES AS PROTEIN SUPPLEMENTS

Pastures are valuable sources of protein and of vitamins. How much of the value of pasture is due to feed value alone, and how much is due to the protein and vitamin content, is not easy to say. It appears, however, that the protein supplied by the pastures is of considerable value. This is shown by an experiment recently completed at the Louisiana station where pigs fattened in a dry lot ate 53.7% more protein supplement than pigs fed a similar ration on white clover pasture, yet the pigs on pasture made 11.5 faster gains. These two lots ate practically the same amount of corn. Robison found that where pigs were fed corn in dry lots, the feeding of tankage reduced the amount of feed 205 pounds for each 100 pounds gain. But fed on pasture, the feeding of tankage reduced the feed requirement only 48 pounds for each 100 pounds gain. This showed that the pastures were supplying nearly enough protein for the hogs.

Experiments show, however, that it is more economical to feed some protein supplements even with the best pasture. At the Kansas station where tankage was fed to one lot of pigs on corn and alfalfa pasture, each 3½ cents worth of tankage (1 pound) saved 7 cents worth of corn, or 4% pounds as compared to the corn consumed by pigs on corn and alfalfa pasture only. The pigs receiving tankage gained 1.34 pounds per day as compared to .85 pounds gain for those receiving corn and alfalfa only, a very important difference where early selling means a higher sale price per pound.

Fig. 5. One acre of Dwarf Essex rape contained as much crude protein as is contained in a ton of tankage. Pastures supply vitamins and minerals in addition, which help to keep the pig in good health.

An analysis of rape pasture\textsuperscript{33} showed that an acre of winter rape pasture in December contained 1098 pounds of crude protein or practically as much as a ton of tankage. Lush\textsuperscript{34} has shown that an acre of white clover may produce over a ton of crude protein in one year on good bottom lands, and over one-half a ton of crude protein on the upland soils. The value of legume pasture in cheapening rations needs to be especially emphasized.

**DOES IT PAY TO LIMIT THE PROTEIN SUPPLEMENT ON PASTURE?**

When feeding hogs a palatable protein supplement in self-feeders, it was thought that they might be eating more protein supplement than they actually needed, instead of making full use of the pasture. The following test gives a comparison of limited feeding of protein supplement as compared to full feeding both on pasture and in the dry lot.

The saving from restricted feeding was very slight, and could not be considered significant. The pigs in Lot 6 on pasture and receiving all the protein supplement they would eat used little more than half the protein eaten by the pigs in dry lot. This showed that they would restrict their own protein when they had pasture. The saving from hand feeding was not worth the extra labor.

\textsuperscript{33}Louisiana State Experiment Statiton, 1932.
\textsuperscript{34}Lush, R. H. Unpublished data.
### Table VI

Swine Fattening Experiments—Limited and Unlimited Protein Supplements on Pasture.

(On test 60 days—8 pigs per lot. Dec. 14, 1931—Feb. 10, 1932)

<table>
<thead>
<tr>
<th></th>
<th>2 Pasture Limited Protein Supplement</th>
<th>6 Pasture Unlimited Protein Supplement</th>
<th>5 Dry Lot Unlimited Protein Supplement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average initial weight</td>
<td>91.3</td>
<td>91.0</td>
<td>92.0</td>
</tr>
<tr>
<td>Average final weight</td>
<td>185.1</td>
<td>188.6</td>
<td>189.3</td>
</tr>
<tr>
<td>Average gain</td>
<td>93.8</td>
<td>97.6</td>
<td>1.62</td>
</tr>
<tr>
<td>Average daily gain</td>
<td>1.6</td>
<td>1.63</td>
<td>1.62</td>
</tr>
<tr>
<td>Feed for 100-lb. gain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>346.3</td>
<td>345.9</td>
<td>331.9</td>
</tr>
<tr>
<td>Shrimp bran</td>
<td>12.4</td>
<td>15.4</td>
<td>26.3</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>8.3</td>
<td>10.3</td>
<td>17.5</td>
</tr>
<tr>
<td>Mineral</td>
<td>.493</td>
<td>.23</td>
<td>.81</td>
</tr>
<tr>
<td>Average feed per day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>5.4</td>
<td>5.6</td>
<td>5.4</td>
</tr>
<tr>
<td>Shrimp bran</td>
<td>.19</td>
<td>.25</td>
<td>.43</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>.13</td>
<td>.17</td>
<td>.28</td>
</tr>
<tr>
<td>Mineral</td>
<td>.0077</td>
<td>.004</td>
<td>.013</td>
</tr>
<tr>
<td>Total Cost of Feed per Head</td>
<td>$3.83</td>
<td>$4.05</td>
<td>$4.18</td>
</tr>
<tr>
<td>Cost per 100 lb. gain—1931 market prices</td>
<td>$4.08</td>
<td>$4.15</td>
<td>$4.30</td>
</tr>
<tr>
<td>Cost per 100 lb. gain—farm prices</td>
<td>$2.49</td>
<td>$2.55</td>
<td>$2.74</td>
</tr>
</tbody>
</table>

### Protein Needed with Sweet Potatoes

The following table shows the advantage of feeding a protein supplement to hogs fed sweet potatoes in a dry lot. The hogs receiving tankage made a little over three times as much gain per day on practically the same amount of potatoes. Sweet potatoes are very low in protein and this must be supplied if the hogs are to make the best use of the potatoes.

Probably seven million bushels of cull sweet potatoes are fed to hogs annually in Louisiana. Fed with a protein supplement, these cull potatoes had a feeding value of about 11c per bushel when fed with tankage and only 6c a bushel when fed without tankage.
Fig. 7. Fed Sweet Potatoes and Tankage in dry lot. Gained .91 lbs. per day. One pound of tankage replaced 241 pounds of sweet potatoes.

Fig. 8. Sweet Potatoes only, fed in dry lot. Gained only .27 lbs. per day. Sweet potatoes need a supplement.
VALUE OF TANKAGE WITH SWEET POTATOES IN DRY LOT

TABLE VII

December 8, 1927, to January 19, 1928—42 Days—10 Hogs per Lot.

J. B. FRANCIONI, JR.—C. I. BRAY

<table>
<thead>
<tr>
<th></th>
<th>Sweet Potatoes</th>
<th>Sweet Potatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tankage Lbs.</td>
<td>No Tankage Lbs.</td>
</tr>
<tr>
<td>Average initial weight</td>
<td>104.3</td>
<td>104.3</td>
</tr>
<tr>
<td>Average final weight</td>
<td>142.7</td>
<td>115.5</td>
</tr>
<tr>
<td>Gain per pig</td>
<td>38.4</td>
<td>11.2</td>
</tr>
<tr>
<td>Average daily gains</td>
<td>.91</td>
<td>.27</td>
</tr>
<tr>
<td>Average daily ration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>15.3</td>
<td>15.6</td>
</tr>
<tr>
<td>Tankage</td>
<td>1.58</td>
<td>...</td>
</tr>
<tr>
<td>Total feed per hog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>642.0</td>
<td>655.5</td>
</tr>
<tr>
<td>Tankage</td>
<td>66.5</td>
<td>...</td>
</tr>
<tr>
<td>Feed per 100 lbs. gain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>1671.9</td>
<td>5852.7</td>
</tr>
<tr>
<td>Tankage</td>
<td>173.2</td>
<td>...</td>
</tr>
</tbody>
</table>

100 pounds of tankage replaced 2,413.8 pounds sweet potatoes.

$1.00 tankage replaced 603.5 pounds sweet potatoes.
SWINE FEEDING EXPERIMENTS 1928-1932

I. EXPERIMENTS WITH PROTEIN SUPPLEMENTS FOR SWINE

The following pages give the experimental records on protein supplement tests and pasture feeding tests largely as these were previously reported in mimeographed form. The prices of hogs and the prices of feeds given are the market prices at the time the experimental work was done. However, in order to give the swine feeder an estimate of the cost of gains at present prices, a separate line has been added to the tables giving the probable cost of gains with corn at 42c per bushel, cottonseed meal at $18.00 a ton, alfalfa meal at $10.00 a ton, rice polish at $18.00 a ton, and shrimp meal at $30.00 and tankage at $40.00 a ton. Shrimp meal can be obtained in some sections of the state at $20.00 and $25.00 per ton.

Experimental work on feeding sweet potatoes (1928-1932) and on hogging down corn will be reported in a separate bulletin at the close of the 1932 season.

EXPERIMENTS WITH TANKAGE AND SHRIMP MEAL SINGLY AND IN MIXTURES — AS SUPPLEMENTS FOR SWINE

June 26—Aug. 7, 1928

EXPERIMENT I

J. B. FRANCIONI, JR., CHAS. I. BRAY

Objects of Experiment:

1. To compare standard digester tankage, shrimp meal, and cracklings tankage as supplements to a corn and rice-polish ration for fattening swine.

2. To determine the value of replacing half the tankage or shrimp meal with a protein mixture of equal parts cottonseed meal, ground soybeans, and ground alfalfa.

Hogs Used:

Grade Duroc Jersey and Hampshire pigs averaging 72.7 pounds weight were purchased from a local hog feeder. These pigs were above average grade, uniform and of good breeding. They were vaccinated for hog cholera, dipped, and had been treated twice for roundworms.

Feeds Used:

The digester tankage was a standard 60% tankage donated by Swift & Company of Chicago. The cracklings tankage was donated by the Rapides Packing Company of Alexandria, Louisiana. The shrimp meal was purchased from the Pelican Lake Oyster & Fish Company of Houma, Louisiana. The ground alfalfa was from hay
grown on the University farm and the ground soybeans made from a mixture of cracked seed beans. The cottonseed meal was classed as prime meal.

Plan of Experiment:
The hogs were fed in self feeders, the basal ration, and the protein supplement being fed free choice in separate compartments. A mineral mixture of 50 pounds bone meal, 25 pounds acid phosphate (16%), 20 pounds air slacked lime and 5 pounds common salt was available at all times.

Conclusions:
1. An improved protein supplement mixture of shrimp meal 3 parts, ground alfalfa 1 part, ground soybeans 1 part and cottonseed meal 1 part, proved superior to shrimp meal alone in balancing a corn and rice polish ration.
2. In this test, tankage alone proved superior to the supplemental mixture of tankage 3, ground alfalfa 1, cottonseed meal 1 and ground soybean meal supplement used alone. This result is not in line with the results obtained at other experiment stations or in two later Louisiana experiments.
3. The Rapides tankage containing pork cracklings gave excellent results, the gains being equal to the improved shrimp meal mixture. On account of its low cost, this lot showed a greater profit than that from any other group.

Note. It may be noted that the feed requirements per 100 pounds gain are unusually low. This is due to the fact that these pigs had been on a garbage and pasture ration previous to the experiment and were in excellent condition to put on rapid gains in dry lot.
EXPERIMENT I

Feeding Period June 26—August 7, 1928
Table Based on Average Weights

<table>
<thead>
<tr>
<th>Lot number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs in lot</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

**Ration**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn, Rice Polish, Standard Tankage</th>
<th>Corn, Rice Polish, Standard Tankage</th>
<th>Corn, Rice Polish, Standard Tankage</th>
<th>Corn, Rice Polish, Standard Tankage</th>
<th>Corn, Rice Polish, Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Corn</td>
<td>Rice</td>
<td>Polish</td>
<td>Standard</td>
<td>Tankage</td>
</tr>
<tr>
<td>2</td>
<td>Corn</td>
<td>Rice</td>
<td>Polish</td>
<td>Standard</td>
<td>Tankage</td>
</tr>
<tr>
<td>3</td>
<td>Corn</td>
<td>Rice</td>
<td>Polish</td>
<td>Standard</td>
<td>Tankage</td>
</tr>
<tr>
<td>4</td>
<td>Corn</td>
<td>Rice</td>
<td>Polish</td>
<td>Standard</td>
<td>Tankage</td>
</tr>
<tr>
<td>5</td>
<td>Corn</td>
<td>Rice</td>
<td>Polish</td>
<td>Standard</td>
<td>Tankage</td>
</tr>
</tbody>
</table>

**Initial weight**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn</th>
<th>Rice Polish</th>
<th>Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>72.7</td>
<td>72.6</td>
<td>72.7</td>
</tr>
<tr>
<td>2</td>
<td>72.6</td>
<td>72.7</td>
<td>72.6</td>
</tr>
<tr>
<td>3</td>
<td>72.7</td>
<td>72.6</td>
<td>72.7</td>
</tr>
<tr>
<td>4</td>
<td>72.6</td>
<td>72.7</td>
<td>72.6</td>
</tr>
<tr>
<td>5</td>
<td>72.6</td>
<td>72.7</td>
<td>72.6</td>
</tr>
</tbody>
</table>

**Final weight**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn</th>
<th>Rice Polish</th>
<th>Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>148.2</td>
<td>145.9</td>
<td>143.0</td>
</tr>
<tr>
<td>2</td>
<td>145.9</td>
<td>143.0</td>
<td>151.6</td>
</tr>
<tr>
<td>3</td>
<td>143.0</td>
<td>151.6</td>
<td>151.7</td>
</tr>
<tr>
<td>4</td>
<td>151.6</td>
<td>143.0</td>
<td>151.7</td>
</tr>
<tr>
<td>5</td>
<td>151.7</td>
<td>143.0</td>
<td>151.7</td>
</tr>
</tbody>
</table>

**Total gain**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn</th>
<th>Rice Polish</th>
<th>Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75.5</td>
<td>73.3</td>
<td>70.3</td>
</tr>
<tr>
<td>2</td>
<td>73.3</td>
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<td>79.0</td>
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<tr>
<td>3</td>
<td>70.3</td>
<td>79.0</td>
<td>79.0</td>
</tr>
<tr>
<td>4</td>
<td>79.0</td>
<td>79.0</td>
<td>79.0</td>
</tr>
<tr>
<td>5</td>
<td>79.0</td>
<td>79.0</td>
<td>79.0</td>
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</tbody>
</table>

**Daily gain**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn</th>
<th>Rice Polish</th>
<th>Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.80</td>
<td>1.75</td>
<td>1.67</td>
</tr>
<tr>
<td>2</td>
<td>1.75</td>
<td>1.67</td>
<td>1.88</td>
</tr>
<tr>
<td>3</td>
<td>1.67</td>
<td>1.88</td>
<td>1.88</td>
</tr>
<tr>
<td>4</td>
<td>1.88</td>
<td>1.88</td>
<td>1.88</td>
</tr>
<tr>
<td>5</td>
<td>1.88</td>
<td>1.88</td>
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</tbody>
</table>

**DAILY RATION—PER PIG**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn</th>
<th>Rice Polish</th>
<th>Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.91</td>
<td>3.95</td>
<td>3.93</td>
</tr>
<tr>
<td>2</td>
<td>3.95</td>
<td>3.93</td>
<td>4.02</td>
</tr>
<tr>
<td>3</td>
<td>3.93</td>
<td>4.02</td>
<td>3.73</td>
</tr>
<tr>
<td>4</td>
<td>4.02</td>
<td>3.73</td>
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</tr>
<tr>
<td>5</td>
<td>3.73</td>
<td>3.73</td>
<td>3.73</td>
</tr>
</tbody>
</table>

**FEED FOR 100 POUNDS GAIN.**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Corn</th>
<th>Rice Polish</th>
<th>Standard Tankage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>217.3</td>
<td>226.10</td>
<td>234.9</td>
</tr>
<tr>
<td>2</td>
<td>226.10</td>
<td>234.9</td>
<td>213.5</td>
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<tr>
<td>3</td>
<td>234.9</td>
<td>213.5</td>
<td>198.3</td>
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<td>4</td>
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</tr>
<tr>
<td>5</td>
<td>198.3</td>
<td>198.3</td>
<td>198.3</td>
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</table>

**FINANCIAL STATEMENT**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Initial value at $.10</th>
<th>Cost of feed</th>
<th>Cost per 100 lb. gain</th>
<th>Final weight—less 3%</th>
<th>Value at $.11</th>
<th>Selling costs</th>
<th>Vaccination and worming</th>
<th>Total cost, per head</th>
<th>Balance, per head</th>
<th>Cost per 100 lb. gain at estimated 1932 feed prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$7.27</td>
<td>6.15</td>
<td>8.14</td>
<td>143.8</td>
<td>158.2</td>
<td>.89</td>
<td>.36</td>
<td>14.67</td>
<td>1.15</td>
<td>2.67</td>
</tr>
<tr>
<td>2</td>
<td>$7.26</td>
<td>5.95</td>
<td>8.12</td>
<td>143.5</td>
<td>155.7</td>
<td>.89</td>
<td>.36</td>
<td>14.46</td>
<td>1.11</td>
<td>2.66</td>
</tr>
<tr>
<td>3</td>
<td>$7.27</td>
<td>5.94</td>
<td>8.44</td>
<td>148.1</td>
<td>152.6</td>
<td>.89</td>
<td>.36</td>
<td>14.46</td>
<td>0.80</td>
<td>2.73</td>
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<tr>
<td>4</td>
<td>$7.26</td>
<td>6.16</td>
<td>7.79</td>
<td>141.7</td>
<td>161.8</td>
<td>.89</td>
<td>.36</td>
<td>14.46</td>
<td>1.51</td>
<td>2.48</td>
</tr>
<tr>
<td>5</td>
<td>$7.27</td>
<td>5.74</td>
<td>7.27</td>
<td>147.1</td>
<td>161.9</td>
<td>.89</td>
<td>.36</td>
<td>14.26</td>
<td>1.93</td>
<td>2.39</td>
</tr>
</tbody>
</table>

**PRICES OF FEEDS**

- Corn: $2.45
- Rice polish: 2.55
- Standard tankage: 5.00
- Cracklings tankage: 3.50
- Shrimp meal: $3.40
- Cottonseed meal: 2.72
- Ground soy beans: 2.00
- Ground alfalfa hay: 1.80
EXPERIMENTS WITH TANKAGE AND SHRIMP MEAL SINGLY 
AND IN COMBINATION WITH COTTONSEED MEAL AS SUPPLE­
MENTS TO CORN FOR SWINE. EFFECTS OF ADDING 
CODLIVER OIL TO RATIONS OF FALL PIGS

EXPERIMENT II
January 31 to April 11, 1930—70 Days
J. B. FRANCIONI, JR., M. G. SNELL, C. L. BRAY

Objects of Experiment:
1. To compare shrimp meal with standard digester tankage as pro­
tein supplements for swine.
2. To determine the value of cottonseed meal in replacing half of 
the tankage or shrimp meal.
3. To determine the value of adding codliver oil to a winter fattening 
ration for fall pigs.

Hogs Used:
Nearly all of the pigs used in this test were purebred Duroc 
Jerseys, Poland-Chinas, and Hampshires raised in the University 
herd. Nine grade Duroc Jerseys were purchased from a local 
feeder. All these pigs had been wormed and vaccinated for 
cholera.

Feeds Used:
Corn was the basal feed, ground and fed in self feeders. Shrimp 
meal was purchased from the Pelican Lake Oyster Company, 
Houma. Cottonseed meal was a 7% meal (7% nitrogen). Codliver 
oil was a standard commercial grade. Tankage was standard 
digester tankage, 60% protein. Feeds were fed in self feeders with 
separate compartments for corn, protein supplements and min­
erals. Where two protein supplements were used they were mixed 
and fed together in the same compartment of the self feeder. The 
mineral mixture was made up of common salt, 20%, lime 40%, 
steamed bone meal 40%. Codliver oil was mixed with the protein 
supplements for lots III and IV.

Conclusions:
1. Shrimp meal is a more efficient supplement to corn chops than 
tankage for fattening growing hogs.
2. One hundred pounds of shrimp meal when compared to tankage 
as in Lots I and II was equivalent to 106 pounds of tankage plus 
139 pounds of corn.
3. Shrimp meal and cottonseed meal in equal proportions proved 
superior to shrimp meal alone.
4. When mixed in equal proportions with shrimp meal, 100 pounds 
of cottonseed meal replaced 49.26 pounds of shrimp meal and 
129.42 pounds of corn chops.
## EXPERIMENT II

**Feeding Period January 31 to April 11, 1930—70 Days**

### Table Based on Average Weights

<table>
<thead>
<tr>
<th>Lot number</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pigs per lot</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ration</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, Shrimp Tankage, Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, Shrimp Meal, Cod-liver Oil, Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn, Shrimp Meal, Cod-liver Oil, Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

### AVERAGE DAILY RATION

<table>
<thead>
<tr>
<th>Corn</th>
<th>4.36</th>
<th>3.97</th>
<th>3.97</th>
<th>3.76</th>
<th>4.09</th>
<th>4.05</th>
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</thead>
<tbody>
<tr>
<td>Tankage</td>
<td>.48</td>
<td>.49</td>
<td>.42</td>
<td>.42</td>
<td>.40</td>
<td>.40</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>.59</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Codliver oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FEED PER 100 LBS. GAIN

<table>
<thead>
<tr>
<th>Corn</th>
<th>306.4</th>
<th>363.5</th>
<th>341.7</th>
<th>374.2</th>
<th>270.7</th>
<th>255.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tankage</td>
<td>43.5</td>
<td></td>
<td>41.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>41.15</td>
<td></td>
<td>42.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td></td>
<td></td>
<td>2.23</td>
<td>2.19</td>
<td>27.6</td>
<td>28.0</td>
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<tr>
<td>Codliver oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.68</td>
<td>2.68</td>
</tr>
<tr>
<td>Minerals</td>
<td>.12</td>
<td>.22</td>
<td>.16</td>
<td>.22</td>
<td>.15</td>
<td>.19</td>
</tr>
<tr>
<td>Total concentrates</td>
<td>347.55</td>
<td>407.00</td>
<td>383.94</td>
<td>415.90</td>
<td>325.90</td>
<td>341.40</td>
</tr>
</tbody>
</table>

### FINANCIAL STATEMENT

<table>
<thead>
<tr>
<th>Initial value per pig at 9 cents per lb</th>
<th>$6.17</th>
<th>$6.21</th>
<th>$6.20</th>
<th>$6.20</th>
<th>$6.22</th>
<th>$6.19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed cost per pig</td>
<td>7.34</td>
<td>7.25</td>
<td>7.05</td>
<td>7.15</td>
<td>7.24</td>
<td>7.09</td>
</tr>
<tr>
<td>Feed cost per 100 lb. pork</td>
<td>7.37</td>
<td>9.49</td>
<td>8.68</td>
<td>9.16</td>
<td>6.84</td>
<td>7.75</td>
</tr>
<tr>
<td>Final value at $10.50 per 100 (3% shrink)</td>
<td>17.14</td>
<td>14.80</td>
<td>15.39</td>
<td>14.19</td>
<td>17.82</td>
<td>17.12</td>
</tr>
<tr>
<td>Estimated sale costs</td>
<td>.75</td>
<td>.75</td>
<td>.75</td>
<td>.75</td>
<td>.75</td>
<td>.75</td>
</tr>
<tr>
<td>Total costs per pig</td>
<td>14.26</td>
<td>14.21</td>
<td>14.00</td>
<td>14.10</td>
<td>14.21</td>
<td>14.63</td>
</tr>
<tr>
<td>Estimated profit per head</td>
<td>2.88</td>
<td>0.59</td>
<td>1.29</td>
<td>0.09</td>
<td>3.61</td>
<td>2.49</td>
</tr>
<tr>
<td>Feed cost per 100 lb. gain at estimated 1932 feed prices</td>
<td>2.89</td>
<td>3.62</td>
<td>3.75</td>
<td>4.18</td>
<td>2.69</td>
<td>2.95</td>
</tr>
</tbody>
</table>

### PRICES OF FEEDS

- Corn $2.07 per 100 pounds
- Tankage $4.50 per 100 pounds
- Shrimp meal $2.50 per 100 pounds
- Cottonseed meal $2.00 per 100 pounds
- Codliver oil .25 a pound
- Minerals $3.90 per 100 pounds

5. Tankage and cottonseed meal in equal proportions make a more efficient supplement than tankage alone, but not so efficient as shrimp meal and cottonseed meal. Under these conditions 100 pounds of cottonseed meal replaced 183 pounds of corn chops and 1.68 pounds of tankage in producing 100 pounds of pork.
6. Cottonseed meal when mixed in equal proportions with shrimp meal or tankage makes an efficient and economical supplement for fattening growing hogs.

7. Codliver oil proved uneconomical and resulted in reduced gains as well as more expensive gains. It is not certain why codliver oil showed to such disadvantages in this test. The oil was tested for vitamin D content by Dr. Sunderlin and found to be potent. A small amount of codliver oil might have given better results. The 1929 test was conducted in open feed lots so that the pigs had all the sunlight available.

**EXPERIMENT III**

**TANKAGE AND SHRIMP MEAL SINGLY AND IN MIXTURES AS SUPPLEMENTS TO RICE POLISH ALONE, AND TO CORN AND RICE POLISH FOR SWINE**

December 5, 1930 to March 15, 1931 — 100 Days

C. I. BRAY, E. M. GREGORY

**Objects of Experiment:**

To test the value of shrimp meal, tankage, shrimp meal and cottonseed meal combined, and tankage and cottonseed meal combined, as supplements to rice polish alone and to a corn and rice polish ration.

**Hogs Used:**

The hogs used were purebred Poland-Chinas, Duroc Jerseys and Hampshires from the University herd.

**Plan of Experiment:**

The hogs were fed in self feeders in dry lots. The corn, rice polish, and the protein supplement mixtures were fed in separate compartments of the feeders and a mineral mixture was self fed in a separate compartment.

For the first 70 days, rice polish was the only fattening feed given to Lots I, II, IV and V. For the last 30 days, corn and rice polish were fed in separate compartments, free choice. Lot III was fed corn as the only fattening feed throughout the experiment.
# EXPERIMENT III
Protein Supplements for Swine

## FIRST PERIOD
December 5, 1930, to February 13, 1931—70 Days

<table>
<thead>
<tr>
<th>Ration</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice Polish, Shrimp Meal</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Corn, Shrimp Meal</td>
<td>57.26</td>
<td>59.90</td>
<td>60.32</td>
<td>57.41</td>
<td>57.94</td>
</tr>
<tr>
<td>Polished Corn, Shrimp Meal</td>
<td>114.30</td>
<td>106.90</td>
<td>114.60</td>
<td>108.90</td>
<td>95.50</td>
</tr>
<tr>
<td>Cottonseed Meal</td>
<td>57.10</td>
<td>47.00</td>
<td>54.30</td>
<td>51.50</td>
<td>37.60</td>
</tr>
<tr>
<td>Tankage, Cottonseed Meal</td>
<td>.81</td>
<td>.67</td>
<td>1.20</td>
<td>.73</td>
<td>.54</td>
</tr>
</tbody>
</table>

### FEED FOR 100 LBS. GAIN

<table>
<thead>
<tr>
<th>Ration</th>
<th>FEED PER 100 LBS. GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>319.00</td>
</tr>
<tr>
<td>Rice polish</td>
<td>812.10</td>
</tr>
<tr>
<td>Tankage</td>
<td>324.50</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>322.70</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>330.30</td>
</tr>
<tr>
<td>Minerals</td>
<td>347.90</td>
</tr>
<tr>
<td>Total concentrates</td>
<td>486.10</td>
</tr>
<tr>
<td>lb. pork</td>
<td>406.30</td>
</tr>
<tr>
<td></td>
<td>371.20</td>
</tr>
<tr>
<td></td>
<td>369.50</td>
</tr>
<tr>
<td></td>
<td>420.70</td>
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</table>

## SECOND PERIOD—30 DAYS
(Corn; Self-Fed in All Lots)

<table>
<thead>
<tr>
<th>Ration</th>
<th>FEED PER 100 LBS. GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average initial weight</td>
<td>114.30 106.90 144.60 108.90 95.50</td>
</tr>
<tr>
<td>Average final weight</td>
<td>157.30 155.70 201.30 142.80 133.40</td>
</tr>
<tr>
<td>Average gains</td>
<td>48.00 48.80 56.70 33.90 37.90</td>
</tr>
<tr>
<td>Average gain per day</td>
<td>1.43 1.63 1.89 1.13 1.26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ration</th>
<th>FEED PER 100 LBS. GAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>358.10</td>
</tr>
<tr>
<td>Rice polish</td>
<td>86.00</td>
</tr>
<tr>
<td>Tankage</td>
<td>330.30</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>42.00</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>17.70</td>
</tr>
<tr>
<td>Mineral</td>
<td>430.00</td>
</tr>
<tr>
<td>Total concentrates</td>
<td>486.10</td>
</tr>
</tbody>
</table>
# EXPERIMENT III

## Summary Both Periods

December 5, 1930, to March 15, 1931—100 Days

<table>
<thead>
<tr>
<th>Lot number</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ration</td>
<td>*Corn, Rice Polish, Shrimp Meal</td>
<td>*Corn, Rice Polish, Shrimp Meal, Cotton-Seed Meal</td>
<td>Corn, Shrimp Meal</td>
<td>*Corn, Rice Polish, Tankage</td>
<td>*Corn, Rice Polish, Tankage, Cotton-Seed Meal</td>
</tr>
<tr>
<td>Number of hogs in lot</td>
<td>10</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Average initial weight</td>
<td>57.2</td>
<td>59.9</td>
<td>60.3</td>
<td>57.7</td>
<td>57.94</td>
</tr>
<tr>
<td>Average final weight</td>
<td>157.3</td>
<td>155.7</td>
<td>201.3</td>
<td>172.8</td>
<td>133.4</td>
</tr>
<tr>
<td>Average gain</td>
<td>100.1</td>
<td>96.6</td>
<td>141.0</td>
<td>85.7</td>
<td>75.5</td>
</tr>
<tr>
<td>Average gain per day</td>
<td>1.00</td>
<td>.96</td>
<td>1.41</td>
<td>.85</td>
<td>.755</td>
</tr>
</tbody>
</table>

## TOTAL FEED PER HEAD

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>*154.0</td>
<td>*161.2</td>
<td>*157.4</td>
<td>*122.6</td>
<td>*117.3</td>
</tr>
<tr>
<td>Rice polish</td>
<td>219.3</td>
<td>172.8</td>
<td></td>
<td>194.5</td>
<td>146.7</td>
</tr>
<tr>
<td>Tankage</td>
<td></td>
<td></td>
<td></td>
<td>33.0</td>
<td>20.4</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>56.35</td>
<td>30.8</td>
<td>33.4</td>
<td></td>
<td>20.4</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>.14</td>
<td>.17</td>
<td>.75</td>
<td>2.85</td>
<td>2.5</td>
</tr>
</tbody>
</table>

## FEED PER 100 LB. GAIN

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>153.8</td>
<td>168.5</td>
<td>367.0</td>
<td>144.2</td>
<td>155.4</td>
</tr>
<tr>
<td>Rice polish</td>
<td>219.1</td>
<td>180.6</td>
<td></td>
<td>229.0</td>
<td>196.0</td>
</tr>
<tr>
<td>Tankage</td>
<td></td>
<td></td>
<td></td>
<td>38.6</td>
<td>27.2</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>56.3</td>
<td>32.2</td>
<td>37.6</td>
<td></td>
<td>27.2</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>.14</td>
<td>.19</td>
<td>.75</td>
<td>3.33</td>
<td>3.44</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>429.2</td>
<td>413.5</td>
<td>404.6</td>
<td>411.8</td>
<td>405.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed cost per head</td>
<td>$6.13</td>
<td>$5.61</td>
<td>$8.66</td>
<td>$8.48</td>
<td>$4.50</td>
</tr>
<tr>
<td>Feed cost per 100 lb. gain</td>
<td>6.12</td>
<td>5.86</td>
<td>6.14</td>
<td>6.41</td>
<td>5.96</td>
</tr>
<tr>
<td>Initial value at 8 cents</td>
<td>4.58</td>
<td>4.79</td>
<td>4.82</td>
<td>4.59</td>
<td>4.63</td>
</tr>
<tr>
<td>Total cost</td>
<td>10.71</td>
<td>10.40</td>
<td>13.48</td>
<td>10.07</td>
<td>9.18</td>
</tr>
<tr>
<td>Appraised sale price</td>
<td>8.25</td>
<td>8.22</td>
<td>8.25</td>
<td>8.16</td>
<td>7.97</td>
</tr>
<tr>
<td>Estimated sale value, less 3% shrinkage</td>
<td>12.59</td>
<td>12.40</td>
<td>16.11</td>
<td>11.30</td>
<td>10.31</td>
</tr>
<tr>
<td>Estimated balance per head</td>
<td>1.88</td>
<td>2.00</td>
<td>2.63</td>
<td>1.23</td>
<td>1.13</td>
</tr>
</tbody>
</table>

## Estimated cost per 100 lb. gain at 1932 prices

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.97</td>
<td>3.64</td>
<td>3.31</td>
<td>3.91</td>
<td>3.72</td>
</tr>
</tbody>
</table>

## PRICES OF FEEDS

<table>
<thead>
<tr>
<th></th>
<th>Prices 1931</th>
<th>Est. Prices 1932</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, per bushel</td>
<td>$ .80</td>
<td>$ .42</td>
</tr>
<tr>
<td>Rice polish, per ton</td>
<td>24.00</td>
<td>24.00</td>
</tr>
<tr>
<td>Tankage, per 100 lbs</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Shrimp meal, per 100 lbs</td>
<td>2.30</td>
<td>2.30</td>
</tr>
<tr>
<td>Cottonseed meal, per ton</td>
<td>31.50</td>
<td>31.50</td>
</tr>
<tr>
<td>Mineral, per 100 lbs</td>
<td>2.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*Corn fed last 30 days only. †Corn fed entire period.
Conclusions:

1. In this test, rice polish fed as the only fattening concentrate was not equal to corn.
2. Cottonseed meal gave unsatisfactory results where rice polish was the only fattening feed. Feeding cottonseed meal with shrimp meal or tankage reduced gains 20% and increased the feed requirement for 100 pounds gain 20%.
3. Shrimp meal produced greater gains per day than tankage, either with or without cottonseed meal as a supplement to a rice polish ration and the gains were cheaper. The pigs ate more of the shrimp meal. If the shrimp meal had been sold at the same price as tankage, the cost of gains would have been higher than with tankage.
4. With a ration of corn and rice polish fed free choice, the feeding of cottonseed meal produced 12.9% larger gains than in the two rations containing no cottonseed meal and reduced the feed requirements 15.5% per 100 pounds gain.
5. It would appear from this experiment that cottonseed meal and rice polish do not form a satisfactory combination. This may possibly be due to a higher relative proportion of phosphorus and magnesium compared to lime in these two feeds, or it might be due to the proteins not supplementing each other. Further work will be done on this problem.
6. Pigs receiving tankage ate more mineral matter than those receiving shrimp meal. It is probable that pigs eating all the shrimp meal they want do not require a mineral supplement, though this has not been tested experimentally.

EXPERIMENT IV. PROTEIN SUPPLEMENTS FOR SWINE

I. CORN VS. CORN AND RICE POLISH
II. DEHYDRATED ALFALFA VS. COTTONSEED MEAL

Hogs Used:

Twenty-four pigs practically all purebreds, owned by the University were divided into three lots and fed as follows:

RATIONS

Lot No.
5. Ear corn, shrimp meal, cottonseed meal.
7. (a) Ear corn, rice polish, shrimp meal—first 21 days.
    (b) Dehydrated alfalfa meal added—last 28 days.
EXPERIMENT IV  
Shrimp Meal, Cottonseed Meal and Dehydrated Alfalfa Meal as Supplements to Corn and Rice Polish  
Corn Versus Corn and Rice Polish  
March 2 to April 20, 1932—49 Days—8 Pigs per Lot

<table>
<thead>
<tr>
<th>Lot number</th>
<th>V</th>
<th>VI</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ration</td>
<td>Corn, Shrimp Meal, Cottonseed Meal</td>
<td>Corn, Rice Polish, Shrimp Meal, Cottonseed Meal</td>
<td>Corn, Rice Polish, Shrimp Meal, Dehydrated Alfalfa Meal</td>
</tr>
<tr>
<td>Average initial weight</td>
<td>127.25</td>
<td>127.75</td>
<td>127.1</td>
</tr>
<tr>
<td>Average final weight</td>
<td>206.75</td>
<td>201.5</td>
<td>203.1</td>
</tr>
<tr>
<td>Average gain</td>
<td>79.5</td>
<td>73.7</td>
<td>76.0</td>
</tr>
<tr>
<td>Average gain per day</td>
<td>1.62</td>
<td>1.505</td>
<td>1.55</td>
</tr>
</tbody>
</table>

**AVERAGE DAILY RATION**

<table>
<thead>
<tr>
<th>Ration</th>
<th>V</th>
<th>VI</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (ear)</td>
<td>9.05</td>
<td>6.234</td>
<td>6.234</td>
</tr>
<tr>
<td>Rice polish</td>
<td>1.872</td>
<td>1.17</td>
<td>1.17</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>.426</td>
<td>.34</td>
<td>.35</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>.284</td>
<td>.227</td>
<td>.066</td>
</tr>
<tr>
<td>Alfalfa meal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FEED PER 100 LBS. GAIN**

<table>
<thead>
<tr>
<th>Ration</th>
<th>V</th>
<th>VI</th>
<th>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, shelled, basis 71%</td>
<td>394.3</td>
<td>294.1</td>
<td>294.1</td>
</tr>
<tr>
<td>Rice polish</td>
<td>124.4</td>
<td>117.1</td>
<td></td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>17.4</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>26.1</td>
<td>22.6</td>
<td>22.5</td>
</tr>
<tr>
<td>Dehydrated alfalfa meal</td>
<td>4.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total feed</td>
<td>437.8</td>
<td>456.2</td>
<td>437.97</td>
</tr>
</tbody>
</table>

**FINANCIAL STATEMENT**

| Value of gains at 4 cents per lb. | $3.18 | $2.95 | $3.04 |
| Feed costs (retail prices) | 2.89 | 2.79 | 2.754 |
| Balance | .29 | .16 | .29 |
| Cost per 100 lbs. gain | 3.64 | 3.79 | 3.62 |

**FEED COSTS**

<table>
<thead>
<tr>
<th>Ration</th>
<th>Cost per bushel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, per bushel</td>
<td>$ .42</td>
</tr>
<tr>
<td>Rice polish, per ton</td>
<td>16.00</td>
</tr>
<tr>
<td>Shrimp meal, per ton</td>
<td>18.00</td>
</tr>
<tr>
<td>Cottonseed meal, per ton</td>
<td>10.00</td>
</tr>
</tbody>
</table>

**Conclusions:**

In a previous trial, it was indicated that cottonseed meal was not a satisfactory protein supplement to use in combination with rice polish. This experiment was planned to show whether this was true in a ration of two-thirds corn and one-third polish, and whether alfalfa meal would prove a more satisfactory supplement.

Lot VII received shrimp meal as the only protein supplement for 21 days of the test. At the end of this period, Lot VII weighed less
than Lot VI fed a protein supplement of 60 parts shrimp meal and 40 parts cottonseed meal. They also required more feed per 100 pounds gain. It appeared therefore that cottonseed meal was satisfactory as a supplement when the rice polish made up only one-third of the ration.

Dehydrated alfalfa meal, dried in the experimental hay drier at the University was then added to the ration of Lot VII. The gains improved and by the end of the experiment on the 49th day, Lot VII had made a greater gain for the whole period than Lot VI. Alfalfa meal appeared therefore to be a more satisfactory supplement to corn-rice polish and shrimp meal than is cottonseed meal.

**EXPERIMENT I.**

Pasture Crops for Swine

SUDAN GRASS AND RAPE PASTURE COMPARED TO DRY LOT AND TO SOY BEAN PASTURE

Lots I and II—May 31 to August 3; Lots III—August 5-Sept. 26, 1931

Introduction:

In the spring of 1931, an experiment in pasture crops for pork production was submitted to the Office of Experiment Stations at Washington. Approval of this experiment was not finally given until late in the season, but two preliminary crops had been put in on the University hog farm, on such fields as were then available. Sudan grass and rape, and soybeans were the two pastures used.

Plan of Experiment:

The hogs used in these tests were principally purebred pigs with some crossbreds and grades, all belonging to the University, and the University furnished all feeds, the Experiment Station supplying the labor.

Where hogs are being fed experimentally on a feed crop or a pasture, a check lot of similar hogs is usually fed in a dry pen without pasture and fed a similar ration. In this way, it is possible to measure the value of the pasture or feed crop. There were not enough pigs available for a check lot when the test was made on soybean pasture. This Lot (Lot 3) has been tabulated along with the two lots in the first experiment, although there was some difference in the rations fed.

All pigs had shade, plenty of water, and were fed protein supplements, free choice in self-feeders. A mineral mixture of salt, bone meal, and ground oystershell was also available.
PASTURES FOR SWINE, 1931
Lots I and II, May 31 to August 3; Lot III, August 5 to September 15

<table>
<thead>
<tr>
<th>Lot number</th>
<th>I Dry Lot</th>
<th>II Sudan and Rape Pasture</th>
<th>*III Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days on test</td>
<td>66</td>
<td>66</td>
<td>42</td>
</tr>
<tr>
<td>Pigs in lot</td>
<td>10</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Average initial weight</td>
<td>45.15</td>
<td>44.4</td>
<td>57.6</td>
</tr>
<tr>
<td>Average final weight</td>
<td>97.7</td>
<td>101.7</td>
<td>102.9</td>
</tr>
<tr>
<td>Average gain</td>
<td>52.5</td>
<td>57.3</td>
<td>45.2</td>
</tr>
<tr>
<td>Average daily gain</td>
<td>.79</td>
<td>.87</td>
<td>1.07</td>
</tr>
</tbody>
</table>

Average Feed Eaten—Pounds

<table>
<thead>
<tr>
<th>Feed</th>
<th>I Dry Lot</th>
<th>II Sudan and Rape Pasture</th>
<th>*III Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>78.00</td>
<td>64.8</td>
<td>51.2</td>
</tr>
<tr>
<td>Rice polish</td>
<td>119.75</td>
<td>99.5</td>
<td>27.9</td>
</tr>
<tr>
<td>Wheat shorts</td>
<td>32.25</td>
<td>24.2</td>
<td></td>
</tr>
<tr>
<td>Tankage</td>
<td>11.62</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>11.62</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>11.62</td>
<td>8.2</td>
<td></td>
</tr>
</tbody>
</table>

Feed Per 100 Lbs. Gain

<table>
<thead>
<tr>
<th>Feed</th>
<th>I Dry Lot</th>
<th>II Sudan and Rape Pasture</th>
<th>*III Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>148.6</td>
<td>113.1</td>
<td>114.8</td>
</tr>
<tr>
<td>Rice polish</td>
<td>227.7</td>
<td>173.7</td>
<td>61.6</td>
</tr>
<tr>
<td>Wheat shorts</td>
<td>61.4</td>
<td>42.2</td>
<td></td>
</tr>
<tr>
<td>Tankage</td>
<td>22.1</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>22.1</td>
<td>14.3</td>
<td>19.4</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>19.4</td>
<td>19.4</td>
<td></td>
</tr>
<tr>
<td>Feed cost per 100 lb. gain</td>
<td>$6.05</td>
<td>$4.43</td>
<td>$2.78</td>
</tr>
</tbody>
</table>

Financial Statement

<table>
<thead>
<tr>
<th>Item</th>
<th>I Dry Lot</th>
<th>II Sudan and Rape Pasture</th>
<th>*III Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed cost, per head</td>
<td>$3.17</td>
<td>$2.54</td>
<td>$1.25</td>
</tr>
<tr>
<td>Pork produced per lot at 7c</td>
<td>36.75</td>
<td>120.33</td>
<td>47.47</td>
</tr>
<tr>
<td>Less feed cost, per lot</td>
<td>31.77</td>
<td>76.20</td>
<td>18.89</td>
</tr>
<tr>
<td>Balance</td>
<td>4.98</td>
<td>44.13</td>
<td>28.65</td>
</tr>
</tbody>
</table>

Value of Pasture

<table>
<thead>
<tr>
<th>Item</th>
<th>I Dry Lot</th>
<th>II Sudan and Rape Pasture</th>
<th>*III Soybeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lbs. feed replaced per acre</td>
<td>2371.0</td>
<td>1621.0</td>
<td></td>
</tr>
<tr>
<td>Per 100 lb. gain</td>
<td>$1.62</td>
<td>$3.26</td>
<td></td>
</tr>
<tr>
<td>Value of 9/10 acre</td>
<td>27.84</td>
<td>22.15</td>
<td></td>
</tr>
<tr>
<td>Value per acre</td>
<td>30.93</td>
<td>24.61</td>
<td></td>
</tr>
</tbody>
</table>

*Note—Lot III is not strictly comparable to the other lots, as this test was made at a later date, and some changes had to be made in the ration. It is presented here in similar form for purposes of comparison. The pigs used were of similar weight, type and previous treatment.

Feed Prices

<table>
<thead>
<tr>
<th>Feed</th>
<th>Price per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, per bushel</td>
<td>$ .70</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>27.50</td>
</tr>
<tr>
<td>Tankage, per ton</td>
<td>80.00</td>
</tr>
<tr>
<td>Wheat shorts, per ton</td>
<td>18.00</td>
</tr>
<tr>
<td>Rice polish, per ton</td>
<td>21.50</td>
</tr>
<tr>
<td>Shrimp meal, per ton</td>
<td>45.00</td>
</tr>
</tbody>
</table>

Conclusions:

1. One acre of sudan grass and rape pasture replaced 2371 pounds concentrates in putting gains on spring pigs.
2. One acre of soybeans, pastured when the pods were forming, replaced 1621 pounds of concentrates, in putting gains on spring pigs. This test was made one month later than the test on sudan grass and rape, and the two lots are not strictly comparable on that account.

3. On the basis of market feed prices at the time, the sudan and rape pasture was worth $30.93 per acre and the soybean pasture $24.61 per acre.

4. One of the advantages of sudan grass and rape pasture is that these crops keep growing while being pastured and are not easily killed. One disadvantage of a soybean pasture is that the vines are easily injured by the hogs stepping on them, and they are soon tramped down and killed.

**EXPERIMENT II. PASTURE CROPS FOR SWINE**

1. WINTER PASTURES FOR FATTENING SWINE
2. BREWERS RICE VS. CORN
3. VALUE OF DEHYDRATED SOYBEAN HAY FOR SWINE

**Hogs Used:**

Forty high grade Duroc Jerseys raised by a local breeder and eight purebred pigs from the University herd were used in this test.

**Pastures:**

A field of 1½ acres was divided into 3 half-acre lots and seeded to Texas Red Rustproof oats and Dwarf Essex rape in September. For some reason a better stand of rape was obtained in the pasture given to lot 2. Owing to the mildness of the winter, all pastures grew luxuriantly and there was an abundance of pasture for all three lots. The pigs in Lot 6 had eaten all their rape at the end of the test.

**Plan of Experiment:**

The forty-eight hogs were divided into six lots, equal in weight and type. All lots were full fed in self feeders with the exception of the protein supplement in Lot 2. With the exception of Lot 1 the protein supplement was made up of shrimp bran 60 parts, cottonseed meal 40 parts. The supplement for Lot 1 was shrimp meal 7 parts, cottonseed meal 5 parts, ground dehydrated soybean hay 2 parts.

**Rations Fed:**

<table>
<thead>
<tr>
<th>Lot</th>
<th>Type</th>
<th>Ration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot 1</td>
<td>Dry Lot</td>
<td>Corn, shrimp meal, cottonseed meal, and ground dehydrated soybean hay.</td>
</tr>
<tr>
<td>Lot 2</td>
<td>Pasture</td>
<td>Corn, shrimp meal, cottonseed meal, protein feed limited—fed daily.</td>
</tr>
<tr>
<td>Lot 3</td>
<td>Dry Lot</td>
<td>Brewers’ rice, shrimp meal, cottonseed meal.</td>
</tr>
<tr>
<td>Lot 4</td>
<td>Pasture</td>
<td>Brewers’ rice, shrimp meal, cottonseed meal.</td>
</tr>
<tr>
<td>Lot 5</td>
<td>Dry Lot</td>
<td>Corn, shrimp meal, cottonseed meal.</td>
</tr>
<tr>
<td>Lot 6</td>
<td>Pasture</td>
<td>Corn, shrimp meal, cottonseed meal.</td>
</tr>
</tbody>
</table>
Feeds:
The corn was Yellow Creole, shelled and fed through the self feeders. The brewers rice was a good grade of brewers rice. The shrimp bran was the best grade of dehydrated shrimp meal.

<table>
<thead>
<tr>
<th></th>
<th>Crude Protein</th>
<th>Fat</th>
<th>Nitrogen Free Extract</th>
<th>Crude Fiber</th>
<th>Water</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Creole corn</td>
<td>10.25</td>
<td>5.20</td>
<td>69.60</td>
<td>1.95</td>
<td>11.45</td>
<td>1.56</td>
</tr>
<tr>
<td>Brewers rice</td>
<td>7.94</td>
<td>0.55</td>
<td>76.96</td>
<td>0.65</td>
<td>12.80</td>
<td>1.10</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>43.88</td>
<td>2.00</td>
<td>0.42</td>
<td>10.00</td>
<td>11.85</td>
<td>31.85</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>41.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green rape</td>
<td>2.89</td>
<td>0.54</td>
<td>2.90</td>
<td>2.67</td>
<td>89.47</td>
<td>1.53</td>
</tr>
<tr>
<td>Green oats</td>
<td>2.66</td>
<td>0.54</td>
<td>2.90</td>
<td>2.82</td>
<td>89.13</td>
<td>1.95</td>
</tr>
<tr>
<td>Soybean hay meal</td>
<td>12.94</td>
<td>2.05</td>
<td>32.56</td>
<td>34.05</td>
<td>9.15</td>
<td>9.25</td>
</tr>
</tbody>
</table>
### SWINE FATTENING EXPERIMENTS—PASTURE AND DRY LOT

On Test 60 Days—8 Pigs per Lot—December 14, 1931, to February 10, 1932

<table>
<thead>
<tr>
<th>Lot number</th>
<th>1 Dry Lot Corn, Dehydrated Soybean Hay</th>
<th>2 Pasture Corn, Limited Protein</th>
<th>3 Dry Lot Brewers Rice</th>
<th>4 Pasture Brewers Rice</th>
<th>5 Dry Lot Corn</th>
<th>6 Pasture Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average initial weight</td>
<td>91.3</td>
<td>91.3</td>
<td>91.0</td>
<td>92.0</td>
<td>92.0</td>
<td>91.0</td>
</tr>
<tr>
<td>Average final weight</td>
<td>187.6</td>
<td>185.1</td>
<td>208.15</td>
<td>200.5</td>
<td>189.3</td>
<td>188.6</td>
</tr>
<tr>
<td>Average gain</td>
<td>96.2</td>
<td>93.8</td>
<td>117.2</td>
<td>108.1</td>
<td>97.3</td>
<td>97.6</td>
</tr>
<tr>
<td>Average daily gain</td>
<td>1.6</td>
<td>1.6</td>
<td>1.95</td>
<td>1.81</td>
<td>1.62</td>
<td>1.63</td>
</tr>
</tbody>
</table>

#### AVERAGE FEED PER DAY

<table>
<thead>
<tr>
<th>Feed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>5.9</td>
<td>5.4</td>
<td>6.8</td>
<td>6.3</td>
<td>5.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Brewers rice</td>
<td>.25</td>
<td>.19</td>
<td>.26</td>
<td>.20</td>
<td>.43</td>
<td>.25</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>.09</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
<td>.004</td>
</tr>
<tr>
<td>Dried soybean hay</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
<td>.004</td>
</tr>
<tr>
<td>Mineral</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
<td>.004</td>
</tr>
</tbody>
</table>

#### FEED FOR 100 LB. GAIN

<table>
<thead>
<tr>
<th>Feed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>366.9</td>
<td>346.3</td>
<td>350.0</td>
<td>348.8</td>
<td>331.9</td>
<td>345.9</td>
</tr>
<tr>
<td>Brewers rice</td>
<td>.25</td>
<td>.19</td>
<td>.26</td>
<td>.20</td>
<td>.43</td>
<td>.25</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>.09</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
<td>.004</td>
</tr>
<tr>
<td>Dried soybean hay</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
<td>.004</td>
</tr>
<tr>
<td>Mineral</td>
<td>.013</td>
<td>.0077</td>
<td>.0073</td>
<td>.002</td>
<td>.013</td>
<td>.004</td>
</tr>
</tbody>
</table>

#### FINANCIAL STATEMENT

<table>
<thead>
<tr>
<th>Feed per head</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cost of feed per head</td>
<td>$4.47</td>
<td>$3.83</td>
<td>$3.75</td>
<td>$3.39</td>
<td>$4.18</td>
<td>$4.05</td>
</tr>
<tr>
<td>Cost per 100 lb. gain, market prices</td>
<td>$4.65</td>
<td>$4.08</td>
<td>$3.20</td>
<td>$3.14</td>
<td>$4.30</td>
<td>$4.15</td>
</tr>
<tr>
<td>Cost per 100 lb. gain, farm prices</td>
<td>$2.89</td>
<td>$2.49</td>
<td>$2.62</td>
<td>$2.55</td>
<td>$2.74</td>
<td>$2.55</td>
</tr>
</tbody>
</table>

Market price of feeds: Corn, 60 cents a bushel; brewers rice, $16.00 per ton; shrimp meal, $45.00 per ton; cottonseed meal, $18.00 per ton.

Local prices of feeds: Corn, 35 cents a bushel; brewers rice, $13.00 per ton; shrimp meal, $40.00 per ton; cottonseed meal, $15.00 per ton.

**Conclusions:**

1. The pigs on the pasture consumed less of the protein supplements for each 100 pounds gain than did the pigs in the dry lots.
2. Where the protein supplement was hand-fed and fed in limited amounts on rape pasture, the saving per 100 pounds of gain was 30c per 100 pounds. Since one-half acre of pasture would have carried 40 hogs or more, the value per half acre would be $12.00.
3. Brewers rice was equal to Yellow Creole corn for fattening hogs. The pigs on brewers rice ate less protein feeds, and slightly more of the fattening feed (rice) than did the pigs getting corn.
At $16.00 per ton, for the brewers rice, the cost of 100 pounds gains was $1.10 less than for the corn fed hogs at 60c per bushel for corn.

4. Feeding a small amount of dehydrated soybean hay meal to pigs in dry lot did not take the place of pasture. For some reason this group of pigs did not produce so economical gains as any of the other lots.

5. On the basis of this experiment brewers rice has the following values per ton with corn at various prices per bushel:

<table>
<thead>
<tr>
<th>Corn Price per Bushel</th>
<th>Brewers Rice per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>13.06</td>
</tr>
<tr>
<td>40</td>
<td>14.89</td>
</tr>
<tr>
<td>50</td>
<td>18.61</td>
</tr>
<tr>
<td>60</td>
<td>22.33</td>
</tr>
<tr>
<td>70</td>
<td>26.12</td>
</tr>
</tbody>
</table>

6. Feed costs have been calculated in two ways: (1) on retail prices in Baton Rouge, (2) on lower prices at which feeds have been sold locally in the state. The figures show that at present farm prices pork can be produced at 2½ to 3 cents a pound.

7. One acre of rape pasture as used in this experiment would contain 1098.2 pounds of protein or 977.4 pounds calculated digestible protein equal to the amount of digestible protein in a ton of good tankage.

EXPERIMENT III
PASTURE CROPS FOR SWINE
March 2, 1932—June 10—100 Days

In the fall of 1931, an area of one and one-half acres of upland adjacent to the experimental feeding pens was set aside for pasture experiments. One acre was seeded to white Dutch clover, to be divided later into two half-acre plots, and one-half acre was seeded to yellow sweet clover “Melilotus Indica.” This land was limed with waste lime from the sugar factory. A good stand of clover was obtained on each plot, but the sweet clover was at its best in March. The white clover was very short on March 2, and was cut down by a late frost on March 10. There was very little white clover pasture for the first month.

Hogs Used:

Most of the pigs used in this test were loaned by the University and 18 grade Duroc Jerseys purchased to complete the number required. These were divided into four lots of ten each, two lots being on pasture and two in dry lots. They were fed on ear corn, hand fed, twice daily and self-fed a protein supplement mixture of 60 parts shrimp meal and 40 parts cottonseed meal. On April 20, this was changed to 60 parts of shrimp meal, 20 parts cottonseed meal and 20 parts ground alfalfa hay.
One pig became sick on Lot I (sweet clover), and was removed on the first weigh day (28 days). It later died, and was found to have the lungs adhering to the sides of the chest cavity. One pig on Lot III (separated milk) proved to be unthrifty and was removed from the experiment on the 56th day.

**Rations Fed:**

Lot I. Ear corn, protein supplement—½ acre sweet clover pasture.

II. Ear corn, protein supplement—1 acre white clover pasture.

III. Ear corn, protein supplement—separated milk, dry lot.

IV. Ear corn, protein supplement—dry lot.

**EXPERIMENT III—PASTURE CROPS FOR SWINE**

March 2 to June 10, 1932—100 Days

*Table Based on One Average Pig*

<table>
<thead>
<tr>
<th>Number pigs in lot</th>
<th>I 9</th>
<th>II 10</th>
<th>III 9</th>
<th>IV 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ration</td>
<td>Ear Corn, Shrimp Meal, Cottonseed Meal, Green Alfalfa, Sweet Clover Pasture</td>
<td>Ear Corn, Shrimp Meal, Cottonseed Meal, Green Alfalfa, White Clover Pasture</td>
<td>Ear Corn, Shrimp Meal, Cottonseed Meal, Green Alfalfa, Separated Milk, Dry Lot</td>
<td>Ear Corn, Shrimp Meal, Cottonseed Meal, Green Alfalfa, Dry Lot</td>
</tr>
<tr>
<td>Average initial weight.</td>
<td>62.4</td>
<td>64.1</td>
<td>65.0</td>
<td>64.8</td>
</tr>
<tr>
<td>Average final weight.</td>
<td>186.8</td>
<td>195.3</td>
<td>199.6</td>
<td>183.4</td>
</tr>
<tr>
<td>Average gain per head</td>
<td>123.9</td>
<td>131.2</td>
<td>134.6</td>
<td>116.6</td>
</tr>
<tr>
<td>Average gain per day</td>
<td>1.24</td>
<td>1.31</td>
<td>1.346</td>
<td>1.18</td>
</tr>
</tbody>
</table>

**AVERAGE DAILY FEED—LBS.**

<table>
<thead>
<tr>
<th>Ration</th>
<th>Ear corn (Estimated shelled corn 69%)</th>
<th>Shrimp meal</th>
<th>Cottonseed meal</th>
<th>Ground alfalfa</th>
<th>Separated milk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(4.14)</td>
<td>.49</td>
<td>.27</td>
<td>.056</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>(4.07)</td>
<td>.38</td>
<td>.22</td>
<td>.036</td>
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</tr>
<tr>
<td></td>
<td>(4.14)</td>
<td>.26</td>
<td>.17</td>
<td>.025</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.10)</td>
<td>.50</td>
<td>.30</td>
<td>.036</td>
<td></td>
</tr>
</tbody>
</table>

**FEED PER 100 LBS. GAIN**

<table>
<thead>
<tr>
<th>Ration</th>
<th>Corn, shelled (est.)</th>
<th>Shrimp meal</th>
<th>Cottonseed meal</th>
<th>Ground alfalfa</th>
<th>Separated milk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>333.8</td>
<td>39.5</td>
<td>21.8</td>
<td>4.5</td>
<td>551.6</td>
</tr>
<tr>
<td></td>
<td>310.8</td>
<td>29.0</td>
<td>16.6</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>309.6</td>
<td>19.7</td>
<td>12.5</td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>346.3</td>
<td>42.2</td>
<td>25.1</td>
<td>3.1</td>
<td></td>
</tr>
</tbody>
</table>

Cost per 100 lbs. gain (Concentrates only) $351.1 $307.4 $283.8 $368.3

**VALUE OF PASTURE**

<table>
<thead>
<tr>
<th>Ration</th>
<th>Per 100 lbs. gain</th>
<th>Per acre</th>
<th>On basis of 20 hogs per acre</th>
<th>Value of separated milk per 100 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.2c</td>
<td>$1.82</td>
<td>1.82</td>
<td>15.3c</td>
</tr>
<tr>
<td></td>
<td>60.9c</td>
<td>$7.99</td>
<td>15.98</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ration</th>
<th>Per 100 lbs. gain</th>
<th>Per acre</th>
<th>On basis of 20 hogs per acre</th>
<th>Value of separated milk per 100 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.2c</td>
<td>$1.82</td>
<td>1.82</td>
<td>15.3c</td>
</tr>
<tr>
<td></td>
<td>60.9c</td>
<td>$7.99</td>
<td>15.98</td>
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</tbody>
</table>
ANALYSIS OF FEEDS

<table>
<thead>
<tr>
<th></th>
<th>Crude Protein</th>
<th>Fat</th>
<th>Nitrogen Free Extract</th>
<th>Crude Fiber</th>
<th>Water</th>
<th>Ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, yellow</td>
<td>9.44</td>
<td>4.05</td>
<td>72.96</td>
<td>2.15</td>
<td>10.00</td>
<td>1.40</td>
</tr>
<tr>
<td>Shrimp meal</td>
<td>40.31</td>
<td>2.40</td>
<td>2.39</td>
<td>8.50</td>
<td>10.55</td>
<td>35.85</td>
</tr>
<tr>
<td>Cottonseed meal</td>
<td>41.06</td>
<td>.55</td>
<td>32.81</td>
<td>43.90</td>
<td>4.60</td>
<td>7.20</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>10.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FEED COSTS

- Corn, per bushel: $0.42
- Shrimp meal, per ton: $40.00
- Cottonseed meal, per ton: $18.00
- Alfalfa (ground) per ton: $10.00

Fig. 9. White clover pasture was practically equal to separated milk for growing hogs. Gains 1.31 pounds per day. Cost of concentrates per 100 pounds gain $3.07. Value of pasture 71c per pig, or $15.98 per acre on the basis of 20 pigs per acre.

CONCLUSIONS

Yellow Sweet Clover:

Yellow sweet clover (Melilotus Indica), sometimes called “sour” clover was not a satisfactory pasture under the condition tested. However, it was ready for use a month before the experiment began, and had an excellent stand of green feed when the test began. Soon after this, the clover became affected with anthracnose and more than half of it withered and died in three to four weeks. By the third month, there was only a small amount of sweet clover left, and it was replaced largely by Bermuda grass.
The pigs on this pasture, however, did not gain as rapidly or make as economical gains as did those on white clover. They did not appear to relish the sweet clover as well as they did the roots, and did not appear as thrifty at any time as did the pigs on the white clover.

The yellow sweet clover showed a feeding value of only 20c per pig for a period of 100 days, equal only to $1.82 for one acre. If this clover is to be used as a hog pasture, it will have to be used in late winter before the white clover pastures are available.

At the Kansas station in 1924, results somewhat similar to these were obtained in comparing sweet clover pasture to alfalfa pasture, the sweet clover producing 25% smaller gains per day than the alfalfa. A later experiment at this station gave sweet clover pasture as high a value as alfalfa pasture.

White Clover:

This pasture crop will prove highly satisfactory in any section where it can be grown. This pasture saved 35 pounds corn, 13.2 pounds of shrimp bran, and 8.5 pounds of cottonseed meal for each 100 pounds of gain, equal to 61c per 100 pounds gain, or 79c per head. If we assume that 20 hogs could have been carried on one acre of clover, an acre would be worth $15.98 for the 100-day period. There was little difference in the gains of the pigs on white clover pasture and those receiving separated milk in dry lot, showing the high value of clover pasture as a supplement to corn.

Fig. 10. Dry lot feeding is the most expensive. Gains 1.2 lbs. per day. Cost of concentrates per 100 lbs. gain was $3.68.

Separated Milk:

Separated milk is usually considered to be an ideal supplement to corn for swine. However, a diet of white corn and separated milk is
not satisfactory unless fed with some such feeds as alfalfa meal, well cured clover hay, or pasture.

In this test, 551.6 pounds of separated milk replaced 36.7 pounds corn, 22.5 pounds shrimp meal, 12.6 pounds cottonseed meal, and 1 pound of alfalfa meal for each 100 pounds gain, a value of 15.3c for each 100 pounds (12 gallons) of milk. With a less complete protein supplement, the milk might have given better returns.

In comparing the amount of concentrates replaced by separated milk in different periods, it was evident that the milk was of much greater value when the pigs were small than when they were nearly finished for market. The separated milk had an apparent value of 20.6c per 100 pounds, the first four-week period and was worth only 9.2c per 100 pounds the third four weeks. If separated milk is available in limited quantities, and is to be fed to the best advantage, it should preferably be fed to the younger pigs.
BIBLIOGRAPHY


