VALUE OF COROZO PALM NUT AND SESAME OIL MEALS, BANANAS, A.P.F. AND COW MANURE IN RATIONS FOR GROWING AND FATTENING PIGS

R. L. SQUIBB AND E. SALAZAR

Instituto Agropecuario Nacional

This is a preliminary report of a series of studies in the American Tropics on the nutritional value of local feedstuffs for growing and fattening pigs.

Malnutrition in animals is a major problem in these tropical areas. Apparently the problem is related to inadequate storage and transportation facilities, the lack of regulation in feed production, and insufficient experimentation on the nutritional value of indigenous feedstuffs. Many workers have shown that tropical areas contain many valuable feeds that may be used in swine rations (Lewy van Severen, 1949; Munsell et al., 1949; Squibb et al., 1949; Squibb and Wyld, 1949).

The feeds tested in the studies reported herein may be obtained in quantity or may be economically cultivated. Corozo palms (Orbignya cohune and species of the genus Scheelea) grow abundantly in many areas in the American Tropics. Corozo oil meal, a byproduct of local oil factories, is highly palatable and has been fed to animals for a number of years. Sesame oil meal, which is being produced locally in increased quantities, contains protein of excellent quality and is of value in local chicken rations (Squibb and Wyld, 1948–1949, 1949). Bananas may be obtained readily; large quantities become available as the result of “blow downs” in plantations, rejects for export, or surplus production. Many farms are able to cultivate bananas economically as an animal feedstuff. Bogert, 1942, in a review of the literature, concluded that bananas are nutritious in that they furnish energy, minerals, and certain vitamins. The value of bananas and other tropical fruits and vegetables in rations for swine (at the

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2 Animal Husbandmen.

3 The writers wish to express their appreciation to Mr. Francis Suremain in aiding in the care of the experimental animals and to Dr. T. H. Jukes and the Lederle Laboratories for the APF concentrate.
Hawaiian Experiment Station) has been summarized by Henke, 1949. The object of the studies reported herein was to evaluate a number of simplified all-vegetable-protein rations for growing and fattening pigs. These rations contained corozo palm nut and sesame oil meals and ripe reject bananas, supplemented with an APF concentrate and cow manure.

Experiments

The experiments reported herein were carried out at the Institute's Chocolá Station, which lies on the slope of a volcano and has an average altitude of approximately 2,700 feet and an average rainfall of 177 inches. Although most of the rain falls during 8 months of the year there is a significant precipitation during the other 4 months.

The pigs used in these experiments were the second and third generation descendants of two purebred Duroc Jersey sows and one purebred Duroc Jersey boar, which had been imported from Minnesota. All pigs were raised on pasture until the start of the trials during which they were kept in concrete pens. The pigs were weighed individually once each week and were fed the experimental rations twice daily in such amounts that there were always small weigh backs. Fresh clean water was constantly available in all pens. All pigs received, in addition to the experimental rations, 0.5 pound of fresh green Kikuyu grass (*Pennisetum clandestinum*) per head per day as a supplemental source of vitamins and other essential nutrients.

Experiment No. 1

The first experiment was begun in February 1949 and was carried on for 110 days. It was designed to test the value of corozo palm nut and sesame oil meals fed separately and in combination as the principal sources of protein.

Eighteen recently weaned Duroc Jersey pigs were divided into three comparable lots of 6 pigs per lot. One of three test rations was randomly assigned to each lot of pigs.

Corozo palm nut oil meal was fed at 30 percent of the concentrate mixture to lot No. 1. The sesame oil meal was added to the ration of lot No. 2 at a level to contribute approximately the same amount of protein as supplied by the corozo oil meal of lot No. 1. For lot No. 3 the corozo and sesame oil meals were added to the ration in such

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4 Corozo oil meal contains: 90.8, dry matter; 19.8, crude protein; 7.2, fat; 36.7, N.F.E.; 4.3, ash; 21.8, crude fiber; 0.14, calcium; and 0.86 phosphorus.

5 Sesame oil meal contains: 92.2, dry matter; 40.1, crude protein; 14.4, fat; 17.5, N.F.E.; 10.7, ash; 6.0, crude fiber; 2.37, calcium and 1.21, phosphorus.
amounts that each contributed approximately the same amount of protein.

Because corozo oil meal is a medium protein feedstuff, the rations tested contained less protein than recommended for pigs of these ages. Low protein rations are commonly used in this area. The simplified, all-vegetable low protein rations, grouping of the pigs, and the resulting gains are presented in Table 1.

As that table indicates, all lots of pigs grew at approximately the same rate. The pigs fed corozo oil meal as the principal source of protein were slightly more efficient in the utilization of feed.

**TABLE 1. EFFECT OF COROZO PALM NUT AND SESAME OIL MEALS IN SIMPLIFIED RATIONS FOR GROWING PIGS**

<table>
<thead>
<tr>
<th>Lot No.</th>
<th>No. of pigs</th>
<th>Supplement to basal ration</th>
<th>Total crude protein</th>
<th>Average weight</th>
<th>Average daily gain²</th>
<th>Efficiency of gain³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Percent</td>
<td>Percent</td>
<td>Pounds</td>
<td>Pounds</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Corozo meal</td>
<td>30</td>
<td>11.5</td>
<td>40</td>
<td>146</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Sesame meal</td>
<td>15</td>
<td>12.6</td>
<td>40</td>
<td>149</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Corozo meal + Sesame meal</td>
<td>15</td>
<td>11.9</td>
<td>40</td>
<td>144</td>
</tr>
</tbody>
</table>

¹ Consisted of ground yellow corn, 97 percent; calcium carbonate, 1 percent; bone meal, 1 percent; and iodized salt, 1 percent. The oil meals were substituted for the corn of the basal ration.

² No significance between rations in daily gain.

³ Pounds of feed to produce 100 pounds gain in weight.

**Experiment No. 2**

Experiment No. 2 was designed to determine the value of ripe bananas (including skins), supplemented with an APF concentrate or dry cow manure, for growing and fattening pigs.

Three test rations were randomly assigned to six lots of pigs, two lots per ration. The rations were fed *ad libitum*. The assignment of the rations, the length of the feeding periods, and other data related to the experiment are presented in Table 2. The cow manure supplement was included at 8 percent of the test ration. This supplement was prepared by rapidly-drying the fresh manure in the sun and then grinding it in a hammermill. The APF concentrate was fed at a level equivalent to the APF potency of the cow manure, or 0.7 pound per 100 pounds of the basal concentrate mixture. This potency was determined in the Nutrition Laboratories of the Institute by means of biological assays employing New Hampshire baby chicks. Both the cow manure and the APF concentrate were assayed twice during the trials and once at the end of the trials. The basal concentrate
ration consisted of sesame oil meal, 50; ground yellow corn, 47; calcium carbonate, 1; salt, 1; bonemeal, 1; and Delsterol, 3 grams per 100 pounds of the basal concentrate mix. This ration analyzed 24 percent protein (N×6.25). The cow manure, containing approximately 10 percent protein, and the APF concentrate were substituted for the corn of the basal concentrate mix. In order to regulate the crude protein intake to the weight of the pigs, the basal concentrate mix was fed in a ratio to the ripe bananas. Pigs weighing between 25 and 125 pounds received by weight 1 part of the concentrate mix to 1 part of ripe bananas. This ration analyzed 18 percent protein. Pigs weighing between 125 and 210 pounds received 1 part of the concentrate mix to 2 parts of ripe bananas. This ration analyzed 14 percent protein.

As may be observed in table 2, the lots fed the APF concentrate made slightly faster daily gains and utilized the feed more efficiently. The addition of cow manure to the ration apparently had little effect and did not increase the rate of growth of the pigs or the efficiency of feed utilization over the control lots. Further, in lot No. 5, which was fed cow manure, there was a slight depression of growth as compared with the control lot No. 4.

**TABLE 2. GROWTH OF PIGS FED RIPE BANANAS AND CONCENTRATES SUPPLEMENTED WITH AN APF CONCENTRATE AND DRY COW MANURE**

<table>
<thead>
<tr>
<th>Lot No.</th>
<th>Supplement to basal ration</th>
<th>No. of pigs</th>
<th>Length of trial (Days)</th>
<th>Average weight Initial Pounds</th>
<th>Average weight Final Pounds</th>
<th>Concentrate mix Feed per 100 pounds gain</th>
<th>Bananas Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>3</td>
<td>119</td>
<td>63</td>
<td>202</td>
<td>1.17</td>
<td>293</td>
</tr>
<tr>
<td>2</td>
<td>Cow manure</td>
<td>3</td>
<td>119</td>
<td>62</td>
<td>199</td>
<td>1.14</td>
<td>307</td>
</tr>
<tr>
<td>3</td>
<td>APF</td>
<td>3</td>
<td>105</td>
<td>61</td>
<td>202</td>
<td>1.34*</td>
<td>271</td>
</tr>
<tr>
<td>4</td>
<td>None</td>
<td>4</td>
<td>175</td>
<td>22</td>
<td>193</td>
<td>.91</td>
<td>310</td>
</tr>
<tr>
<td>5</td>
<td>Cow manure</td>
<td>5</td>
<td>175</td>
<td>28</td>
<td>168</td>
<td>.80</td>
<td>313</td>
</tr>
<tr>
<td>6</td>
<td>APF</td>
<td>5</td>
<td>175</td>
<td>28</td>
<td>202</td>
<td>.99*</td>
<td>259</td>
</tr>
</tbody>
</table>

* Statistically significant differences at 5-percent level from lots No. 1 and No. 4, respectively.

Discussion

Owing to irregular feed supplies and the scarcity of vitamin and animal protein concentrates, rations must be simplified in American tropical areas.

The results of experiment No. 1 indicate that corozo palm nut and sesame oil meals may be fed separately or in combination with similar results. These oil meals did not exercise a mutual supplementary effect at the levels fed in this trial. Squibb and Wyld, 1949, have shown
that sesame oil meal likewise had no supplementary effect on corozo oil meals when fed to rats. The rate of gain and the efficiency of feed utilization observed in this experiment may be considered satisfactory for pigs fed these simplified all-vegetable low protein rations.

In experiment No. 2, the bananas were allowed to ripen and were fed with the skins. Since bananas are a carbohydrate feedstuff, they had to be fed with a high protein concentrate mixture. By feeding the concentrate mix in a ratio to the ripe bananas, the intake of crude protein was regulated to the weight of the pigs.

The addition of the APF concentrate in lots Nos. 3 and 6 increased the rate of gains and the efficiency of feed utilization over those of the control lots Nos. 1 and 4. The increased gains, however, were not so large as those previously reported (Cunha et al., 1949; Lepley et al., 1949). This difference may have been caused by the presence of some APF in the control ration and/or a lower APF-potency intake. An assay at the end of the trial of the APF concentrate, which was kept in the laboratory at 20°C to 24°C, indicated some loss of the original potency.

Although the dried cow manure supplied the same APF potency as the APF concentrate, the pigs did not benefit from it. The lots fed the cow manure were unthrifty and lacked uniformity. The tendency of the cow manure to depress the rate of growth of the pigs in lot No. 5 may have been because these pigs were younger at the beginning of the trials than those of lot No. 2. The apparent failure of pigs to utilize the APF potency of the cow manure was not caused by small total feed intake or unpalatability of the rations. The pigs fed cow manure ate the rations readily and consumed as much feed as did the other lots.

In none of the experiments reported herein were there clinical symptoms of malnutrition in any of the pigs. Although the experimental conditions were not the same, the growth rates and efficiency of feed utilization of the pigs compared favorably to those reported by Henke, 1949, at the Hawaiian Experiment Station. These preliminary data are encouraging as they indicate that Duroc Jersey pigs fed simplified all-vegetable protein rations will do well in this tropical area.

**Summary**

Corozo palm nut and sesame oil meals may be fed separately or in combination to growing and fattening pigs with similar results. These meals did not exercise a mutual supplementary effect at the levels fed in these studies.
Ripe bananas produced satisfactory gains when fed in 1:1 and 2:1 ratio with a high protein concentrate mixture.

An APF concentrate increased the rate of gain and the efficiency of feed utilization over those of the control lots.

Under the conditions of these experiments, cow manure fed to provide the same APF potency as an APF concentrate did not increase the rate of gain or the efficiency of feed utilization over those of the control lots.

The rate of gain and efficiency of feed utilization for growing and fattening pigs fed simplified all-vegetable protein rations with and without the APF in this tropical area were satisfactory and comparable to those expected in temperate zones.

**Literature Cited**


