The International Society for Tropical Root Crops in collaboration with Centro Internacional de Agricultura Tropical, International Development Research Centre, and United States Agency for International Development

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Edited by James Cock, Reginald MacIntyre, and Michael Graham
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FOR TROPICAL ROOT CROPS

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Utilization of Cassava as a Carbohydrate Source for Pigs

V. F. Hew and R. I. Hutagalung

Cassava is shown to serve as an inexpensive source of valuable energy for pigs. The correct choice of cassava with low cyanogenic glucosides and the use of high quality proteins to make up for nutrient deficiencies in amino acids and vitamins makes the replacement of grains by cassava possible. The use of cassava would substantially reduce the cost of feed.

When 30 Landrace pigs were assigned to diets containing 0, 15, 30, 45, and 60% cassava as the energy source in their diets, no significant difference in performance nor carcass characteristics was observed. The increase in cassava levels was accompanied by an increase in fishmeal, a high quality and locally available protein source. The inclusion of fishmeal rather than other proteins of plant origin in high cassava diets is comparable to the supplementation in the cassava diets of methionine or other synthetic amino acids.

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HEW AND HUTAGALUNG: CASSAVA DIETS FOR PIGS

Table 1. Composition of diets for pigs (15-50 kg body weight).

<table>
<thead>
<tr>
<th>Cassava level (%)</th>
<th>0</th>
<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, yellow</td>
<td>71.00</td>
<td>54.50</td>
<td>37.15</td>
<td>20.50</td>
<td>2.50</td>
</tr>
<tr>
<td>Cassava root meal*</td>
<td>—</td>
<td>15.00</td>
<td>30.00</td>
<td>45.00</td>
<td>60.00</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>18.00</td>
<td>18.00</td>
<td>18.00</td>
<td>18.00</td>
<td>18.00</td>
</tr>
<tr>
<td>Fishmeal</td>
<td>9.15</td>
<td>10.65</td>
<td>13.00</td>
<td>14.65</td>
<td>17.65</td>
</tr>
<tr>
<td>Iodized salt</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>Tricalcium phosphate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Vitamin premixb</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Mineral mixc</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Antibioticsd</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Cassava has been used as a feedstuff for livestock and provides a major source of energy for swine in the Philippines, Africa, Latin America, and Malaysia. Numerous experiments have shown that cassava could serve as an inexpensive source of energy for pigs. However, results have been variable. A number of reports indicate that large amounts of cassava in various forms have been fed to swine with satisfactory results and with no evidence of cyanide toxicity; however, others have found reduced gains as the level of cassava in the swine diet was increased.

Experimental Procedure

Thirty Landrace pigs averaging 14.6 kg were randomly assigned by weight and sex to five dietary treatments. The treatments were a basal corn-soybean-fishmeal diet and the basal plus four graded levels of cassava at 15, 30, 45, and 60%. Each treatment consisted of six pigs in two replicates of three. The animals were fed with isonitrogenous diets of 18% protein until they reached 50 kg, after which the level of protein was reduced to 16%. The composition of the diets is presented in Table 1.

Feed and water were given to the pigs ad libitum. Weight gains and feed consumption were recorded weekly and all data were subjected to analysis of variance. Each pig was slaughtered as it reached a weight of approximately 70 kg. The carcasses were chilled at 0 °C for 48 h after which records of carcass shrink were noted, length measured from the anterior edge of the first rib to the anterior edge of the aitchbone, backfat thickness taken at first rib, kidney and last lumbar positions and loin eye muscles were traced out at the fourth rib and second lumbar sections. Samples of liver, meat, and fat were collected and stored in a freezer at −43 °C. The liver and meat tissues were then ground and dried in a vacuum oven at 35 °C for 24 h for proximate analysis.
Results

There were no significant differences in average daily gain, feed intake, and feed efficiency in pigs fed different cassava levels.

The number of days taken by the animals to reach the 70 kg weight for all treatments was not significantly different, nor were the dressing percentage and percentage of shrink of all the pigs. However, the pigs on the control diet showed lower percentage shrink than the pigs on the cassava diets. The loin eye area of all pigs measured at the second lumbar position showed no significant difference among treatments, whereas the loin area taken at the fourth rib region showed significant difference (p < 0.05) for carcasses from the different treatments. The pigs fed the control ration had a bigger loin eye area than those on the other rations. The loin eye area decreases with increasing cassava level.

Data of haematocrit, crude protein, crude fat and moisture of the meat and liver tissues, and the iodine number of the backfat were collected. There was no significant difference in the haematocrit values taken from all the pigs. The results of the proximate analysis of the meat and liver showed no significant difference in moisture, dry matter crude protein, or in the dry matter crude fat content among the treatments. Although there was a decreasing trend in the iodine number values of backfat as cassava increased, the difference was not significant.

Discussion

The results of this trial have indicated clearly that cassava root meal can be used as a main carbohydrate source in pig rations without depressing their performance. No depression in growth rate, feed intake, or efficiency of feed conversion was observed in pigs fed cassava levels as high as 60%. Similar observations have been recorded by others. It has been observed that cassava has a beneficial influence on the quality of pork, and Castillo et al. (1963) found that carcasses, vitamin A in plasma and liver, as well as backfat thickness of pigs fed diets with and without cassava did not vary appreciably. Maner and Gómez 1973, using weanling pigs weighing 18.1 kg, found no difference between pigs fed a basal corn diet and pigs fed raw chopped cassava in combination with a well fortified protein supplement.
or palm oil plus glucose. Contrary to their finding, cassava inclusion in this experiment had no effect on the performance of the pigs. The variation in results may be due to the source of cassava used and thus to the amount of HCN present. The use of a higher quantity of fishmeal may have improved the protein quality of the feed and thus supported better growth. Also fishmeal is a rich source of vitamin B\textsubscript{12}, which may contribute to the detoxication process. There is evidence that hydroxocobalamin plays an active role in cyanide detoxication, where the hydroxocobalamin takes up the cyanide avidly to form harmless cyanocobalamin. With excess vitamin B\textsubscript{12} to carry out this function it is possible that the methionine may not be needed in the detoxication process.

Thus cassava, when innocuous, is a good source of energy for pigs. The low fibre content and high energy in cassava makes it a valuable source of feedstuff. It has been shown that cassava improves the digestibility of organic matter. In this experiment, the 60% cassava diet had a digestibility value of 80.59%, whereas the control had 80.86%. The moisture content percentage of the faeces from pigs fed 60% cassava was 64%, whereas that of the corn control was 68%. Thus cassava did not appear to affect digestibility adversely although Muller et al. (1972) observed wetter faeces in pigs on high cassava diets and attributed it to the lower amylase content in cassava. Because HCN may be a contributing factor affecting scouring, it may be possible that scouring occurs if the pigs are fed cassava meal high in HCN.

The haematocrit values gave no significant difference among treatments. This confirms that the HCN has not exerted its effect on the haemoglobin level. The treatments did not have any effect on the dressing percentage and backfat thickness of the pigs. Castillo et al. (1963) also did not find any increase in backfat thickness due to use of cassava root meal. This is expected as cassava contains about the same energy content as corn and with the same rate of gain for all the pigs, there is no reason to expect a thicker backfat for the high cassava diets. Loin eye taken at the second lumbar region did not show any difference in cross-sectional area; however, that taken at the fourth rib showed a significant difference. Pigs fed higher cassava appeared to have a smaller loin eye area. Hutagalung et al. (1973) showed smaller loin eye area with increasing cassava content of diet and suggested that pigs fed cassava diets had neither adequate nor proper distribution of total protein intake to support maximum development of lean tissues, regardless of the energy content. The percentage shrink of the carcasses was not significantly different although control carcasses have definitely lower percentage shrink than all the other carcasses. The iodine number also appeared to decrease in the fats of pigs fed increasing levels of cassava. This may indicate a difference in saturation in the fat of pigs fed different levels of cassava. Other than these two factors, there did not appear to be any negative influence of cassava on carcasses and meat quality of pigs.

Cassava meal, when well processed, can be innocuous and well tolerated by pigs. It serves as a good energy source and the performance and carcass characteristics of the pigs depend very much on the composition of the whole ration. Cassava can be used as a main source of carbohydrate as long as the amino acid and mineral requirements are compounded with care.

The authors wish to thank Loh Wan Loy for statistical analysis. Special thanks are due to the junior research assistants, Nantha Kumaran, Balasubramanium and S. Poovan for their unfailing assistance in carrying out the trial. We are also indebted to the late Kassim Ismail who was a helpful consultant.


Use of Cassava as a Food Supplement for Broiler Chicks

Sarote Khajarern and Jowaman M. Khajarern

Two experiments were conducted to determine the substitutional value of cassava for corn in broiler rations. One-day-old Arbor Acres broiler chicks were used. In the first experiment, no significant differences in body weight gain and feed conversion were noted for chicks receiving 0, 7.5, 15, 22.5 and 30% substituted cassava pellets. However, in experiment 2, significantly poorer body weight gain and feed conversion \( p < 0.05 \) were noted during 1–5 weeks of age when the rations contained 0, 10, 20, 30, 40 and 50% cassava root meal. It was also noted that body weight gain was not depressed until the rations contained more than 30% cassava root meal. The ability of chicks to utilize cassava root meal increased with age. Results indicated that, during 5–9 weeks of age and 1–9 weeks of age, there were no significant differences observed on body weight gain and feed conversion when the concentration of cassava root meal increased in the rations. Limiting factors in maximum replacement and economic feasibility in substituting cassava products for corn were: fibre and protein contents; prices of cassava compared to those of fish meal and soybean meal.

Cassava is Thailand's third major export crop next to rice and corn. More than 90% of the nation's cassava root products, approximately 2.4 million tons, is exported annually. The balance is eaten locally, mainly as flour. The Thai Tapioca Trade Association reported that Thailand exported a total of 1.1 million tons of tapioca pellets during the first 6 months of 1975, valued at 1976 million baht (approximately US$ 100 million), while 55,000 t of tapioca flour (137 million baht, US$ 7 million) was exported during the same period.

Meanwhile, there has been a surplus of nearly 100,000 t of tapioca flour since early 1975 that resulted from a cut in imports by Japan of more than 200,000 t in 1973–74 to merely 90,000 t during 1975. Therefore, the economy of cassava growers in Thailand is almost totally dependent on exports.

Cassava root products are sold on the free market in Thailand and prices are totally regulated by supply and demand. Cassava growers sell their fresh root directly to the chip-drying agencies in the field, at the price set by the latter. Cassava chips and pellets are then prepared, and are exported mainly to EEC countries. Since cassava importing countries are limited, more of cassava and its products need