IDRC-080e

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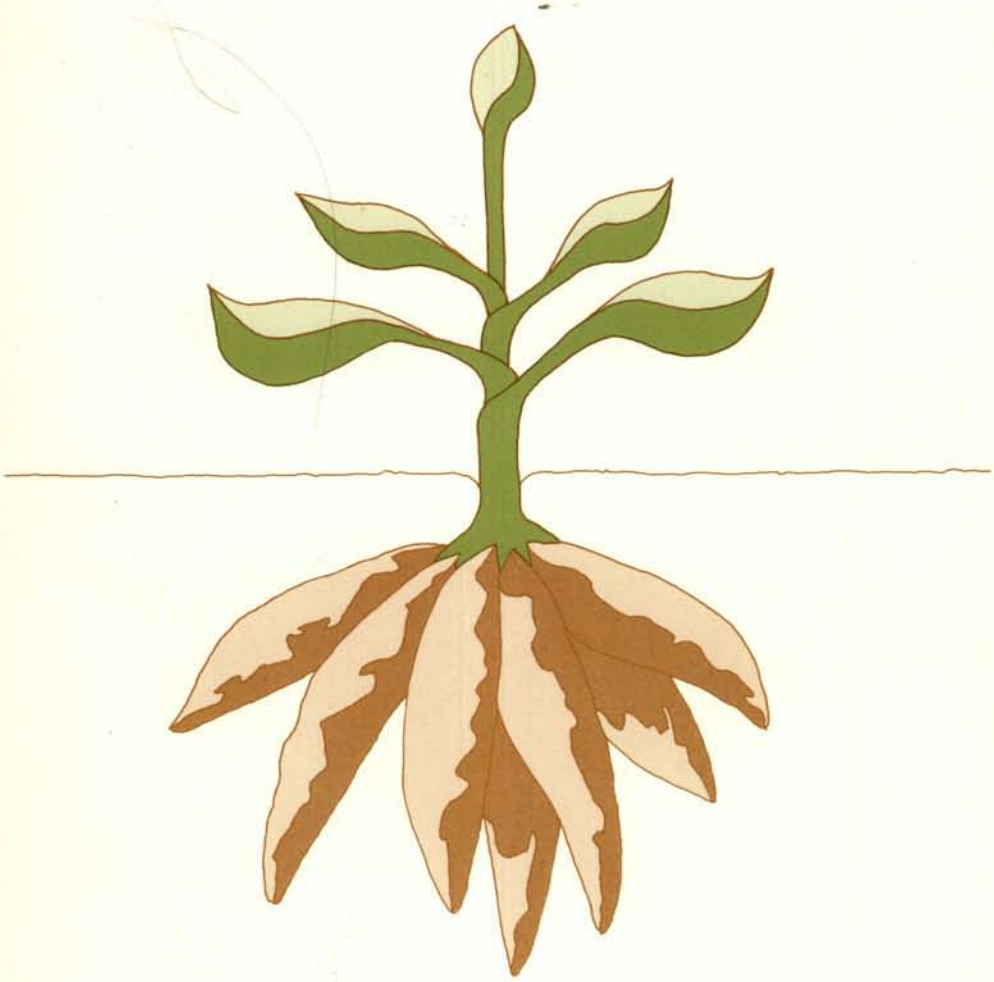
Held at CIAT, Cali, Colombia, 1-7 August 1976

Edited by James Cock, Reginald MacIntyre, and Michael Graham



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

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FOURTH SYMPOSIUM

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Postal Address: Box 8500, Ottawa, Canada K1G 3H9
Head Office: 60 Queen Street, Ottawa

Cock, J.
MacIntyre, R.
Graham, M.
International Society for Tropical Root Crops
CIAT
IDRC
USAID IDRC-080e

Proceedings of the Fourth Symposium of the International Society for Tropical Root Crops held at CIAT, Cali, Colombia, 1–7 August 1976, Ottawa, IDRC, 1977. 277 pp.

/ IDRC pub CRDI /. Proceedings of a symposium on / root crop / / plant production / in the / tropical zone / – includes / list of participants /, / bibliography/s, and / statistical data /.

UDC: 633.4(213) ISBN: 0-88936-115-0

Microfiche Edition $1

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for the purpose of processing cassava. The capital cost (Colombian pesos) of this plant is: land 50 000; buildings 660 000; local equipment 1 318 600; imported equipment 1 100 000; labour costs 350 000; and cost of installation 300 000. The cost of this project (3 778 600 pesos) is being financed as follows: Comité de Cafeteros del Quindio 10%; Federacafé-Prodesarrollo 10%; Productos Ramo 4%; and Agricultores del Quindio 76%.

The plant will be capable of processing 10 t of cassava in an 8 h working day and this will produce 3060 kg of flour and 340 kg of starch. It will employ 14 people of which four will be responsible for general administration and 10 for processing operations. As well, it will provide indirect employment for a further 40 people. It will be situated in the Armenia area, which is a main centre for cassava production, and where yields are the highest in the country at 25–30 t/ha. This compares with a national average in 1975 of 9.3 t/ha.

On the basis of 200 operating days per annum this would amount to about 600 t of flour. It is intended that this should be a pilot plant. When the results of its operation are assessed, consideration can be given as to whether further plants of a similar capacity should be installed. To produce 30 000 t of cassava flour annually would require a total of 50 similar plants, each of which would save approximately US$ 120 000 annually in foreign exchange based on a price of US$ 200/t for wheat. This would provide direct employment for 700 people and indirect employment for a further 2000.

Alternatively, with a view to reducing the number of plants required, consideration could be given to working two shifts of 8 h each per day. This possibility will be given consideration when the pilot plant is in production. This would reduce the amount of capital required in installing new plants, but it would be necessary to take into consideration the higher costs of wages for persons working unsocial hours.

The pilot plant or plants could be expanded at the appropriate time if this were justified by an increase in production of the raw material. At a later stage consideration could also be given to processing other products such as cassava chips, pellets, meal, etc.

Experiments have already been undertaken on the production of frozen cassava. This was successful as the product was of a high quality with a good appearance. It was readily accepted by the supermarkets in Bogota, and requests have been received for further supplies.

Benefits of Cassava Processing Industries

The benefits to be obtained from establishing cassava processing industries are considerable and are summarized as follows: (1) farmers would be encouraged to expand production of cassava as they would have an assured market at stable prices; (2) Colombia would be less dependent upon imports of wheat with a consequential saving in foreign exchange; (3) it would be an investment against a world food shortage such as occurred in 1972; and (4) work would be created in areas where there is a high rate of unemployment, and thus it would assist in decreasing the flow of workers from the agricultural areas into the large cities.

A Profile of Thai Cassava Production Practices

Truman P. Phillips[1]

This paper presents some preliminary results of an agroeconomic survey of Thai cassava producers. The study is part of a larger international network of studies completed or underway in Colombia, Nigeria, and Brazil. All studies have as a common theme the analysis of the economic and agronomic relationships related to cassava production. However, owing to country differences, specific objectives are specified for each study. The objectives of this part of the Thai survey are: (1) the prediction of total cassava production and acreage in Thailand for 1974 and 1975; (2) the identification of major sets of produc-

[1]School of Agricultural Economics, University of Guelph, Guelph, Canada.

tion practices; and (3) the identification of factors encouraging or discouraging the use of certain technologies.

The data for this paper were extracted from two questionnaires. The first related to acreage and production (2153 farmers), the second to specific production and marketing practices (501 farmers).

Thailand, the leading exporter of cassava products, differs from most, if not all, other cassava producing countries because it exports over 90% of total production. In spite of this marketing difference, the indications are that production practices are similar to those of other countries. The similarities are deceiving, however, because Thailand has succeeded in developing an export market while other countries have failed.

Preliminary analysis suggests that in 1974, 445 003 ha (2 781 271 rai) of cassava were planted by 137 087 farmers (approximately 90% of total cassava area); whereas in 1975, 541 711 ha were planted by 165 286 farmers. Because individual farm plantings are relatively constant (3.3 ha), the major expansion has been brought about by new entrants into the industry (27% increase between 1974 and 1975). Not surprisingly, the growth of new entrants (and hence expanded acreage) was lower in the three more important changwats (Chonburi, Rayong, and Nakhonrachsima) than in the "newer" less important producing regions (7% increase in the number of farmers versus 40%). The average size of cassava planting in the three main producing changwats (big three) is more than double that of other changwats (4.3 ha versus 2.0 ha) although the average farm size is approximately equal for both groups (6.8 ha). Accordingly, cassava is the principal crop in the three major producing changwats (65% of total farm acreage), while it is a relatively minor crop in the other changwats (27% of farm acreage).

The timing of planting also differs between specializing and nonspecializing areas. In Chonburi, Rayong, and Nakhonrachsima, planting is evenly spread out over the year with a slight peak occurring in May and June. In the other changwats more than 50% of planting occurs in April and May.

The above cursory examination of the data provides some insight into the possible evolution of Thai cassava production. Expansion, certainly between 1974 and 1975, occurred through an increase in the number of farmers producing cassava. However, this form of expansion is finite owing to both the availability of lands suitable to cassava production and the introduction of legislation to restrict cassava acreage (this is possible if recent Government policies aimed at limiting the spread of cassava production are successfully implemented). Thus, future expansion may have to take place on existing cassava producing farms. The greatest potential for expansion exists in the newer areas that do not now specialize in cassava. If farmers there were to expand their cassava acreage to 65% of total farm acreage (the level achieved in the older producing areas), total cassava acreage could increase by 116 000 ha or 26%. Expansion above this amount would have to come through productivity increases. A question of interest then becomes: Are the means of increasing cassava yield readily available in Thailand? Alternately, is there currently a set of production practices that is superior, and that can be extended to other regions?

A Profile of Production Practices

The following analysis is based primarily on the results of the second questionnaire. Distribution of yields for the kingdom, specializing, and nonspecializing changwats are shown in Table 1. The indications are that the areas not specializing in cassava tend to have slightly fewer farms with low yields (arbitrarily defined as less than 9.4 t/ha) than did the specializing regions. (Analysis of yield data based on farmers' expectations suggests that the specializing areas expect to have fewer farms with low yield than the nonspecializing areas. A fuller analysis of farmers' expectations will be conducted at a later date.) These slight differences of cassava yield between areas obviously depend on numerous endogenous (farmer controlled) and exogenous (not farmer controlled) factors. Of the latter, the most important are inherent soil capacity, weather, disease, and insect problems. Of the former, the most important are varieties, purchased inputs, and labour utilization.

Exogenous Factors

Owing to resource (financial and personnel)

Table 1. Distribution of yields.

Yield level (t/ha)	% of farmers		
	Big three	Other	Kingdom
0–9.4	35.7	31.1	33.2
9.4–12.5	20.6	23.1	21.9
12.5–15.6	21.4	14.0	17.4
15.6–18.8	10.1	17.8	14.3
More than 18.8	12.2	14.0	13.2

constraints, it was only possible to survey farmers' reactions to disease, insect, and water problems. Although 12% of the farmers reported disease problems and 8% reported insect problems, these appeared to have little or no effect on yield. However, yield was adversely affected by water problems (32% of farmers had water problems), with more than 40% of the farmers reporting drought and 48% of those reporting flooding having a yield of less than 9.4 t/ha. Only 28% of the farmers having no water problem had yields below this level.

In four of the six zones with 30% or more of the farmers reporting yields lower than 9.4 t/ha, the exogenous factors seemed to be associated with low yields. At the other extreme, zones with less than 15% of the farmers having low yields, exogenous factors do not seem to be related to yield level.

In summary, regional examination of the data reveals that disease, insect, and water problems do have a deleterious effect on yield, with the most serious problem being drought in Thai agroeconomic zones 3, 4, and 5.

Endogenous Factors

Given that the combination of factors within the farmer's control is virtually infinite, the task of a priori identification of a "best" set of production practices is impossible. However, examination of individual factors and observed combinations of factors should provide some indication of those endogenous factors that make the greatest contribution to production.

One factor that might be assumed to affect yield is variety, but this proved to be insignificant, both for specializing and nonspecializing areas and at the Kingdom level. Based on identification of varieties grown (the choice being government or local varieties), it was not possible to distinguish between the distribution of yield for the two broad variety classifications.

Source of stake did not appear to affect yield (37% of the farmers bought their stakes or got them from a neighbour), but method of storage did seem to have an influence. Most farmers stored their stakes in the open. However, those who used roofed storage (6.6% of farmers) appeared to have higher yields. Length of storage did not appear to affect yield (on average, 78.5% of farmers stored stakes for less than 1 month).

Thus, of all the factors relating to varieties and storage, only roofed storage seemed to have any positive effect. Whether higher yields resulted from method of storage, or whether better storage merely reflected overall superior management, is not clear.

Another endogenous factor that may be expected to influence yield is the use of credit. Approximately 70% of the farmers interviewed used credit, averaging $256 (5132 baht) per farm. The bulk of the loans are borrowed and repaid in cash ($26 426 906 versus total borrowing of $27 910 413). The major purposes of all loans are for general operating expenses related to cassava production and land preparation, with the bulk of the money coming from merchants or Agricultural Banks (43.7 and 33.0%, respectively). As is often the case in developing countries, the interest rate is high, with 41% of the farmers paying between 10 and 15% interest and an additional 37% of the farmers paying over 25% interest. Availability of credit does not seem to be a problem to most farmers who already have credit (93% of the borrowers say that more credit is available). In general the borrowing of capital seems to be related to several factors that suggest that these farmers are better managers. The cumulative effect is that farmers who borrow have higher than average yields (75% have a yield above 9.4 t/ha). This yield effect is associated with two other factors: (1) farmers who borrow have larger than average cassava acreage; and (2) farmers with larger than average acreages of cassava (more than 3.2 ha) have higher yields. Comparison between the cassava specializing and nonspecializing areas again reveals that average cassava plantings are larger in the former while yields are slightly lower. In keeping with having larger average cassava acreage, farmers in the cassava specializing areas borrow more money than those in the nonspecializing areas (average $264 versus $223).

A remaining endogenous factor that may

Table 2. Labour requirements (man days/ha) for basic production activities.

	Thai study	CIAT study	
Land preparation	10.2	—[a]	25.0[b]
Planting	9.9	9.4	11.4
Cultivation	32.7	46.8	43.7
Harvesting	19.9	30.7	24.6

[a]Machinery used for land preparation.
[b]No machinery used for land preparation.

affect yield is the means of production (land preparation, planting, cultivation, and harvesting). As in other producing countries, the means of production tend to be labour intensive. Thailand is perhaps unique in terms of the use of mechanized field preparation, with 60% of the farmers using some form of mechanization, and an additional 27% using animal draft power. All other field activities are accomplished primarily by human labour.

At the Kingdom level the only production practice that appreciably affects yield is the use of family labour in field preparation. Less than 24% of the farmers who manually prepared their fields had yields of less than 9.4 t/ha (versus a Kingdom average of 33% of farmers with yields in this category). By cassava acreage, farmers who relied upon manual field preparation represented a cross section of the industry. That is, the distribution of planted acreage for farmers using manually prepared fields and the sample population are similar. However, the average acreage for farmers who hired machinery for land preparation is generally larger than the average cassava acreage.

In general, the utilization of hired labour is associated with lower yields. But when there is no water problem, the farmers depending on hired labour tend to have higher yields than those depending on family labour. It may be speculated that under bad conditions the family labour puts in extra effort to combat the adverse conditions. This supposition is to be examined at a future date.

In summary, it may be said that production practices in the old and new cassava producing areas appear to be similar and equally successful. The only endogenous factors that seem to be identified with yield improvements are: (1) the storage of stakes under shade; (2) the use of credit; and (3) the manual preparation of land. Furthermore, the exogenous factor of weather seems to influence the productivity of hired labour.

The analysis to date does not indicate that yield and basic output/input ratios for the old and new cassava producing areas are markedly different. If this finding can be substantiated it will cast some doubt on the generally accepted Thai belief that, in time, the productivity of cassava areas is drastically decreased. This survey will, however, not be able to assess if differences in soil and topographical conditions in the old and new areas will prohibit the latter areas from duplicating the long run production practices of the old cassava producing areas.

Some Benchmark Values

Whereas the preceding analysis provides some indication of the factors affecting yield, it does not provide all the information required for international comparison of production practices. This section contains some of the data required for such comparisons.

As noted, Thailand differs from other cassava producing countries in terms of the use of machinery for land preparation, but is similar to such countries in that all other production activities are labour intensive. A comparison of Colombian (Diaz et al. 1974) and Thai production practices reveals the similarities that exist between the two countries (Table 2).

There is little difference between the two countries regarding the time needed for planting, but Thai farmers appear to require less labour for weeding, cultivating, and harvesting, than do Colombian farmers. Thai cassava producers also seem to be more efficient when one realizes that 80% of production occurs within 12 months (versus 42% in Colombia) and that the average Thai yield is approximately 15 t/ha versus 11 t/ha in Colombia.

The Thai farmer also differs from his Colombian counterpart in that the former rarely intercrops cassava, whereas one third of the latter farmers do. Cassava in Thailand is, of course, grown in competition with other crops. Although the farmers' anticipated response to increases or decreases of cassava acreage is basically symmetrical, 10% of the farmers suggested that they would grow vegetables, flowers, fruit, or other high value crops if cassava acreage were decreased.

To conclude this section, an examination of the potential profitability of cassava is presented. The gross margin of cassava production is used as a proxy measure of cassava

profitability in the two countries. Gross margin is defined as: gross revenue minus cost (or inputed cost) of land preparation, planting, cultivating, and harvesting.

For Thailand the average revenue is $358/ha while the average cost of production (excluding purchased inputs, interest, and return on investment) is $84/ha, giving a gross margin of $274/ha. Because average farm acreage of cassava is 3.3/ha, the average farm gross margin derived from cassava is $898.72 from which other variable and fixed costs must be deducted. Comparable figures for Colombia are: cost $111/ha, returns $424/ha; and gross margin $313/ha. Thus, if gross margin is a good proxy measure for profit, it appears that cassava is more profitable in Colombia than in Thailand (on a per unit land basis). If, however, the length of the production cycle is considered, then production in Thailand appears to be more profitable It may in fact be the Thai's ability to produce a crop of cassava every year that is the single most distinguishing factor of cassava production in Thailand. The annual production of cassava allows the farmer to utilize his land more fully, and enables him to annually alter his cropping pattern in response to emerging market conditions. Such flexibility is not generally possible with production cycles of more than one year, because some land will sit idle if harvesting occurs just prior to a dry season.

This paper has attempted to highlight major factors related to cassava production in Thailand, and to compare Thai production practices with those of Colombia. The analysis reveals no startling findings. Instead it suggests that the methods of production are fairly consistent in different areas of Thailand, albeit factors such as weather, credit, farm size, and method of field preparation appear to affect yield. Furthermore, the comparison of Thai and Colombian production practices suggests that any competitive edge in productivity that Thailand may enjoy is primarily related to a shorter growth cycle.

Thus, Thailand's preeminence among cassava producing countries is not the result of superior technology, but rather the result of superior application of technology that is readily available in many other countries.

The research for this paper was made possible by the generous assistance of the Division of Agricultural Economics (DAE), Royal Thai Ministry of Agriculture and Cooperatives, and the International Development Research Centre. Special thanks are owing to Somnuk Striplung, Chief DAE, and Apichart Pongsrihadulchai, Thai Project Coordinator, for their efforts in this joint Thai-Canadian venture.

Diaz, Rafael O., Per Pinstrup-Anderson, and Ruben Dario Estrada. *Cost and use of inputs in cassava production in Colombia: a brief description*, CIAT, Series EE No. 5, September 1974.

The Prophylactic Action of Cassava

O. L. Oke[1]

Cyanogenic glycosides are toxic in large doses, but the body can cope with small doses, which are converted to compounds of high physiological activity, e.g. glucose, cyanate, and thiocyanate (used for sickle cell crisis and certain hypertension), salicylic acid and isomers (an antipyretic and analgaesic), and hydrocyanic acid (a potent cytotoxin). Under certain conditions such as development of neoplasm or schistosomiasis, the cells affected contain high amounts of glucosidases or glucuronidases, which are capable of hydrolyzing the glycosides but are devoid of the enzyme rhodanese for converting the highly toxic hydrocyanic acid to the much less toxic thiocyanate. This therefore results in selective toxicity in which the cells are destroyed, but the somatic cells with high amounts of rhodanese survive. Since the diets of people in developing countries contain a lot of cassava high in cyanogenic glycosides, this might account for the prophylactic property that results in rarity of sickle cell anaemia and bowel cancer.

[1]Chemistry Department, University of Ife, Ile-Ife, Nigeria.