

CASSAVA (INDONESIA):

AN EVALUATION

Phase I - 3-P-73-0043

Phase II - 3-P-76-0060

RECIPIENT INSTITUTION: Faculty of Agriculture  
Universitas Brawijaya  
Malang, Indonesia

DURATION: Phase I - Nov. 1973 to Oct. 1976  
Phase II - Nov. 1976 to Oct. 1980

IDRC CONTRIBUTION: Phase I - \$ 98,000  
Phase II - \$328,000

October 1978

## 1. THE RESEARCH PROBLEM

### 1.1 Background

Indonesia, with a yearly production of 11 million tons of fresh root, is the second largest cassava-producing country in the world and the second largest exporter of cassava (200,000 tons dried cassava).

Cassava is a small farmers crop in Indonesia. It is consumed mostly as fresh roots, with a small but increasing amount as pelleted animal feed for export. It is the third most important crop in Indonesia after rice and corn, although yields are low with an average of about 7 tons per hectare. One reason for these low yields was that there was very little research capability at the time the project began, with almost no research work being undertaken.

East Java, one of the most densely populated regions of the world, and the most important cassava-producing region in Indonesia, is the home of a potentially very significant production innovation developed by a local farmer, Mr. Mukibat, in 1952. This technique was adopted by a number of farmers in East Java, but before this project was undertaken, only a few unsystematic experiments had been carried out to determine the merit of this new technique.

### 1.2 Project Development

The project can be seen as a follow-up of a cassava workshop held in London in January 1973, during which a working relation between Brawijaya University and the Centre was established. Dr. G.N. de Bruijn from the Department of Tropical Crops, Agricultural University, Wageningen, was the mediator of such contacts.

The cassava network established by IDRC with substantial back-up from CIAT scientists, had gradually expanded from Latin America to include most of the important cassava-producing countries. Indonesia was difficult to bring into this network since it lacked even a minimal research nucleus around which one could build a strong research program.

The AFNS Associate Director concerned with the cassava program decided to encourage Brawijaya University in East Java to prepare and submit a research project to further investigate the Mukibat system.

The Mukibat cassava system consists of grafting the tree cassava (M. glaziovii), a perennial that does not produce tuberous roots, onto the normal cassava (M. esculenta). It was estimated (based on sketchy data) that under comparable conditions, yields using the Mukibat system at least doubled those from the traditional system. Another indicator of the new system's potential was its spread to a small but increasing number of farmers in East Java.

### 1.3 Objectives

A project was developed with the following three objectives (which remain essentially the same in Phase II except for the addition of d):

- a) To study and further develop the potential of the Mukibat system of combining tree and normal cassava;
- b) To link Indonesia into the CIAT Cassava Research Network; and,
- c) To provide practical training in cassava research and development for staff and graduate students at Brawijaya University.
- d) In Phase II it was decided to undertake studies on a variation of the Mukibat technique called the Satrawi system, named after a local farmer also. This new system involves the simultaneous grafting of one M. glaziovii scion (the leafy canopy of the cassava) onto three M. esculenta stocks planted to form a tripod. It is hoped that this plant structure will improve resistance to wind damage and increased yields will result. The Mukibat system will be compared to the Satrawi system and with normal cassava.

### 1.4 The Recipient Institution

The Brawijaya University was chosen because it was located in East Java. It was the only institution that had done previous work on food crops and livestock, but more importantly, IDRC's Associate Director was impressed by the Faculty of Agriculture's small (14 staff members only), young, but very enthusiastic team of scientists who had an interest in cassava research.

## 2. PROJECT PERFORMANCE

### 2.1 Personnel and Resource Use

While there has been a general shortage of staff, the project has benefited from the strong leadership of the two Project Directors. The project originally relied largely on student fieldwork with part-time staff guidance, but given the shortage of students in particular fields at times, and the other commitments of staff, the project has switched to using a mixture of full-time project staff and student workers to carry out the research. In terms of the research staff, there are five agronomists, two entomologists, two soil scientists, one food technologist, and one economist involved. The Faculty of Agriculture has made the majority of their office space and equipment available for use by the project research staff.

## 2.2 The Research Program

In the beginning, experiments were often interrupted or delayed due to shortages of staff and material, unforeseen national events, and also because of the staff's inability to judge how much work they could comfortably handle. This situation has improved largely by restricting the geographic dispersal of experiments, which makes them easier to manage. The problem here is that experimental results may not be as applicable to all ecological regions of East Java.

## 2.3 Time Frame

Despite the difficulties outlined below, Phase I was completed on schedule and Phase II is progressing according to the original program. The project leader, Dr. Soetono, feels that a definite answer to the value of the Mukibat system could be had by 1980, but this will require more conclusive answers as to how the system contributes to the farmers' present overall cropping pattern. It is also felt by consultants that the project will have to involve more experimental station testing to meet the 1980 deadline.

## 2.4 Technical Achievements

Project results have been presented in a series of progress reports, two publications, and seminars. They can be summarized as follows:

a) Comparison of yields between normal and Mukibat cassava has shown that increases from the Mukibat system are anywhere from 114 per cent to 347 per cent on a dry matter basis, the value most often incurred being approximately 130 per cent to 150 per cent. It should be noted, though, that these results are based on a growing season of 10 months for normal cassava and 15 months for Mukibat cassava.

b) Mukibat cassava continues to fix dry matter up to a period of 18 months, compared to only 14 months with normal cassava. Furthermore, at any time during the period of dry matter fixation, the dry matter content is higher in Mukibat cassava. At 10 months dry matter of Mukibat cassava is 26.2 and 23.3 per cent for normal cassava; at 12 months the values are 30.5 and 29.2 per cent respectively; at 14 months it is 34.7 and 31.8 per cent. The increased period of dry matter fixation in Mukibat cassava allows the farmer to store his cassava roots in the ground for a longer time without fear of root decomposition.

c) Although digging planting holes is traditionally used in the Mukibat system, it has been demonstrated that this laborious practice is not necessary. This is an important finding since one of the primary reasons cited by farmers (in a survey in 1973) for not

switching from normal to Mukibat production was the greater labour requirements for Mukibat.

d) Significant fertilizer response has been obtained, but only following the application of nitrogen.

e) The superiority of Mukibat cassava in terms of yield is greatest for the slow growing varieties preferred by consumers.

f) It is possible to use the grafts for more than one planting, enabling farmers to spread their grafting costs over more than just one growing season. Re-use at present appears to be limited by the fear of a carry-over of pests and disease, and the susceptibility of the graft to wind damage.

g) Preliminary results on the Satrawi system indicate that it provides no significant benefits over that of the Mukibat system. Other preliminary results on pest control, growth cycle, planting season, etc., are highly encouraging. However, more experiments are needed to clarify more precisely the technical and economic implications of these technologies.

## 2.5 Personnel and Institutional Development

The project has produced some interesting results and has also raised a number of questions, not only for the future development of the Mukibat system in Indonesia, but also on the whole mechanism of root thickening in cassava. As a result, the project has attracted a lot of attention elsewhere. This has been particularly important for the morale of the young and small Brawijaya University. Brawijaya University has made substantial progress in learning how to manage a research project and in developing a team of scientists who will be capable of carrying on a major research program. The recognition achieved by this project has encouraged the Dean and staff members to attempt to create a Cassava Research Institute at Brawijaya University which, given the importance of cassava in East Java, could become one of the main centres for cassava research in Indonesia.

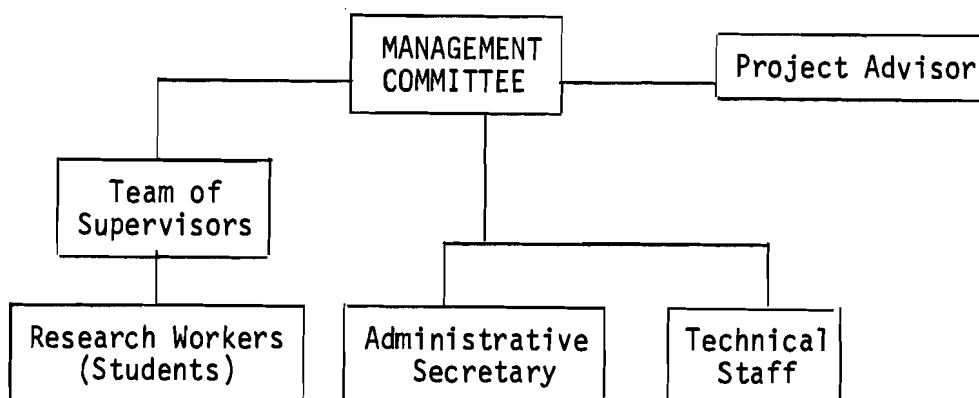
While the Faculty has only one Ph.D on staff at present, there will be an additional three by the end of Phase II in 1980. One scientist now studying towards his Ph.D. at Wageningen University in Holland, is expected to do his fieldwork on cassava at Brawijaya through project funds. Two of the full-time project staff have been offered Ph.D. scholarships in Australia. It is unlikely that any arrangement can be worked out to ensure that they will be able to do their Ph.D. work on cassava, but this possibility is being explored.

While the number of students who will undertake research on some aspect of cassava production for their Ingénieur's degree by the end of the second phase in 1980 will not be as large as originally planned (45) due to the difficulty of recruiting sufficient

students of the right type and then providing adequate supervision, the total number will represent an increase of 18 graduates experienced in cassava research in Indonesia.

## 2.6 Management and Coordination

The following is a diagram of the management structure.



The management of the project has been broadened from the project leader to a four-man committee, composed of four university staff, all of whom are involved in the project. This structure has been relatively successful in ensuring completion of experiments given the limited number of staff and students available. The Management Committee has met frequently and has been active primarily in the first two of the following three functions normally carried out by a project management committee:

- a) Administrative control;
- b) Direction of the scientific program; and
- c) External liaison with other government departments, research institutions, and extension services.

## 2.7 Research Planning and Evaluation

The primary consultant used in the project, Dr. de Bruijn, has played a major role in helping the project staff plan each year's trials and evaluating the results of previous work. As de Bruijn had spent several years at the University before the start of the project working on cassava research, he was familiar with both the staff and capability of the University. This has allowed him to provide detailed guidance on the University's experimental program, many aspects of which were completely new to the staff before the project started.

Right from the beginning, IDRC project officers have felt that the project staff have had a very logical procedure for developing its annual research design and has been prompt in submitting six progress reports to IDRC. Where they have developed noticeably is in being able to conduct experiments through to conclusion. Furthermore, IDRC staff and consultants have commented very favourably on the development of the project team's self-confidence and their ability to determine and defend their own research program.

As regards evaluation, the socio-economic analysis and evaluation of the project's results is almost negligible. Some information on farmer practices was collected in a 1974 survey but on a fairly limited basis. The university staff involved in this project tend to evaluate the project in terms of what it is doing to increase the number and level of trained staff rather than in terms of what the research program may be able to achieve. Thus there is a tendency to try to send as many staff as possible for up-grading from project funds. Given the limited number of staff with post-graduate degrees in the University, this is not a surprising or perhaps an unreasonable focus.

## 2.8 Financial and Administrative Problems

Appendix A shows the project budget versus actual expenditures for Phase I and Phase II. Appendix B shows the relationship between the budget versus actual expenditures for both Phase I and Phase II (Year 2 of Phase II are estimates).

The most difficult aspect of dealing with IDRC in this project has arisen from complications in the transfer of funds. The different project managers involved have had no experience in managing and accounting for project expenditures before becoming involved in this project.

In Phase I the first two financial reports were both incomplete and late in arriving. This resulted in delays of two and four months respectively in the sending of project funds to Indonesia. As the project progressed, however, improved financial statements allowed the third and fourth payments to be made ahead of schedule.

The start-up date of Phase II presented considerable difficulties for the project leaders. Since the commitment date for Phase II was November 25, 1976, the project leaders tried to assign subsequent expenditures to either Phase I or Phase II according to the use of the money, not the timing of the expenditures. The expenditures on the 1975 crop (harvested up to May 1977) were assigned to Phase I. All other expenditures were assigned to Phase II. AFNS has now adopted the practice of arranging reporting times most appropriate to local conditions, such as fiscal year or harvest period.

Part of the overall delay in the receipt of funds has been the policy of transferring funds to the University through the Indonesian Institute of Sciences (LIPI). In order to minimize

delays, LIPI has now asked IDRC to send future payments directly to the University.

## 2.9 National Linkages

The links between Brawijaya University and other research institutions including the Central Research Institute for Agriculture (CRIA)\* are limited but improving. No representatives of the Ministry of Agriculture or other institutions have been invited to participate in the regular coordinating committee meetings of the cassava project or involved in the preparation of the project proposal and the annual preparation of the research program.

Similarly, the University has not kept close contact with LIPI which must approve all requests for external donor assistance from Indonesian institutions and Indonesia's counterpart contributions. Thus LIPI's awareness of, and interest in ensuring continuing financial support in the project after IDRC support is withdrawn, is limited.

## 2.10 The Delivery System

The University has begun to cooperate with the small CRIA unit in East Java, and the Project Leader presented a paper on the results of their research at a recent CRIA conference in Kalimantan, where the Government is beginning to promote large-scale production of cassava. Three of the University staff now serve as consultants to the local CRIA unit and CRIA has provided land for one of the project's experimental sites. CRIA also began to pay the per diem costs of field students at this site in the last year. The local director of the CRIA station has approached the University suggesting that a formal agreement of cooperation between the two groups be established with CRIA's financial responsibilities outlined. If such an agreement is reached, this would create the first official links between the Ministry of Agriculture and the University within the region and help set the framework for incorporation of a cassava research program at Brawijaya into a national program.

However, until an effective national program and delivery system is established it will be difficult for Brawijaya to disseminate its results and have any major impact on small farmer production. The results of its program are likely to be of more immediate benefit to the larger cassava plantations and small farmer production units surrounding these plantations which are now being established in Kalimantan and Sumatra.

## 2.11 The Beneficiary

In 1974, the Faculty carried out a survey of cassava and

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\* Established in 1966 and placed under the scope of the Department of Agriculture. Its mandate is to find new technology to stimulate food production and which is also acceptable to the small farmer.



Mukibat production practices involving 292 farmers who used the Mukibat system. This baseline survey published in 1976 was a major achievement for the Faculty which had never organized and run a farm survey before. While this survey was useful in providing some information on production practices (the survey indicated that the average Mukibat farmer had a holding of .88 hectare of which about 20 per cent is planted with normal cassava and 17 per cent with Mukibat plants and that most Mukibat cassava is grown in farmyards where soil fertility is considerably higher), much more information on production techniques and on the integration of Mukibat and normal cassava production within the farmers' overall cropping system is required. Field data collection and analysis is a time-consuming and difficult exercise, and the Faculty at the moment lacks the experience and personnel to carry this out. Thus it will be difficult to develop recommendations for farmers which are tailored to their specific environments.

An encouraging note is that the Agricultural Development Council (ADC) is placing a team of two experienced ADC employees at Brawijaya University. Discussions have taken place among IDRC, ADC, and the University on how this team could undertake some village level studies of the farmers' socio-economic environment and cassava production practices.

## 2.12 Regional Linkages

The project has had regular visits from scientists outside the country and several staff have travelled abroad. This has contributed to the growing self-confidence of the scientists in the project, and to a lesser extent, is beginning to create links between the scientists in the project and those elsewhere, although the University is still fairly isolated. There is a noticeable lack of interchange among scientists in the region.

There have been several CIAT staff who have visited the project but no one who has ever visited Brawijaya University more than once. The most hopeful initiative to create more effective regional links and to ensure some continuity in CIAT's relationship with the national programs in Asia, was the appointment about one year ago of an Asian scientist as a regional CIAT cassava coordinator through funds provided by IDRC. This coordinator will regularly visit each of the cassava research projects in the region, passing on information from CIAT and other national programs and helping to arrange workshops, training, and travel. One of the young scientists at Brawijaya will be attending an intensive four-month training program on cassava at CIAT this year with 24 other young Asian scientists. The young scientists will benefit not only from the training program but from the personal contact with other young scientists working in the same problems in the region.

### 3. IDRC'S ROLE AND INVOLVEMENT

There does not appear to be any feeling of excessive direction on IDRC's part, as the project staff in the University and the staff at CRIA and LIPI all feel that cassava research has been grossly neglected and that IDRC's involvement has accelerated the development of a research program that they now want to establish on a major basis as soon as possible.

However, it does raise the question of how far IDRC can go as a catalyst in creating the right conditions for producing research results that can be utilized by the small farmer. In this case, IDRC support has helped develop a small but effective research team at Brawijaya University, but more effort may be required to ensure ongoing financial support so that the cassava program at Brawijaya can continue after IDRC funding terminates in 1980. National research has just been reorganized with assistance from the World Bank and after two or three years of indecision the Government has decided to give a strong focus to cassava. IDRC feels that Brawijaya University has had some influence on this decision. Related to this, and as an essential component in ensuring that the results of Brawijaya's research can be fed into the Ministry of Agriculture's extension services, is the development of a stronger national program managed by CRIA. CRIA has approached IDRC to assist in the development of a national cassava research program, with IDRC support being sought primarily to help CRIA draw on the resources of the international cassava network, and to provide guidance on the development of CRIA's program rather than for any financial contribution IDRC might provide. Support from IDRC for a cassava project at CRIA could have a major impact in developing this national program and in helping to ensure that the strong cassava team at Brawijaya University is linked with and supported by this national program.

The project staff in their assessment of IDRC's involvement commented particularly on the advantages of IDRC's operating style. They felt that IDRC's operating procedures allowed them to develop and operate this project at little cost and administrative effort relative to other externally supported projects. They listed projects which they are developing with other donor agencies and commented that the resulting negotiations with the few senior staff at the University are extremely time-consuming and frustrating.

One particular policy of IDRC which has caused financial problems was the IDRC policy of providing only 90 per cent of estimated project requirements for the first installment. This policy of partial payment was originally established as many recipient institutions were not able to spend their full allocation in the first year. IDRC now provides full payment of the first installment.

The project staff have appreciated and benefited from the visits of the two IDRC consultants because they have considerable experience in the type of work the project staff are doing and because

they have consistently visited the project and followed up promptly with correspondence, commenting on the research program and suggesting practical adjustments which the staff can implement. The project staff emphasized the importance of using the same consultants since they are familiar with them and they receive consistent recommendations without having to continually educate new consultants. IDRC staff responsible for the project feel that the use of the two consultants in this project was a crucial factor in providing technical advice and encouraged staff to plan a realistic program of experiments each year.

#### 4. BROADER DEVELOPMENT IMPLICATIONS

It was originally hoped when designing the project that it might be possible to prove that the Mukibat cassava production system was a highly profitable innovation, and that a set of recommendations and promotion of this new technology could be accomplished in a short period of time. However, this has not proven to be the case as the research to date indicates that there is considerable variation in the usefulness of this system, depending on such factors as the availability of labour and condition of the soil.

A scientific base for determining and improving on Mukibat cassava techniques is being laid; with the expected addition of several ADC personnel to the University, the project should be able to expand this to relate their experimental program and innovations to the existing production practices of the farmer and to determine the acceptability of new techniques.

The primary achievement of this project may well be, however, the development of the institutional and personnel capacity of the University which has acquired the confidence and ability to carry out future research programs of comparable complexity.

The major remaining questions are whether institutional links between Brawijaya and CRIA, the national agricultural organization, can be created to ensure continued financial support for agricultural research at Brawijaya, and whether the Government's delivery system will be developed to encourage farmers throughout Indonesia to adopt this system. It must be emphasized though that the dialogue between CRIA, IDRC, and Brawijaya University has been extremely encouraging. After three years of inconclusive discussion with the Government regarding the national cassava policy, a much sharper focus has developed. This has arisen from the fact that the leaders of the program from CRIA, the Agricultural Faculty from the University at Bogor, and Brawijaya University jointly participated in January 1978 in a one-month cassava production training course (funded by IDRC). During this course, these three scientists presented a first draft proposal to IDRC staff for support for a CRIA centered national program.

APPENDIX A

Total Budget and Actual Expenditures

CASSAVA (INDONESIA)

	PHASE I									PHASE II								
	YEAR 1			YEAR 2			YEAR 3			YEAR 4			YEAR 5			CUMULATIVE		
	Budget	Actual	% Spent	Budget	Actual	% Spent	Budget	Actual	% Spent	Budget	Actual	% Spent	Budget	Actual*	% Spent	Budget	Actual	% of Total
Salaries & Allowances	3,840	3,805	99.1	6,660	6,518	97.9	6,630	6,518	98.3	11,350	9,533	84.0	12,490	14,594	116.9	40,970	40,968	100.0%
Training	-	-	-	-	-	-	-	-	-	16,100	4,959	30.8	20,100	3,698	18.4	36,200	8,657	23.9%
Research Expenses	7,999	11,098	138.7	13,625	10,159	74.6	7,409	8,153	110.0	23,550	26,035	110.6	22,300	25,010	112.2	74,883	80,455	107.4%
Capital Expenses	14,504	11,160	76.9	2,161	5,223	241.7	-	-	-	28,300	14,358	50.7	1,000	11,698	1169.8	45,965	42,439	92.3%
Travel	4,062	4,192	103.2	6,177	5,874	95.1	7,853	6,534	82.2	9,550	7,032	73.6	9,550	7,423	77.7	37,192	31,055	83.5%
Publication	-	-	-	-	-	-	1,305	508	38.9	1,000	1,172	117.2	1,000	1,856	185.6	3,305	3,536	107.0%
Consultancy	7,000	7,000	100.0	-	-	-	4,500	3,190	70.9	4,000	2,920	73.0	4,000	-	-	19,500	13,110	67.2%
Services & Supplies	694	1,518	218.7	2,029	1,159	57.1	1,200	1,243	103.6	8,150	8,219	100.9	8,700	8,921	102.5	20,773	21,060	101.4
<b>TOTAL</b>	<b>38,099</b>	<b>38,773</b>	<b>101.8</b>	<b>30,652</b>	<b>28,933</b>	<b>94.4</b>	<b>28,897</b>	<b>26,146</b>	<b>90.5</b>	<b>102,000</b>	<b>74,228</b>	<b>72.8</b>	<b>79,140</b>	<b>73,200</b>	<b>92.5</b>	<b>278,788</b>	<b>241,280</b>	<b>86.6%</b>

\* Estimated

APPENDIX B: CASSAVA (INDONESIA)

