TERMINAL REPORT
OF THE
STRENGTHENING OF LEGUMES IN RELATION TO CROPPING SYSTEMS RESEARCH PROJECT (ATA–218)

A JOINT RESEARCH PROJECT BETWEEN THE
JAPAN INTERNATIONAL COOPERATION AGENCY
AND THE CENTRAL RESEARCH INSTITUTE FOR FOOD CROPS
BOGOR, INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY, TOKYO, JAPAN
AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT, JAKARTA
CENTRAL RESEARCH INSTITUTE FOR FOOD CROPS, BOGOR, INDONESIA
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PREFACE

Over the last 7 years the Japan International Cooperation Agency (JICA) and the Central Research Institute for Food Crops (CRIFC) of Indonesia have collaborated in a major research project: the Strengthening of Legumes in Relation to Cropping Systems Research Project. This project was designed to help promote Indonesia's production of legumes, and especially of soybean. Legumes are an important agricultural commodity and a cheap source of protein for Indonesians' diets. Indonesia is still importing soybean to meet domestic needs.

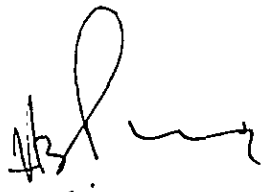
This report presents the result of 7 years of cooperation since the project began in 1978. The project resulted in a number of important research findings which will support the Indonesian Government's program for self sufficiency in food, including the grain legumes. These research results have been published elsewhere. CRIFC's research facilities have been very much improved through the project, and Indonesian researchers have gained substantial knowledge and experience, enabling them to conduct deeper and more productive research in the future. All the project's research activities have been implemented at Bogor Research Institute for Food Crops (BORIF).

We consider the project to have been very successful. This success has only been possible because of the efforts and mutual understanding of the Indonesian and Japanese scientists and personnel. Their participation to make this cooperation a success is highly appreciated.

CRIFC and BORIF are now in a much better position to conduct research on pioneering technology for food crops production.

I hope that continuing cooperation between JICA and CRIFC will give the opportunity to Indonesian and Japanese scientists to further their communication in the future, and to exchange knowledge and experience to promote food crops production for their benefit of both countries.

October 1985



Dr. B.H. Siwi
Director, CRIFC

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SUMMARY

Technical cooperation between Indonesia and Japan on food crops research was initiated in 1970. The executing agencies were the Overseas Technical Cooperation Agency (OTCA) of Japan, and the Central Research Institute for Agriculture (CRIA) of Indonesia. This project was originally planned to last 5 years, and was subsequently extended another 3 years, under the name "Japan-Indonesia Joint Food Crops Research Program". This project stressed lowland rice, since at that time much improvement was needed in the Indonesian rice production system and technologies. The Indonesian government made a strong drive to produce more rice, and was aiming at rice production self-sufficiency. The project strengthened the research capability of the Indonesian researchers and the research facility at the Central Research Institute for Agriculture in Bogor. Significant research findings were released during the cooperation and gave an important contribution to the Indonesian rice production program. Therefore the cooperation was considered to be very successful.

After the termination of the project in 1978, it was realized that research on legumes needed to be strengthened. A new project was therefore initiated, namely the "Strengthening of Legumes in Relation to Cropping Systems Research Project" (ATA-218). The executing agencies were the Japan International Cooperation Agency (JICA) and the Central Research Institute for Agriculture (CRIA), which was later reorganized to become the Central Research Institute for Food Crops (CRIFC) and Bogor Research Institute for Food Crops (BORIF). These institutions implemented the cooperation in the research programs. Legumes are a strategic commodity and a major source of protein in the Indonesian diet. Soybean imports have risen every year to meet domestic needs. Therefore cooperative research with JICA was considered appropriate to seek new technology to promote production of legumes production, particularly soybean. The scope of the cooperation included plant breeding, cultural practices, water management, soil management, weed control, plant physiology, and plant protection.

The objectives of the cooperation were to strengthen and to expand the CRIFC research program, with emphasis on legumes and other food crops. A number of Indonesian researchers were sent to Japan for training to increase their research capabilities. Long- and short-term experts were dispatched from Japan to share their knowledge and experience with Indonesian counterparts. JICA also provided modern equipment to create better research facilities.

A number of significant research findings were released as a result of the project. These have been of importance in the formulation of packages of technology to support the government's program for food self-sufficiency. In 1983 the cooperation was extended for another 2 years. It therefore terminated in October 1985.

The cooperation was considered to be very successful. The Indonesian reseachers gained in knowledge and experience through the project, and were hence able to conducct better research. Two Indonesian

scientists obtained their Ph.D degrees in Japan under this project, namely Dr. M. Sundaru (weed scientist) and Dr. Mukelar Amir (phytopathologist).

The modern laboratory equipment donated by JICA through this program is successfully maintained. Indonesian researchers are now fully qualified in the operation and use of all this equipment because of a smooth transfer of technology from the Japanese experts to their Indonesian counterparts.

Many technical reports have been released or published in various scientific journals in Indonesia and abroad. Japanese and Indonesian scientists presented their reports jointly in seminars and scientific conferences. The close operation and exchange of ideas between Japanese and Indonesian researchers has promoted better understanding between scientists of both countries. Based on the success of the ATA-218 Project, future similar projects in different or related fields can be deemed viable and potentially highly beneficial.

INTRODUCTION

Historical background

Previous to this project, the "Japan-Indonesia Joint Food Crops Research Program" was implemented at the Central Research Institute for Agriculture (CRIA), Bogor, for 8 years beginning in 1970. Although the cooperative research activities of this program concentrated on the problems of plant pathology and plant physiology of rice, it gained a reputation as one of the most successful of various bilateral technical assistance projects, through its success in promoting research activities and improving the research facilities and research capabilities of junior staff in this field.

Before this program ended, a request for continued cooperation was made, based on the progress already achieved in the program and the prospects anticipated through a new project.

At that time, rice production was increasing at an annual growth rate of 4.4 %, while the growth of other food crops production was left behind. The targeted growth of agricultural production of 4.6 % for the period 1975-1985 had not been achieved without additional significant inputs from agricultural research.

Responding to this situation, in November 1977 the Japanese government sent a survey team to Indonesia to discuss the background of the request for the new project and details of further research cooperation areas. Consequently, an official proposal for the new project was sent to the Japanese government through Mr. Sadikin Sumintawikarta, Director-General of the Agency for Agricultural Research and Development.

The official proposal for the new project was studied by the Japanese government, and the evaluation team for the Program was sent in July 1978 to exchange opinions on the master plan of the new project. In the discussion between the Japanese team and CRIA, the following consensus was reached :

> "It is desirable that the new project be started as a comprehensive agricultural program covering not only plant protection but also aiming at basic studies and application research on a greater diversity of fields such as water management, breeding methods of leguminous crops, weed control, soil and fertilization management, plant physiology, nematology, rodent control, toxicology, and so forth. Moreover, in this cooperative project, emphasis should be placed on efforts to improve and intensify study on legumes and other food crops as components in the cropping system."

In October 1978, a Japanese Project Formulation Team was sent with the purpose of working out the details of the new project. The Record of Discussion on the technical cooperation for "The Strengthening of Legumes in Relation to Cropping Systems Research Project" was signed by Mr. M. Kitano, Leader of the Japanese Formulation Team, and Dr. Rusli Hakim, Director of the Central Research Institute for Agriculture, in Jakarta on 12 October 1978 (Appendix I). The first Japanese experts were dispatched

to Indonesia in February 1979, and the project started its activities.

The project was originally planned to last 5 years from 23 October 1978. However, towards the beginning of 1983, the hope of continuing the cooperation was expressed by the Central Research Institute for Food Crops (CRIFC; the Central Research Institute for Agriculture had been reorganized as CRIFC in April 1981). The Japanese Evaluation Team sent to evaluate the project in August 1983 recommended to extend the cooperation for another 2 years, as the result of its overall review and evaluation of the project performance.

On 14 September 1983 a "Record of Discussions on Extension of the Period of the Technical Cooperation for the Strengthening of Legumes in Relation to Cropping Systems Research Project" was signed by Mr. A. Yamamura, Resident Representative of JICA, and Dr. B.H. Siwi, Director of CRIFC (Appendix II). The 2 years' follow-up cooperation was based on this Record of Discussions.

Objectives of the Project

With a view to developing packages of technology for food crops production suitable for agro-climatic conditions in Indonesia, the Project had the following objectives :

1. Immediate objectives

a. To strengthen and expand the research program at CRIFC with emphasis on legumes (soybean, peanut and mungbean) and other food crops (rice, corn, tuber crops) as components in cropping systems.

b. To train and upgrade the Indonesian research staff at the Institute to fully develop its capability to carry out a relevant and viable research program to support the Indonesian government's food production program.

2. Long range objectives

a. By improving and strengthening CRIFC's research capability and research program, to have a significant impact on food production and farmers'incomes.

b. To develop packages of technology for food crop production suited to specific agro-climatic conditions.

c. To strengthen and intensify the dissemination of research findings and linkages with other agricultural agencies.

Figure 1. The administrative building of the Central Research Institute for Food Crops (CRIFC), Jalan Merdeka 99, Bogor.

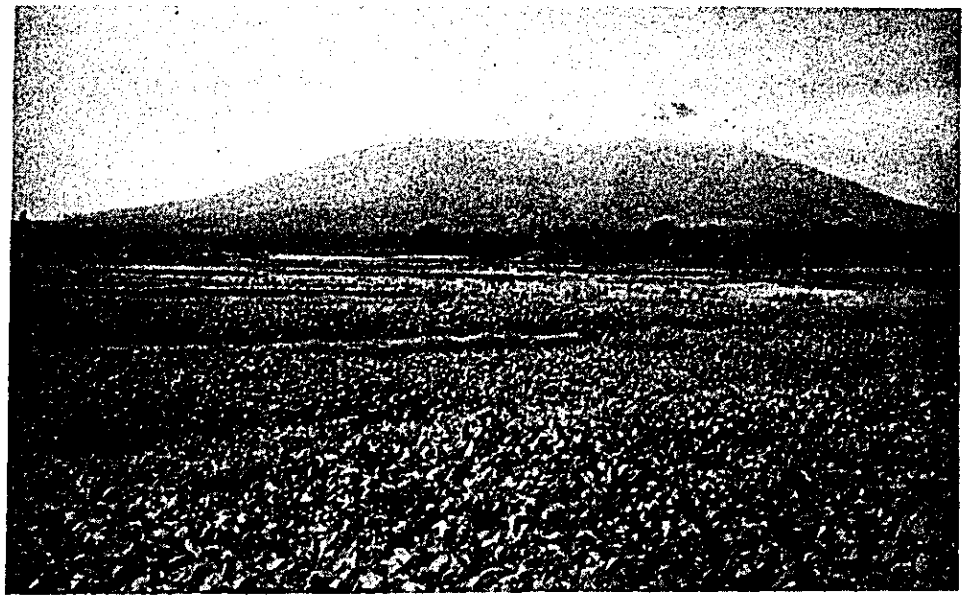

Figure 2. Experimental plots at Muara sub-station of BORIF. In the background is Mount Salak, a landmark of the Bogor area.

EXECUTING AGENCIES

Indonesia: CRIA (CRIFC) and BORIF

CRIA (the Central Research Institute for Agriculture, Bogor) initiated the implementation of the ATA-218 Program in 1978. CRIA's headquarters are located at Jalan Merdeka 99, Bogor, about 40 miles south of the Indonesian capital, Jakarta. CRIA then coordinated 5 Research Institutes strategically located in major food-producing areas in Sumatra, Java, Kalimantan, and Sulawesi.

Almost all of the recommended food crop production technologies in Indonesia have been extended from research conducted by the CRIA system. The research institutes conduct experiments leading to recommendations for food crop production practices which are later adopted by the agricultural extension services. The institutes also serve as a clearing house for new technology to be extended to farmers in their respective regions.

In April 1981 CRIA was reorganized to become CRIFC (Central Research Institute for Food Crops). This office coordinates the 6 research institutes, including that located at Bogor, now known as BORIF (Bogor Research Institute for Food Crops).

Since 1981, the executing agency for the program has been CRIFC, through its Director. The implementing agency was BORIF, which has integrated all ATA-218 activities in its research program. Figure 3 shows the present organizational structure of CRIFC.

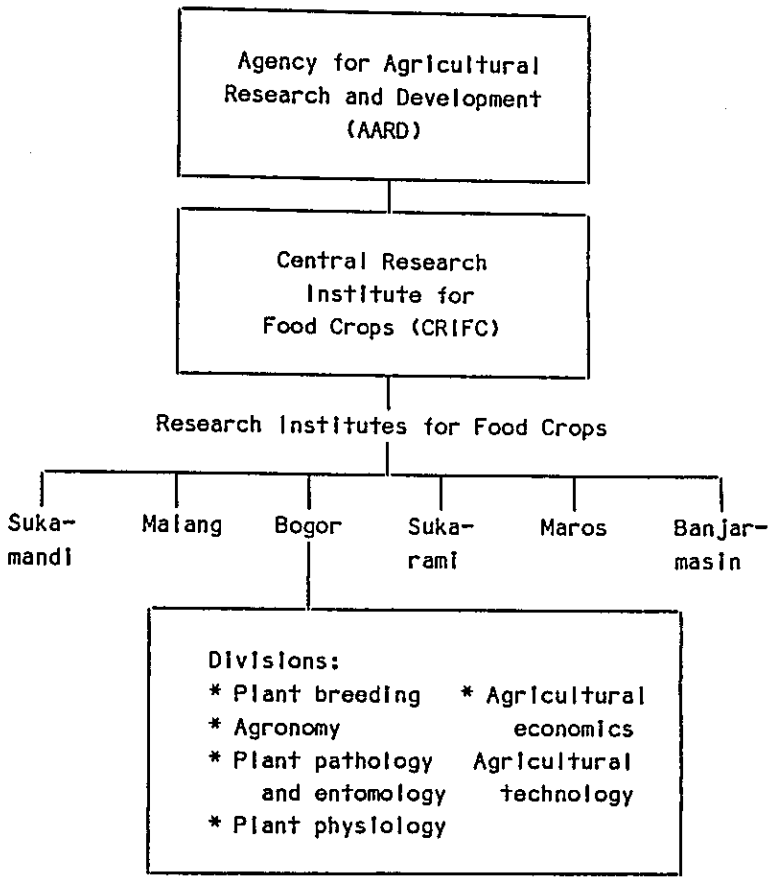

Figure 3. Organization of CRIFC, the executing agency of ATA-218.

Japan: Japan International Cooperation Agency (JICA)

With a view to promoting international cooperation for the social and economic development of the developing world, the Government of Japan established the Japan International Cooperation Agency (JICA) in August 1974 under the Japan International Cooperation Agency Law. JICA was formed by merging the then Overseas Technical Cooperation Agency (responsible for carrying out government-based technical cooperation) and the Japan Emigration Service (responsible for assisting emigration from Japan), and by taking over part of the functions of the Overseas Trade Development Association.

JICA is the sole government agency of Japan whose main function is to extend technical cooperation to developing countries based upon agreements with those countries. Such technical cooperation is designed to help developing countries in their economic and social development. For this purpose JICA undertakes the following activities :

1. JICA invites people from developing countries for technical training in Japan
2. It dispatches Japanese experts and Japan Overseas Cooperation Volunteers (JOVC) members
3. It dispatches survey teams to help in formulating development plans and projects
4. It recruits and trains Japanese experts for overseas postings
5. It supplies necessary equipment for technical cooperation
6. It undertakes implementation of grant aid assistance
7. It finances those projects of Japanese origin that are expected to contribute to the socio-economic development of developing countries.

Combining into a development project the "acceptance of trainees", the "dispatch of experts", and the "grant of equipment", JICA extends integrated cooperation (known as project-type technical cooperation). JICA also extends capital grant assistance to developing countries for building schools, hospitals and other facilities related to technical cooperation. Under certain conditions, JICA provides financial assistance to Japanese private enterprises to help them in their development cooperation. For Japanese people wishing to emigrate, JICA serve as an information center, and for those who have already emigrated, JICA extends assistance.

The Strengthening of Legumes in Relation to Cropping Systems Research Project (ATA-218) is a project-type technical cooperation. JICA has been continuing this project-type cooperation in Bogor since 1970. By the end of 1985, two Project Agreements had been completed, namely:

1970 - 1978: Japan-Indonesia Joint Food Crops Research Project, at CRIA, Bogor.

1978 - 1985: Strengthening of Legumes in Relation to Cropping Systems Research Project (ATA-218), at CRIFC/BORIF, Bogor.

Figure 4 shows the process followed in project-type technical cooperation by JICA and in agreement in the Government of Indonesia.

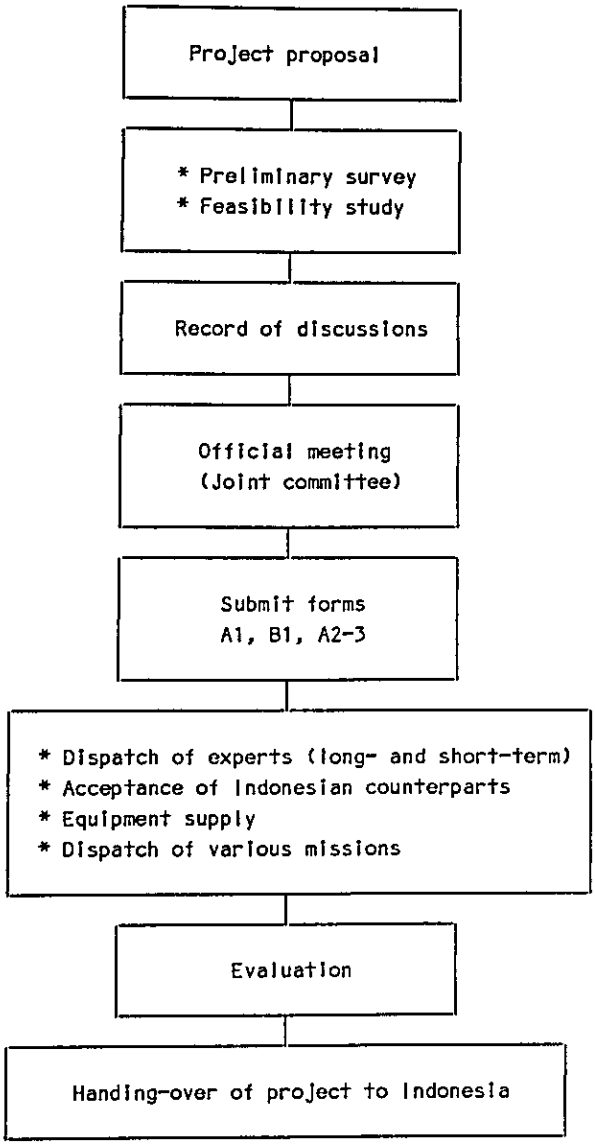

Figure 4. Process of project-type technical cooperation between Japan and Indonesia.

PROGRAM ACTIVITIES

Research programs

Research programs were implemented in accordance with the Master Plan in the Record of Discussions. The Master Plan states that research on the component technologies of cropping systems should be done using an interdisciplinary approach on the following themes :

1. Breeding techniques for legumes and other non-rice food crops

   The relatively low yield of legumes, especially soybean, is partly due to the need for better varieties. These should have higher yields than the present improved varieties. One important character to be considered in developing better soybean varieties is tolerance to pests and diseases, low acidity, and aluminium toxicity.

2. Cultural practices in legumes and other non-rice food crops

   The relatively low yields of legumes have been attributed to traditional cultural practices. In this connection, more agronomic and soil research is needed to provide new information on improved practices.

3. Water management

   Research on water management is required to obtain higher yields. The research will cover plant-soil-water relationships, water requirements, and water management for the efficient use of the water supply.

4. Methods of fertilizer appliction, conservation and improvement of soil productivity

   Lower crop yields are caused by various factors. They could be due to improper use of fertilizer and the lack of knowledge in preservation and improvement of soil productivity, including the proper use of organic matter and erosion control. In this connection, more intensive study is needed to provide new information on improved practices.

5. Weed control

   Weeds are a problem in legume cropping. Study on weed management is required, particularly on the existence and importance of weeds in legume production in relation to cropping systems research.

6. Plant physiology

The increasing demand for food calls for higher yields of legumes and other food crops. The increasing use of fertilizers requires a better understanding of the nutritional requirement of crops. Unbalanced and improper use of fertilizers could cause various physiological disorders, especially in soils with relatively low productivity. The limited area of fertile land for cropping expansion requires the exploration of less fertile, marginal land. Research on soil microbiology, particularly on Rhizobium for legumes, needs more intensive study. The proper management of Rhizobium for legumes would save inorganic fertilizers, especially nitrogen in areas where legumes cannot at present be grown economically. It could also open opportunities for significant expansion of the legume area in Indonesia.

7. Plant protection

Intensive pest management is one requirement for producing better crop yields, especially of legumes. Improper use of insecticides may cause various hazards: inefficient use of agricultural inputs, unnecessary pollution which endangers human and animal health, the development of new resistant biotypes, and the disruption of the natural biological balance. A better knowledge of insects and other pests such as rats, and of proper pest management practices, is required.

Significant food production losses in Indonesia are caused by outbreaks of legume diseases. A better understanding of the disease agents (viruses, fungi or bacteria), as well as of better practices for disease management, is urgently needed.

For the extension period of the program (1984 and 1985), research on water management, fertilizer and soil conservation and improvement, and weed control (items 3, 4 and 5 above) were omitted in the Master Plan due to limitations in staff and time.

Research subjects for each year were formulated in the Master Plan and in Annual Operation Work Plans which were discussed at the Joint Committee Meeting. Research topics investigated during the cooperation period are shown in Table 1.

Although there were some changes in the research subject in accordance with the Japanese experts on duty at the time, and due to amendments to the Master Plan, the research consistently aimed to solve important problems in Indonesian agriculture, in line with the purpose of the project.

Details of the research activities are reported in the next chapter.

Table 1. Research subjects during the cooperation period, 1978 to 1985

1978 - 1980	1981 - 1983	1984 - 1985
Plant breeding techniques on legumes and other upland crops		
(1) Plant breeding techniques of soybean	(1) Plant breeding techniques of soybean and other upland crops	(1) Plant breeding techniques of soybean and other upland crops 1. Plant breeding techniques for varieties adaptable to environmental conditions
Cultivation practices of legumes and other upland crops		
(1) Cultivation practices of soybean	(1) Cultivation practices of soybean 1. Crop production and increase of productivity in soybean	(1) Cultivation practices of soybean 1. Enhancement of soybean productivity based on growth habit and yield component factors
(2) Cultivation practices of other upland crops	(2) Cultivation practices of tuberous root crops 1. Crop production of sweet potato and cassava	2. Liming techniques for soybean production on acid soil
Irrigation water control		
(1) Effective use of irrigation water	(1) Effective use of irrigation water 1. Effects of surface drainage in ripening stage on rice yield	
Application practices of fertilizer conservation and improvement of soil fertility		
(1) Application practices of fertilizer on lowland rice in cropping systems	(1) Application practices of fertilizer on lowland rice after soybean cultivation 1. Investigation of locality	

Table 1. Research subjects (continued)

1978 - 1980	1981 - 1983	1984 - 1985
Weed control		
(1) Weed control in upland fields		
Plant physiology		
(1) Increase of protein yield of soybean	(1) Increase of protein yield of soybean	(1) Chemical composition of soybean seed in relation to its viability
1. Effects of nitrogen on the growth, yield and nutrient uptake of soybean	1. Improvement of fertilizer application	(2) Physiological disorders of soybean
2. Varietal differences in plant growth and nutrient uptake of soybean	2. Relationship between nutritive value and cultivation practices	1. Diagnosis of soil and plant nutrition for soybean
3. Estimation of nitrogen fixation by root nodules	3. Increase of seed viability	2. Imbalance of basic elements in soybean
4. Studies on the germination of soybean	(2) Physiological disorders of upland crops	3. Survey of physiological disorders of soybean
(2) Behavior of nitrogen in the soil	1. Physiological disorder types and distribution	4. Micro-nutrients in soybean
	2. Moisture deficiency in upland crops	
	3. Cadmium analysis	
Plant protection (Pathology)		
(1) Survey of disease occurrence in upland crops	(1) Studies on the bionomics and control of legume diseases	(1) Bionomics and control of main diseases affecting production of grain legumes
(2) Diseases of soybean	1. Relation between cultural practices and disease occurrence in soybean	1. Studies of fungal diseases in soybean
(3) Rhizoctonia disease of several crops	2. Varietal test of rust disease occurrence in soybean	2. Studies on viral diseases in soybean
(4) Causal agents of cassava bacterial wilt		

Table 1. Research subjects (continued)

1978 - 1980	1981 - 1983	1984 - 1985
Plant Protection (Pathology) [continued]		
(5) Distribution of physiological races of Pyricularia oryzae	(2) Confirmation and control of seed infective fungal and bacterial diseases	3. Studies on main diseases in other crops
	(3) Scab diseases and Cercospora leaf spot of mungbean	
	(4) Ecology of nematodes	
Plant protection (Entomology)		
(1) Studies on the bionomics and control of main insect pests	(1) Studies on the bionomics and control of main insect pests	(1) Bionomics and control of main insect pests affecting production of grain legumes
1. Classification and identification of stem- and podborers and seed pests	1. Identification of podborers	1. Studies on podborers on soybean
2. Evaluation and identification of key insect pests	2. Seasonal fluctuation and biology of two species of podborers	2. Studies on natural enemies of the main insect pests in soybean
3. Seasonal prevalence, damage and control of beanfly as pests of soybean	3. Control methods of podborers	3. Studies on whitefly on soybean
4. Chemical control of key pests	(2) Investigation of pest problems in high-yielding areas of soybean in Java	
5. Developing artificial diets and mass rearing of insects	(3) Utilization of pheromone trap for forecasting occurrence of Spodoptera litura in soybean areas	
6. Control of lepidopterous pests by utilization of microorganisms	(4) Aphid fauna on leguminous crops	
(2) Studies on the ricefield rat		

Dispatch of Japanese Experts

Japanese experts were dispatched on the basis of the Annex II of the Record of Discussions. It is prescribed in this Annex that the following long-term experts be dispatched :

For the period 1978-1983

1. Team leader

2. Researchers covering the following fields:
   (1) Upland/secondary crops cultivation
   (2) Rice agronomy/cultivation
   (3) Plant physiology
   (4) Plant pathology
   (5) Entomology

3. Coordinator/liaison officer

For the extension period 1984-1985

Researchers covering the following fields:
1. Upland crops cultivation
2. Upland crops agronomy
3. Plant physiology
4. Plant pathology
5. Entomology

This plan was implemented in full, and 19 long-term Japanese experts were posted in Bogor throughout the cooperation period. Cooperative research and other activities stated in the Master Plan were conducted through the collaboration of these experts and their Indonesian counterparts.

Short-term experts were posted for research as well as other activities e.g. for guidance in degree study, setting up of facilities and equipment, and repair and maintenance of equipment.

During the cooperation period the folowing short-term experts were dispatched :

For research activities	21
For guidance in degree study	3
For setting up facilities or equipment	8
For repair or maintenance of equipment	8
Total	40

The names of these experts are listed in Table 2, and their periods of work are shown diagramatically in Appendix III.

Table 2. Dispatch of Japanese Experts (Researchers)

No.	Name	Major Field	Period
1.	Kanenori NAKAYAMA*	Upland crops cultivation	15 Feb.1979-14 May 1981
2.	Norimitsu ISHIKURA*	Rice cultivation	15 Feb.1979-14 Feb.1981
3.	Shigetada MATSUMI*	Team leader	22 Feb. - 30 Nov.1979
4.	Takeo YAMAGUCHI*	Plant pathology	22 Feb.1979-21 Aug.1981
5.	Takao FUJIMOTO*	Plant physiology	28 Mar.1979-27 Mar.1981
6.	Muneo OKADA*	Entomology	28 Mar.1979-27 Mar.1981
7.	Mikio HABU	Coordinator	14 Mar.1979-13 May 1981
8.	Koushi NISHIYAMA	Plant pathology	7 Feb.1980-26 May 1981
9.	Hiroshi FUJII	Guidance in degree study	9 - 15 Mar 1980
10.	Isamu BABA	Guidance in degree study	6 - 15 Mar.1980
11.	Setsuro TODA*	Team leader	1 Apr.1980-22 Oct.1983
12.	Hideo TAKAGI*	Upland crops cultivation	18 Jul. - 15 Aug.1980
13.	Masato KUWAHARA	Plant physiology	4 Oct. - 28 Nov.1980
14.	Satoshi SHIRAISHI	Tropical rats	8 Dec.1980- 7 Mar.1981
15.	Reiichi YOSHINO	Plant pathology	25 Feb. - 23 May 1981
16.	Hiromi KOBAYASHI*	Rice cultivation	4 Mar.1981- 3 Mar.1983
17.	Makoto NAKASHIMADA*	Plant physiology	8 Apr.1981-22 Oct.1983
18.	Yoshimune NIHEY*	Coordinator	1 May 1981-22 Oct.1983
19.	Yoshio HOZYO*	Upland crops cultivation	24 Jun.1981-23 Jun.1983
20.	Atsushi NAITO*	Entomology	3 Jul.1981-22 Oct.1983
21.	Nobuyoshi NARISAWA*	Plant pathology	22 Jul.1981-22 Jan.1984

22.	Jiro HARADA	Weed control	6 Mar. - 14 May 1982
23.	Masahisa MIYAZAKI	Entomology	19 Mar. - 30 May 1982
24.	Tsutomu NISHIZAWA	Nematology	7 Apr. - 6 Jun.1982
25.	Kouchi YUITA	Plant physiology	20 Oct. - 20 Dec.1982
26.	Miyoshi IMANISHI	Plant physiology	1 Dec.1982-28 Feb.1983
27.	Shigeki NAKAMURA	Plant breeding	12 Jan. - 11 Apr.1983
28.	Toshihiro KAJIWARA	Guidance in degree study	28 Feb. - 9 Mar.1983
29.	Yoichi IZUMIYAMA	Upland crops cultivation	5 Jul. - 4 Oct.1983
30.	Saneyuki OKUDA*	Upland crops agronomy & Coordinator	17 Oct.1983-31 Mar.1987
31.	Fumio YAZAWA*	Plant physiology	21 Oct.1983-22 Oct.1985
32.	Yoichi IZUMIYAMA*	Upland crops cultivation & Team leader	9 Nov.1983- 8 Nov.1985
33.	Kenpei HONMA*	Entomology	20 Jan.1984-20 Jan.1986
34.	Kazuo MATSUMOTO*	Plant pathology	16 Mar.1984-22 Oct.1985
35.	Norio IIZUKA	Plant pathology	22 Aug. - 21 Oct.1984
36.	Junji ISHIZUKA	Plant physiology	10 Sep. - 9 Nov.1984
37.	Haruo MIKOSHIBA	Plant breeding & Agronomy	3 Oct. - 25 Dec.1984
38.	Kenzuo YAMAGISHI	Entomology	15 Feb. - 30 Apr.1985
39.	Haruo MIKOSHIBA	Agronomy	28 Feb. - 27 Apr.1985
40.	Soichiro AKAO	Plant physiology	21 Aug. - 18 Sep.1985
41.	Akira TANAKA	Agronomy	3 Sep. - 23 Sep.1985
42.	Keiichi NAKAZAWA	Entomology	5 Sep. - 22 Oct.1985
43.	Tadaoki INABA	Plant pathology	5 Sep. - 9 Oct.1985

Note: * Long-term expert

Table 2 (continued). Dispatch of Japanese Experts (Engineers)

No.	Name	Major Field	Period
1.	Masaru MAEJIMA	Equipment repair	11-25 Feb.1980
2.	Gunji SAKURAI	Greenhouse construction	27 Feb.-17 Mar.1980
3.	Seiji SOGAWA	" "	27 Feb.-17 Mar.1980
4.	Masateru MIZUNOE	Planning of irrigation facility	28 Apr.-27 Jun.1980
5.	Hideo MORI	" "	28 Apr.-27 Jun.1980
6.	S. KAWAKUBO	Repairing of agricultural machinery	23 Apr.- 5 May 1981
7.	Yonezo SAKATA	" "	23 Apr.- 7 Jun.1981
8.	Masaru MAEJIMA	Equipment repair	24 Apr.- 8 May 1982
9.	Yoshihiro MORI	Irrigation installation	6 Mar.- 3 Jun.1982
10.	Makoto MISHIKAWA	Greenhouse construction	20 Mar.-23 Apr.1982
11.	Kousaburo SAITO	" "	20 Mar.-23 Apr.1982
12.	Makoto NISHIKAWA	Greenhouse repair	21 Oct.-13 Nov.1982
13.	Kousaburo SAITO	" "	21 Oct.-13 Nov.1982
14.	Kazuo MURAKAMI	Installation of electron microscope	1-10 Sep.1983
15.	Masao MASAKI	Equipment repair	1-10 Sep.1983
16.	Masao MASAKI	" "	11-25 Jun.1984

Indonesian counterparts

This project aimed to strengthen the research capability of Indonesian researchers and technicians. Another objective was to promote the transfer of technical knowledge in various fields to Indonesian counterparts, particularly the junior staff/technicians.

Between 1979 and 1985 many Indonesian research staff have attended training in Japan in various fields of crop production. Some were trained in research management or communication techniques.

During the implementation of this project, two Indonesian counterparts have successfully obtained doctoral degrees in agriculture, one in agronomy (Dr. Ir. M. Sundaru), and one in plant pathology (Dr. Ir. Mukelar Amir). These were granted doctoral degrees by Tokyo University of Agriculture. Dr. Sundaru unfortunately passed away after an extended illness in 1984. A list of the Indonesian counterparts is presented in Table 3.

Study/training in Japan

Technical training and observation tours in Japan are important activities of the project. Article IV of the attached Record of Discussions states :

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive at its own expense the Indonesian personnel connected with the project for technical training or observation tours in Japan through the normal procedure under the Colomdo Plan Technical Cooperation Scheme.

2. The Government of the Republic of Indonesia will take necessary measures to ensure that the knowledge and experience acquired by the Indonesian personnel from technical training in Japan will be utilized effectively for the implementation of the Project.

The project study/training activities were carried out on the basis of the above Article of the Record of Discussions.

These study/training activities can be categorized into 3 types, namely observation tours, individual training, and group training. Observation tours were usually offered to administrative personnel to observe the research situation in Japan and to exchange views on technical cooperation between the two countries. Such tours usually lasted 2 or 3 weeks. Individual training was given to researchers to enhance their expertise in their respective fields. They were trained at government research institutes in Japan, and conducted research under the guidance of senior researchers in these institutes. This training normally lasted 6 months or more. Group training was given to researchers or technical workers to improve their skills in specific subjects. Two Indonesian researchers attended such courses under the Project.

The number of participants in these activities were :

Observation tours	6
Individual training	
Plant breeding	1
Agronomy	9
Plant physiology	8
Plant pathology	6
Entomology	7
Group training	
Agronomy	1
Plant physiology	1
Total	39

The names of these participants and their periods of study/training in Japan are listed in Table 4 and Appendix IV.

Two Indonesian researchers, Dr. Mas Sundaru and Dr. Mukelar Amir, obtained their doctoral degrees under the project. Dr. Mas Sundaru visited Japan for individual training for 3 months in 1979 and 6 months in 1980. During his visits he was granted a doctoral degree from Tokyo University of Agriculture for his research on weed control in rice fields in Indonesia. Dr. Mukelar was also received in Japan for individual training for 3 months in 1979 and one year in 1983-1984, and received a doctoral degree from Tokyo University of Agriculture for his research on scab disease of mungbean.

Equipment provision and facility construction

In accordance with Article III of the attached Record of Discussions, machinery, equipment and other materials necessary for the implementation of the project were provided by Japanese government through JICA.

In these days of highly advanced science, modern laboratory equipment and machinery are essential for agricultural research. This equipment and machinery provide researchers with effective tools for productive research work. The equipment and machinery provided through the project has had a great significance in promoting activity, not only of the project but also of BORIF and CRIFC as a whole.

Equipment was provided as the project research evolved to ensure that it was utilized effectively. The technology was transferred smoothly through the Japanese experts and Indonesian counterparts using this equipment in collaboration.

Short-term experts were brought from Japan to repair and maintain the equipment, as described in the preceding section. This was very useful to keep the equipment in good condition. Table 5 lists the equipment and machinery provided in each year of the cooperation.

Table 3. List of Principal Indonesian Counterparts

No.	Major Field	Name	Period
1.	Project leader	Dr. Rusli Hakim	1979 - 1983
		Dr. B.H. Siwi	1983 - 1984
2.	Plant physiology	Dr. M. Ismunadji	1979 - 1985
		Mrs. Sismiyati Roechan	1979 - 1985
		Dr. M. Fathan	1979 - 1984
		Mr. Iskandar Zulkarnaini	1979 - 1985
		Mrs. Ratna Fathan	1979 - 1985
3.	Plant pathology	Dr. D.M. Tantera	1979 - 1985
		Dr. Mukelar Amir	1979 - 1983
		Miss Masdiar Bustaman	1979 - 1982
		Dr. M. Sudjadi	1984 - 1985
		Mrs. Haeni Purwanti	1984 - 1985
4.	Entomology	Mr. Dandi Sukarna	1979 - 1985
		Mr. Agus Iqbal	1979 - 1985
		Mr. Harnoto	1979 - 1985
		Mr. M. Ariffin MS.	1979 - 1981
		Mr. Toto Djuwarso MS.	1984 - 1985
5.	Agronomy	Dr. M. Sundaru	1979 - 1982
		Mr. Soetjipto Ph.	1979 - 1985
		Mr. Djuber Pasaribu MSc.	1981 - 1985
		Mr. Sadikin Somaatmadja	1981 - 1985
6.	Administration	Mr. Soegiyanto	1979 - 1981
		Mr. Mahyuddin Syam	1979 - 1985
		Mr. Abdullah Pr.	1979 - 1985
		Dr. Sridodo	1981 - 1985

Table 4. Study and Training in Japan

Name	Period & Location	Subject	Present Position
1979/1980			
Mr. Widji Soekirno	1 May 1979-20 Dec.1979 National Institute of Agric.Sci., Hokkuriku Agric.Exp. Station	Plant nutrition of rice (Plant physiology)	Staff of Physiology Div. BORIF
Ir. Muhammad Herman	1 May 1979-31 Oct.1979 National Agricultural Experiment Station	Nematodes (Plant pathology)	Staff of Pests & Diseases Division BORIF
Ir. Djatnika Kilin	1 May 1979-31 Oct.1979 Kyushu National Agricultural Experiment Station	Analysis of pesticide residues (Entomology)	Staff of Pests & Diseases Division BORIF
Ir. Paransih Isbagyo	20 May 1979-10 Jun.1979 National Agricultural Experiment Station and other Research Institutes	Agriculture res. organization and its activities (Observation tour)	Head of Programming, AARD
Mr. Djam'an	20 May 1979-10 Jun.1979 National Agricultural Experiment Station and other Research Institutes	Agriculture res. organization and its activities (Observation tour)	Head of Sub-division of Finance, CRIFC
Dr. Mas Sundaru	27 Jun.1979-26 Sep.1979 1 Jun.1980-30 Nov.1980 Tokyo University of Agriculture	Weed control (Doctoral degree)	Died in 1984

Table 4. Study and Training in Japan (continued)

Name	Period & Location	Subject	Present Position
Dr. Mukelar Amir	10 Jun.1979- 9 Sep.1979 17 Mar.1983-16 Mar.1983 Tokyo University of Agriculture, National Institute of Agricultural Science	Studies on mungbean (Doctoral degree)	Staff of Pests & Diseases Division BORIF
Ir. Sutoro Hardjosutarno	13 Mar.1980-12 Sep.1980 Chugoku National Agricultural Experiment Station	Sorghum breeding (Agronomy)	Staff of Agronomy Division BORIF
1980/1981			
Ir. Sutarto Darmosaputro	8 Aug.1980- 7Nov.1980 Kyushu National Agricultural Experiment Station	Peanut cultivation (Agronomy)	Staff of Agronomy Division BORIF
Mr. Nanang Priatna	24 Apr.1980-23 Oct.1980 Kyushu National Agricultural Experiment Station	Chemical analysis (Plant physiology)	Staff of Physiology Div. BORIF
Dra. Masdiar Bustaman	1 May 1980-30 Oct.1980 National Institute of Agricultural Science, Tropical Agriculture Research Center	Java corn downy mildew (Plant pathology)	Staff of Pests & Diseases Division BORIF
Dr. Ir. M. Soehardjan	31 Jul.1980-20 Aug.1980 Kyoto	Attend the meeting of XVI International Congress of Entomology (Kyoto) (Observation tour)	Director of Central Res.Inst. for industrial Crops

Table 4. Study and Training in Japan (continued)

Name	Period & Location	Subject	Present Position
Mr. Bambang Suyeto	14 May 1980- 3 Jun.1980 National Institute of Agric. Sci. and other Research Institute	Agriculture res. organization and its activities (Observation tour)	Staff of Agronomy Division BORIF
1981/1982			
Mr. Tateng Sutarman BSc.	5 Jun.1981- 4 Dec.1981 Tohoku National Agric. Experiment Station (Kariwano)	Soybean breeding (Breeding)	Staff of Breeding Division BORIF
Ir. Ruchiat Damanhuri	5 Jun.1981- 4 Dec.1981 National Agricultural Experiment Station	Rice cultivation (Agronomy)	Staff of Agronomy Division BORIF
Ir. Agus Iqbal	5 Jun.1981- 4 Dec.1981 Upland Crops Research Center of National Agric.Exp. Station	Soybean pests (Entomology)	Staff of Pests & Diseases Division BORIF
Ir. Irwan Nasution	5 Aug.1981- 2 Feb.1982 Hokkaido National Agric.Exp. Station	Plant nutrition (Plant physiology)	Staff of Physiology Div. BORIF
Ir. Murtado	17 Mar.1982-14 Sep.1982 National Institute of Agricultural Science	Plant nutrition (Plant physiology)	Staff of Physiology Div. BORIF

Table 4. Study and Training in Japan (continued)

Name	Period & Location	Subject	Present Position
1982/1983			
Ir. Nasir Saleh	20 May 1982-19 Nov.1982 Institute for Plant Virus Research	Plant virus diseases (Plant pathology)	Staff of Pests & Diseases Division BORIF
Ir. Sutrisno	24 Jun.1982-23 Dec.1982 Kyushu National Agric. Experiment Station National Institute of Agricultural Sciences	Insecticide resistance (Entomology)	Staff of Pests & Diseases Division BORIF
Mr. Ayub Warma Gozali	7 Jul.1982-30 Jun.1983 Okinawa Pref. Agric. Experiment Station	Soil Improvement course: Group (Plant physiology)	Staff of Physiology Div. BORIF
Ir. Melina Megawati	30 Mar.1983-20 Sep.1983 National Agriculture Research Center	Sweet-potato cultivation (Agronomy)	Staff of Agronomy Division BORIF
Ir. Trip Alihamsyah	30 Mar.1983-20 Sep.1983 National Institute of Agricultural Sciences	Irrigation and agricultural machinery (Agronomy)	Staff of Agronomy Division BORIF
Ir. Harnoto	17 Mar.1983-20 Mar.1983 National Agriculture Research Center	Pest control (Entomology)	Staff of Pests & Diseases Division BORIF

Table 4. Study and Training in Japan (continued)

Name	Period & Location	Subject	Present Position
1983/1984			
Mr. Soegiyanto BSc.	1 Jun.1983-18 Jun.1983 National Agriculture Research Center and other Research Institute	Agriculture res. organization and its activities (Observation tour)	Secretary of CRIFC
Ir. Rochman	30 Jun.1983-27 Dec.1983 Kyushu University	Ecology and control of tropical rat (Entomology)	Staff of Pests & Diseases Division BORIF
Drs. Mohammad Djazuli	1 Feb.1984- 6 Sep.1984 Kyushu National Agric. Experiment Station Hokkaido National Agric.Exp. Station	Plant nutrition of tuber crops (Plant physiology)	Staff of Physiology Div. BORIF
Ir. Djumanto Hardjosudarmo	1 Mar.1984-11 Nov.1984 National Agriculture Research Center	Serological and electron microscopic studies of rice and legume viruses (Entomology)	Staff of Pests & Diseases Division BORIF
Ir. Achmad Cholliuddin	21 Feb.1984-26 Nov.1984 Hokkaido National Agric.Exp. Station	Study on mineral nutrition of the soybean plant (Plant physiology)	Staff of Physiology Div. BORIF

Table 4. Study and Training in Japan (continued)

Name	Period & Location	Subject	Present Position
1984/1985			
Ir. Ukup Sudriatna	30 May.1984-31 Aug.1984 National Agriculture Research Center Hokkaido National Agric.Exp. Station	Cropping systems research on upland crops (Agronomy)	Staff of Agronomy Division BORIF
Ir. Toto Djuwarso	20 Jun.1984-26 Dec.1984 National Agriculture Research Center	Eco-biology and legume insect pests (Entomology)	Staff of Pests & Diseases Division BORIF
Dra. Ratna Fathan	20 Jun.1984-11 Dec.1984 National Agriculture Research Center	Plant nutrition related with fertilizer application (Plant physiology)	Staff of Physiology Div. BORIF
Ir. Haeni Purwanti	28 Feb.1985-11 Sep.1985 National Agriculture Research Center	Seed-borne fungal diseases (Plant pathology)	Staff of Pests & Diseases Division BORIF
Ir. Ruchiat Damanhuri	7 Feb.1985-30 Nov.1985 Tsukuba International Agriculture Training	Rice cultivation Group training, Advanced Course (Agronomy)	Staff of Agronomy Division BORIF

Table 4. Study and Training in Japan (continued)

Name	Period & Location	Subject	Present Position
1985/1986			
Ir. Suprapto Sumadi	1 Jul.1985-20 Nov.1985 National Agriculture Research Center	Utilization of *Rhizobium* and soybean growth analysis (Agronomy)	Staff of *Agronomy* Division BORIF
Drs. Mono Rahardjo	1 Jul.1985-12 Feb.1986 Tohoku National Agric.Exp. Station	Mineral nutrition (Plant physiology)	Staff of Physiology Div. BORIF
Dr. B.H. Siwi	25 Aug.1985- 4 Sep.1985 JICA, National Agri. Res. Center and other Research Institutes for Agriculture	Agriculture res. organization and its activities (Observation tour)	Director of CRIFC

Table 5. Provision of equipment during the cooperation period

Year	Principal items of equipment provided	Total cost (1,000 Yen)
1978	Ultracentrifuge; Drying oven for grain; Automatic leaf-area meter; Materials for greenhouse; Station-wagon	7,106
1979	Biological microscope; Atomic absorption spectrophotometer; Auto-polometer; Micro-bus; Center-table	62,988
1980	Land-cruiser; Spectrophotometer; Aluminium frame for greenhouse; Materials for irri-gation facility; Biological microscope	91,523
1981	Automatic leaf-area meter; Clean bench; Land-cruiser; Automatic balance; Materials for greenhouse; Spectrophotometer	68,243
1982	Super-porometer; Prefabricated control room; Scanning electron microscope; Clean bench; Draft chamber; Flame photometer	44,625
1983	Draft chamber; Counter for fertility analyzer; Spare parts for automatic area meter; Deep freezer; System microscope	27,252
1984	Digital double-beam spectrophotometer; Soil sterilizer; Vacuum freezing dryer; Seed collecting thresher; Incubator; Ion meter	25,068
1985	Stereoscopic zoom microscope; Electronic balance; Drying oven; Soybean moisture tester; Chlorophyll meter; Water bath	17,920

Expenses

The program was financed by the Japanese government as grant aid to the Indonesian government.

The Japanese government has contributed the following :

1. The services of short- and long-term experts
2. Equipment
3. Study/technical training in Japan for counterparts
4. Project management

The Japanese government expenditures for implementing the ATA-218 project are given in Table 6.

The Indonesian government has contributed the following :

1. Indonesian counterpart staff
2. Office space and research facilities
3. Travel allowance and operational costs for research activities
4. Funds for the clearance of equipment imported by the project and for installation of the equipment
5. Assistance in government formalities required by the foreign scientists.

The Indonesian government budget for local costs, not including salaries, travel for Indonesian staff, and operational costs for research activities is presented in Table 7.

Table 6. Expenditure by the Japanese Government for the ATA-218 Project (1000 yen)

Item	1978 (Oct 78-Mar 79)	1979 (Apr 79-Mar 80)	1980 (Apr 80-Mar 81)	1981 (Apr 81-Mar 82)	1982 (Apr 82-Mar 83)	1983 (Apr 83-Mar 84)	1984 (Apr 84-Mar 85)	1985 (Apr 85-Mar 86) (est.)
1 Expert services	20,856	60,933	55,206	86,438	61,191	81,529	50,451	31,950
-Travel	11,102	6,479	12,317	17,622	9,575	13,917	9,860	5,500
-Salary, residence allowance, etc.	9,754	54,454	42,889	68,816	51,616	67,612	40,591	26,450
2 Equipment	7,106	62,988	91,523	68,243	44,625	27,257	25,068	17,920
-Purchase	)	)	)	54,052	39,768	)	)	)
-Shipping	) 5,034	) 61,424	) 84,008	7,441	) 4,075	) 24,537	) 21,624	) 17,000
-Local purchase	)	)	)	5,000	)	)	)	)
-Carried equipment	2,072	1,564	7,515	1,750	782	2,720	3,444	920
3 Project management	5,746	11,199	13,189	10,221	13,834	14,651	12,051	11,600
-Missions	2,471	2,755	2,068	1,981	2,959	4,923	2,167	3,000
-Implementation planning	159	108	625	555	0	666	1,555	3,000
-Local operation	3,116	8,336	9,785	8,161	10,875	9,062	8,329	5,600
-Others	0	0	711	24	0	0	0	0
4 Indonesian study/training in Japan	0	4,806	3,762	2,753	13,200	14,133	10,792	6,116
5 Emergency expenses	1,860	0	0	0	0	0	0	0
Total	35,568	139,928	163,680	168,155	132,850	137,570	98,362	67,586

Table 7. Supporting budget for ATA-218 from the Indonesian Government, 1978 to 1985

Fiscal Year	Budget (Rp 1000)
1978/79	11,500
1979/80	29,500
1980/81	27,000
1981/82	59,000
1982/83	12,750
1983/84	10,000
1984/85	24,000
TOTAL	173,750

RESEARCH ACTIVITIES

Research is a continuous process of designing and running experiments, collecting and interpreting data, and writing the results and conclusions of the findings in publications. The objective of Indonesia's legume research was to improve the existing legume production technologies in Indonesia by new and improved techniques. These technologies are extended as new recommendations to the farmers through a chain involving people from many offices in the Ministry of Agriculture.

In the Indonesian system of agricultural research and development, researchers cooperate with the Directorate-General of Food Crops, which coordinates provincial agricultural extension officers to develop and extend better farming technologies. Many demonstration plots are spread all over the country to test new technologues under field conditions. If a technology does not work as it was intended, then the research process has to re-started from the beginning to find out where it has failed. If it is successful, on the other hand, farmers are invited to use it to improve their crop production.

In the following chapter, research results from the project are presented briefly in an abstract form. They are arranged according to discipline, i.e., agronomy, physiology, plant pathology and entomology. Many of the reports have already been published in scientific journals.

As part of the dissemination of research results, Indonesian and Japanese researchers attended national, regional and international scientific meetings. Such seminars and simposia have allowed the exchange of ideas and information between researchers, and have produced new contacts between researchers from different countries.

I. Agronomy

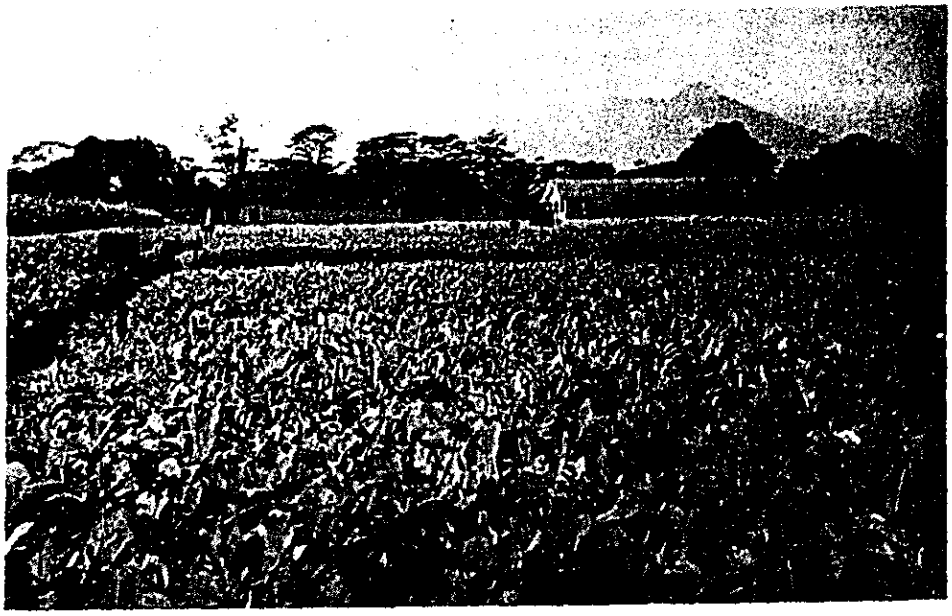

Figure 5. Experiments on legume crops at Cikeumeuh experiment farm by the Agronomy Department of BORIF.

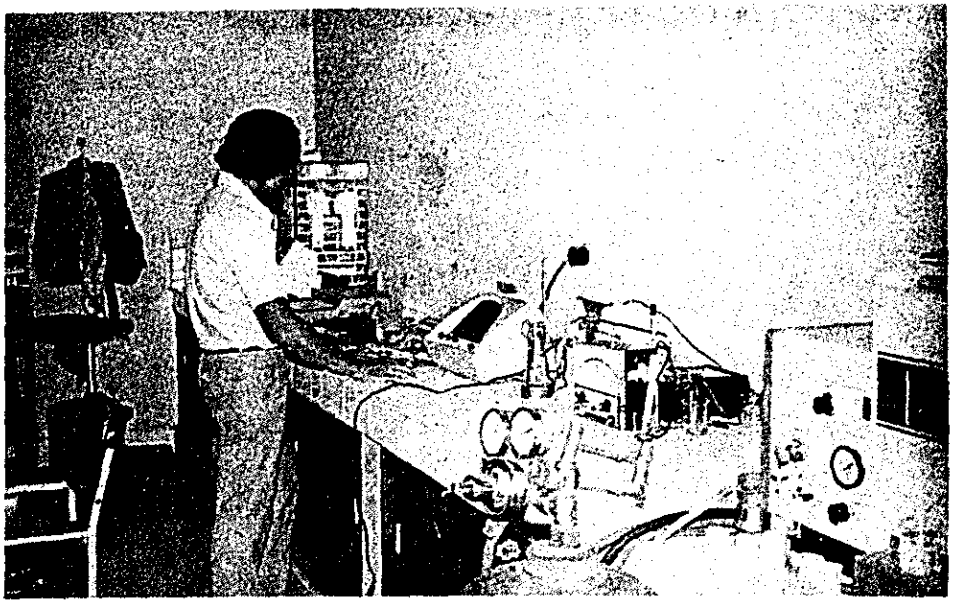

Figure 6. An Indonesian researcher engaged in an experiment at the Fertilizer Efficiency Laboratory of the Agronomy Department, BORIF.

I. 1. Effect of sowing dates on rice seedling characters

S. Partohardjono, Hendrik V., L. Sukarno and N. Ishikura

* Contributions, Central Research Institute for Agriculture, Bogor, no.62, p.1-11, 1980
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.55-60 (English with Japanese summary)
* Seminar, Bogor, February 1981

The effect of sowing dates on rice seedling characters was examined, avoiding the effect of mutual shading. Four hundred grains per m2 of IR 36 rice variety were sown at weekly intervals from September 1979 until September 1980. Leaf age, tiller number, leaf area, and total weight of 19-day-old seedlings showed lower values in the rainy season than in the dry season. Plant height was not related to season. The total dry weight of seedlings was controlled by the net assimilation rate (NAR), which was affected by the amount of solar radiation.

I. 2. Effect of nitrogen application on yield and yield components of lowland rice following soybean

S. Partohardjono, Hendrik V., L. Sukarno and N. Ishikura

* Contributions, Central Research Institute for Food Crops, Bogor, no.65, p.12-24, 1981
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.49-54 (English with Japanese summary)

Grain yields and yield components of rice grown after soybean as affected by different levels of nitrogen (0, 60, 120 and 180 kg N/ha) were studied at Muara experiment farm using IR 36 rice variety. A previous soybean cropping increased the percentage of perfectly ripened grains and gave approximately a 7 % yield increase compared with no soybean cropping. Increasing nitrogen applications resulted in higher yields up to a maximum of 8.5 t dry grain/ha. Higher nitrogen application and previous soybean cropping increased the number of spikelets per unit area, which in turn resulted in higher yields. The percentage of ripened grains and 1000-grain weight did not always affect yields. Higher rice yields with higher nitrogen application in plots which were previously cropped with soybean were due to the greater leaf area index (LAI) and net assimilation rate (NAR) during the ripening stage.

I. 3. Effect of transplanting time on yield and yield components of lowland rice

S. Partohardjono, Hendrik V., and N. Ishikura

* Contributions, Central Research Institute for Food Crops, Bogor, no.66, p.13-20, 1981
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.61-65 (English with Japanese summary)
* Seminar, Bogor, February 1981

Rice yield components as affected by cropping season were studied in field experiments. IR 36 rice variety was transplanted every month between August 1979 and July 1980. Lower grain yields were obtained from October, November and December transplantings. The number of spikelets per unit area and the 1000-grain weight did not significantly affect yields. Yields were affected by ripened grain percentage and grain sterility. The ripened grain percentage was controlled by dry matter production, which was affected by solar radiation and net assimilation rate during the ripening period.

I. 4. Status of agriculture and soybean cultivation in Java

K. Nakayama

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.1-18 (Japanese)

This paper summarizes the current status of agriculture and soybean cultivation methods in Java. It describes the importance of Java in Indonesia's agriculture, the prevailing climates and soils, and the main crops grown. It gives details of the main cropping systems involving soybean in Java, and provides small-scale maps of agroclimate, relief, soil types, rice cropping frequency, the distribution of industrial/estates crops and vegetables, cultivation types, and the distribution of soybean cultivation and varietal types.

I. 5. Studies on drainage during the ripening of lowland rice

Sutjipto Partohardjono, Hendrik V., and N. Ishikura

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.45-47 (English with Japanese summary)

For cropping patterns which combine lowland rice with upland crops, surface drainage during the rice grain-filling period affects the ripening of the rice grains and the sowing time of succeeding crops. This paper describes an experiment designed to examine the effect of time of drainage during the grain-filling period on yield components of rice. Plots of Semeru variety rice were drained at heading time, or at one, two

or three weeks later, or were flooded continuously. Yield and yield components were not significantly affected by drainage treatment. This may be because there was much rainfall (292 mm) and many rainy days during the ripening period.

I. 6. Effect of 2,4-D on the growth on indica and japonica rice varieties in different temperature conditions

Mas Sundaru and K. Nakayama

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.75-84 (English with Japanese summary)

A field experiment was conducted in the 1979/1980 wet season in Bogor to study the growth response of 3 indica and 2 japonica rice varieties to 2,4-D application. Three locations were used, namely Pacet, Muara and Pusakanegara experiment farms, with respectively low, medium and high temperature conditions. Levels of 2,4-D applied were 0, 0.4 and 0.8 kg a.i./ha. Significant inhibition of tiller formation was observed for the indica IR 36 at 2 and 4 weeks after 2,4-D application in all locations. For 0.4 kg a.i./ha it appeared mostly at 2 weeks after application, while for 0.8 kg a.i./ha it was observed at 4 weeks. Retardation of plant growth at 2 weeks and 4 weeks after 2,4-D application was remarkable for both indica and japonica varieties at Muara, while at Pacet it was shown by the indica Gebang and the japonica Hawara Batu. Plant growth inhibition occurred at the same dosage and same time of observation as for tiller formation.

Wider angles between tthe outmost stems of the rice plants were observed only at Pacet in the indica varieties. Tubular leaves, one of the hyperplastic symptoms of 2,4-D response, were shown by the japonica varieties at Pacet, and less at Muara. Yellowing of upper leaves caused by 2,4-D was observed only at Pacet on the indica varieties. A trend of decreasing grain yield caused by 2,4-D was shown by the indica varieties at Pacet, while at the other two locations no significant difference in yield was recorded.

I. 7. Cultivation method of soybean planted after lowland rice

K. Nakayama, S. Sumadi, S. Abdurachman, Adisarwanto and M. Okada

* Contributions, Central Research Institute for Food Crops, Bogor, no.70, p.1-21, 1983
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.19-30 (English with Japanese summary)
* Seminar at CRIFC, Bogor, May 1981

These four experiments compared traditional and intensive methods of soybean cultivation planted after lowland rice. The experiments were conducted in the dry seasons of 1979 and 1980 at Muara and Mojosari. There was a yield difference between tillage and no tillage treatment.

Broadcast seeding was inferior to dibbled seeding with regular spacing in the ratio of number of plants harvested to number of seeds. Insect damage caused by Ophyomiya phaseoli and soil water shortage were limiting factors for increasing yield. Fertilization and insecticide application to control pod insects increased yields remarkably.

I. 8. Effect of tillage, fertilization and irrigation on weed occurrence in soybean

K. Nakayama, A. Sudiman and Adisarwanto

* Penelitian Pertanian 4(1), p.40-43, 1984 (English with Indonesian abstract)
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.67-73
  "Influence of tillage, fertilization and irrigation on the occurrence of weeds in soybean field after lowland rice"
  (English with Japanese summary)
* Seminar at CRIFC, Bogor, May 1980

Influence of tillage, fertilization and irrigation on the occurrence of weeds was investigated in a soybean field planted after lowland rice at Mojosari experiment farm, East Java. The quantity of weeds increased with tillage, fertilizer application or irrigation. The quantity of weeds in fertilized, tilled soil was more than three times that in untilled soil without fertilizer. The tilled soil with irrigation produced about twice the quantity of weeds of the untilled soil without irrigation. The weed community changed from a mixed community to dominance by gramineous weeds with application of tillage or fertilization.

I. 9. Achievements in soybean breeding

S. Nakamura and Y. Hozyo

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.31-39 (Japanese with English summary)

9-1. Standard of soybean survey

S. Nakamura, S. Somaatmadja and Y. Hozyo

* Japan-Indonesia Joint Research Project ATA-218, April 1983, 55 p. (English and Indonesian)

Basic problems in soybean breeding are expanding. the amount of variation in breeding populations, and selecting and fixing desirable characters. We can estimate these characters by surveys of lines and varieties. The methods used in such surveys must be standardized to allow results to be compared over different times and locations. This list of survey standards is written in both English and Indonesian, and is based on the Japanese standards. It lists 3 groups of characters for

survey: (1) growth characters (34 items); (2) yield components (34 items); and (3) seeds, pods and others (60 items). Surveying methods and procedures, measuring units and time are given for each character.

9-2. Simple selection for Al-tolerance in soybean based on seedling root growth in Al-solution

Six soybean cultivars with known degrees of Al-tolerance were used to evaluate the accurancy of a simple screening method for Al-tolerance. Al-tolerant cultivars had high RRL (relative root length), while Al-sensitive cultivars had low RRL. An obvious differences between Al-tolerant cultivars and Al-sensitive ones was recognized at 0.4 mM solution. By using this method, the relative degrees of Al-tolerance of 80 cultivars were determined. Several cultivars, namely Merapi and Kedelai Kucir, were recognized to have high Al-tolerance.

9-3. Variety test for breeding of high yielding soybean

S. Nakamura, S. Somaatmadja and Y. Hozyo

* Seminar at BORIF, Bogor, April 1983

In soybean breeding, it is very important for researchers to understand the varietal difference of ecological and morphological characters in cultivars. We therefore introduced 47 registered or commercial cultivars from Japan and grew them together with 3 Indonesian local cultivars. We advised Indonesian soybean breeders in selection methods for characters of crossing materials for breeding high yielding soybean. We also guided them in the methods of surveying characters by using the standards of survey which we had prepared. The breeders could recognize the different in ecological and morphological characters of soybean cultivars, use the standard survey method, and developed their understanding of soybean breeding.

I.10. Growth of soybean as affected by plant density

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* Penelitian Pertanian 4(2); p.83-86, 1984 (English with Indonesian abstract)
H. Takagi and S. Sumadi

* Research Report of Japan-Indonesia Joint Agricultural Researcch Project, JICA, 1982, p.39-43
"Analysis of the growth of soybean as affected by plant population density"
(English with Japanese summary)
H. Takagi, S. Sumadi and K. Nakayama

The effect of plant density on the growth of soybean was investigated at Muara experiment farm, Bogor, in the 1980 dry season. Orba variety was planted with 45 cm row spacing and 25, 20, 15 and 10 cm spacing in the row. It was found that plant dry-matter production increased up to the leaf-fall stage (72 days after seeding), and then

consistently decreased until harvest. The efficiency of leaf dry-matter production increased with plant density. Leaf weight increased rapidly from the early growth stage through maximum growth. Maximum growth was reached at the reproductive stage (at the mid-podfill period). The relative growth rate was highest during early growth, and decreased in the following stages. The leaf area index showed a linear increase until 62 days after seeding.

I.11. Productive characters of sweet potato (Ipomoea batatas Lam)

Y. Hozyo, M. Megawati and Wargiono Hadi

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.41-53 (Japanese with English summary)
* Seminar at CRIFC, Bogor, June 1983

The plant production process and potential productivity of sweet potato were investigated during the 1981 and 1982 growing seasons at Cikeumeuh experiment farm. Parameters of plant production associated with dry-matter production and tuberous root growth were measured. High crop growth rates and net assimilation rates preceded active tuberous root thickening. Leaf area index and crop growth rate had lower values in the dry season than in the wet season, and these values were also lower than in temperate climates. Daya and Borobudur varieties showed high potential productivity of tuberous roots, because of the large number of tuberous roots per plant or greater weight per tuberous root. It is suggested that sweet potato varieties may be classified as tuberous-root-weight type, tuberous-root-number type, and regrowth type, based on their tuberous-root growth and development properties.

I.12. Productive characters of soybean (Glycine max Merr.)

Y. Hozyo and Djuber Pasaribu

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.54-67 (Japanese with English summary)
* Seminar at CRIFC, Bogor, June 1983

Soybean plant production processes and grain ripening were investigated duting the 1981 wet and 1982 dry seasons at Cikeumeuh experiment farm. Dry matter production, leaf growth, and seed formation were investigated. The highest specific leaf area was attained and the dry weight of the leaf blade increased rapidly, when the leaf reached 70 % of its maximum size. Crop growth rates increased rapidly from the early growth stage to ripening. The maximum net assimilation rate was 55 g/m2/week. The length and width of pod increased quickly at the early ripening stage, and was associated with increased pod dry weight. Seed-filling started when pod growth was nearly completed, and seed dry weight rose steeply as the pod yellowed. Seed moisture decreased after the seed dry weight reached its maximum value.

A second set of experiments aimed to elucidate the relationships between planting density, plant growth and yield of soybean. Planting density affected plant height, branching, node number, internode length, pod setting, leaf area, and dynamic properties of the stem. These plant characters were superior at sparser spacings, but dense planting gave higher grain yields per unit area. It is suggested that a practical population level is below 250 000 plants/ha with careful control of nutrition levels at each growth stage.

I.13. Effect of soil moisture during the ripening period of lowland rice

H. Kobayashi, S. Partohardjono and E. Kosman

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.80-86 (Japanese with English summary)

Draining the field during the ripening stage of lowland rice may be necessary to facilitate the growth of subsequent upland crops. Pot and field experiments were conducted to study the effect of soil moisture on yield and yield components of lowland rice during the ripening stage. Results of the experiments indicated that differences among varieties were apparent. Rice plants in the pot experiment began to wilt when soil moisture fell below 28 %; if this occurred at 18 to 25 days after heading, the yields decreased by 4 to 8 %, respectively. Yield decreases of Krueng Aceh were due to lower percentages of ripened grains and weight of 1000 grains. With IR 36 and Cisadane, however, yield reduction was caused by the decrease of percentage of ripened grains. In the field experiment, drainage did not give a significant effect on grain yield. Therefore, soil moisture content during the latter half of the ripening period does not influence the yield of rice.

I.14. Growth and yield of lowland rice following soybean crop among locations, amounts of nitrogen fertilizer and varieties

H. Kobayashi, S. Partohardjono, E. Kosman and R. Damanhuri

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.87-102 (Japanese with English summary)

This experiment studied the effect of varieties (IR 36, Semeru, and Cimandiri), locations (Kuningan, Muara, and Singamerta substations) and nitrogen fertilizer application (60, 90, and 120 kg N/ha) on growth and yields of lowland rice following soybean. At Kuningan, the rice yield was 6 % less in fields previously cropped with soybean than in fields not previously cropped with soybean. However, it was 3 % more at Muara, and 10 % more at Sinngamerta. Soybean cropping had no effect on the rice response to nitrogen application. Higher nitrogen applications resulted in better rice growth and higher yields. There was a big difference in growth and yields between 60 kg N and 90 kg N/ha, but a small difference between 90 kg N and 120 kg N/ha. Growth and yield of rice varieties differed with locations. IR 36 had the lowest dry matter production but

a higher grain-straw ratio, and was more stable by location than Semeru and Cimandiri. Yield differences among locations were attributed to weather and soil fertility. The dry matter weight and number of spikelets per m2 affected the grain yield.

I.15. Effect of varieties, locations and cropping seasons on growing periods of lowland rice

H. Kobayashi, S. Partohardjono and E. Kosman

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.103-113 (Japanese with English summary)

Experiments were conducted to study the effect of rice varieties, locations [Kuningan (545 m), Muara (260), and Singamerta (15 m)], and cropping seasons on the growing period of transplanted lowland rice. The period until the maximum tillering stage was longer at higher elevations, and in the wet season. It seems that the temperature influences the growth duration until the maximum tillering stage. The period before the panicle initiation stage of the rice varieties varied from 36 to 52 days. The difference due to altitude was 6-7 days. The difference due to cropping season depended on the rice variety. The vegetative lag phase (period between maximum tillering and panicle initiation) of the varieties varied between 0 and 17 days, was longer for late varieties than early ones, and did not depend on location. It was 5-6 days longer in the dry than in the wet season. The period between panicle initiation and heading time was 22 to 29 days, and was shorter in early varieties. There was a difference of 0 to 3 days due to altitude. In the dry season it was 2 to 6 days shorter than in the wet season. The period between heading and maturity differed with rice varieties in the wet season, but not in the dry season. This period was affected by temperature and soil radiation, and was longer at Muara than at the other locations.

I.16. Salvinia molesta, a floating aquatic weed in Indonesia, and its response to some paddy herbicides

H. Pane, M. Sundaru and J. Harada

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.114-119 (Japanese with English summary)

Salvinia molesta D.S. Mitchell is a free-floating fern. It grows rapidly and affects rice cultivation by 1) blocking irrigation and drainage channels, 2) causing rice seedlings to be unable to stand, 3) reducing the number of rice tillers, 4) intercepting fertilizer applied to the field, and 5) reducing rice yields. This weed cannot be controlled by hand weeding because small separate pieces of plant can grow quickly to reinfest the field. This experiment examined the effect of several herbicides to control the weed. S. molesta was collected from the paddy field of Muara experiment farm and transplanted in plastic pots filled with paddy soil. Various herbicides were applied, and twenty days

later plants were sampled and the effect of the herbicides measured.

S. molesta was killed by ACN and ACN-Symetryne-MCPB at three days after application, and by simetryne and prometryne at seven days after application. Other herbicides were not effective, although some induced chlorosis in newly formed leaves. As simetryne and prometryne are toxic to rice plants, especially in indica rice cultivars under high temperature conditions, only ACN seems to be applicable to control S. molesta in tropical paddy fields. Further tests are necessary to determine adequate dosage and time of application.

I.17. Distribution and some characteristics of Mimosa weed species in Indonesia

J. Harada, H. Pane and M. Sundaru

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.121-135 (Japanese with English summary)

Three Mimosa weeds, M. pudica L., M. invisa Mart., and M. pigra L. are distributed in Indonesia. They are considered to be serious weeds since their thorns hinder hand-weeding. Their distribution and some characteristics were examined. M. pudica and M. inviosa are widely distributed in Indonesia. M. pigra was first introduced in the Bogor Botanical Gardens from Kew Gardens, England, in 1918. It is now spread over roadsides, river banks and swampy locations in Java and South Kalimantan. The seeds of M. pudica and M. invisa are thought to be distributed on the fur of animals and clothing of man, while the seeds of M. pigra float on water. Seed emergence of these weeds is very low and irregular because of the hard seed. The germination percentage increased with scarification or concentrated sulphuric acid treatment. Rice seedling growth test using methanolic extract showed that Mimosa weeds contain substances which strongly inhibit the root growth of rice plants.

I.18. Simple screening method against to Al-toxicity of soybean cultivars

H. Mikoshiba and S. Somaatmadja

* Mimeograph report, December 1984
* Seminar at CRIFC, Bogor, December 1984

Various methods of screening for tolerance to Al-toxicity of soybean cultivars were tested using AlCl3 solution. These included the plastic basket method, gemination tester method, and plastic basket with filter paper method. The plastic basket with filter paper method was most useful. Soils with different Al-contents were also tested, and good results were obtained for screening for soybean varieties tolerant to Al-toxicity. A total of 250 soybean cultivars and more than 100 breeding lines were tested for Al-tolerance, and many cultivars and lines were

found to be more tolerant than Lee variety, which is regarded as a tolerant standard.

I.19. Plant production and potential productivity of cassava (Manihot esculenta Crantz

Y. Hozyo, M. Megawati and J. Wargiono

* Contributions, Central Research Institute for Food Crops, Bogor, no. 73, p.1-20, 1985
* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.68-79 (Japanese with English summary)
* Seminar at CRIFC, Bogor, June 1983

Plant production and potential productivity of cassava were investigated during the 1981 and 1982 growing seasons at Cikeumeuh experiment farm. Dry matter production and tuberous root growth were measured, and indices of plant production were analyzed. The crop growth and net assimilation rate had high values in the active thickening and maturation of tubers. The orientation adjustment of the leaf blade toward solar radiation was observed. This movement adjusted the reception of incident solar radiation throughout the day. Variations in the angle were described by the inclination, sub-inclination and direction angles. The potential productivity of cassava was analyzed using grafts combining scion and stock of two cultivars and one local variety. The potential productivity of the tuberous root was found to be independent of the scion character. However, the scion was of secondary influence on tuber thickening if the stock was of a late tuber-thickening type.

I.20. Root development of soybean in acid soil with different exchangeable aluminium contents

H. Mikoshiba, S. Somaatmadja and I.V. Sutarto

* Mimeograph report, April 1985
* Seminar at CRIFC, Bogor, April 1985

Three series of pot experiments were conducted to find the growth reaction of soybean to different aluminium contents of soil. Soybean varieties Orba, Galunggung and B 3035 were used. Five kinds of soil with different exchangeable-Al contents were prepared by mixing 3 types of soil. The growth of soybean top and root was reduced at higher exchangeable-Al levels. The roots failed develop in the high-Al soil (22.2 me Al/100 g soil), and were severely damaged in the soil containing 16.3 me Al/100 g soil. The plants were able to grow in soil containing 2.3-8.6 me Al/100 g soil, though the vigor of the growth was reduced. Varietal differences in growth reaction to exchangeable aluminium content was not found among the varieties used in these experiments.

I.21. Chemical nature of acid soils and Japanese experience to ameliorate them

A. Tanaka

* Seminar in Jakarta, September 1985

Agricultural use of acid soils in Japan has increased since the 1940. This paper describes the nature of acid soils and the amounts of lime and phosphorus required to ameliorate them, the tolerance of various crops to low soil pH, high Al and low P, and the relationship between these tolerances. It discusses the improvement of acid soils in Japan, including government soil amelioration projects and the consumption of amelioration materials and chemical fertilizers

I.22. Techniques of liming for soybean production on acid soil

Y. Izumiyama, S. Sumadi, D. Pasaribu and Novianti S.

* Mimeograph report, October 1985
* Seminar at CRIFC, Bogor, October 1985

The effect of liming and compost application on the growth and yield of soybean was tested at Citayam for three seasons. In general, soybean yield increased with higher of lime rates. In-row application of lime gave higher yields than broadcast application at the same lime dosage. The effect of compost on soybean yield was not clear, but when it was combined with a certain amount of lime high yields were obtained. Liming retarded the vegetative growth of soybean, while compost application promoted it. Among the yield components, grain weight was strikingly affected by liming. Increased grain weight is considered a major cause of increased soybean yield with liming. High growth rates of grain were found in lime application treatments.

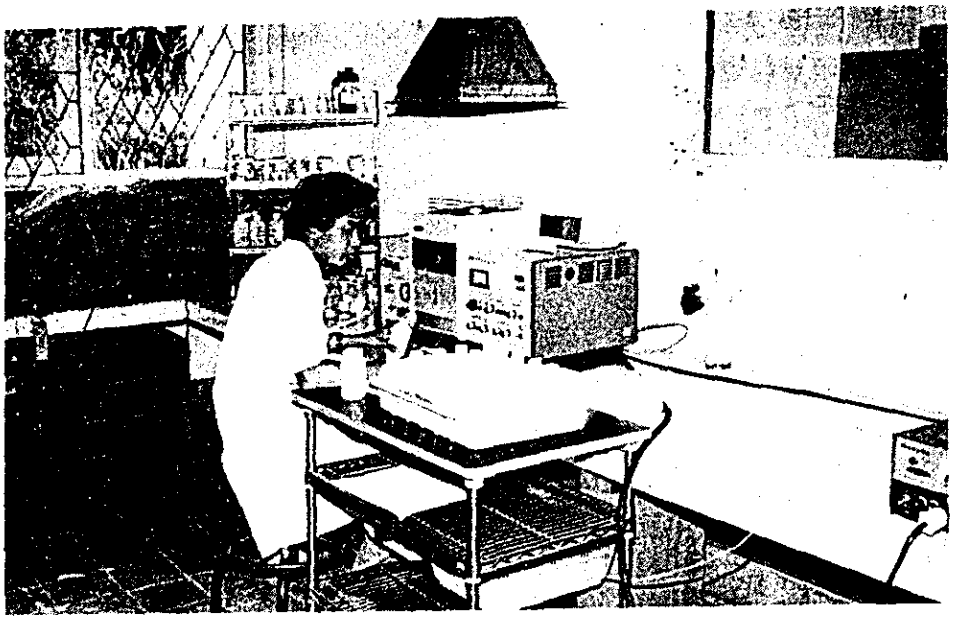

Figure 7. An atomic absorption spectrophotometer apparatus used for one of the many types of research at the Plant Physiology Department, BORIF.

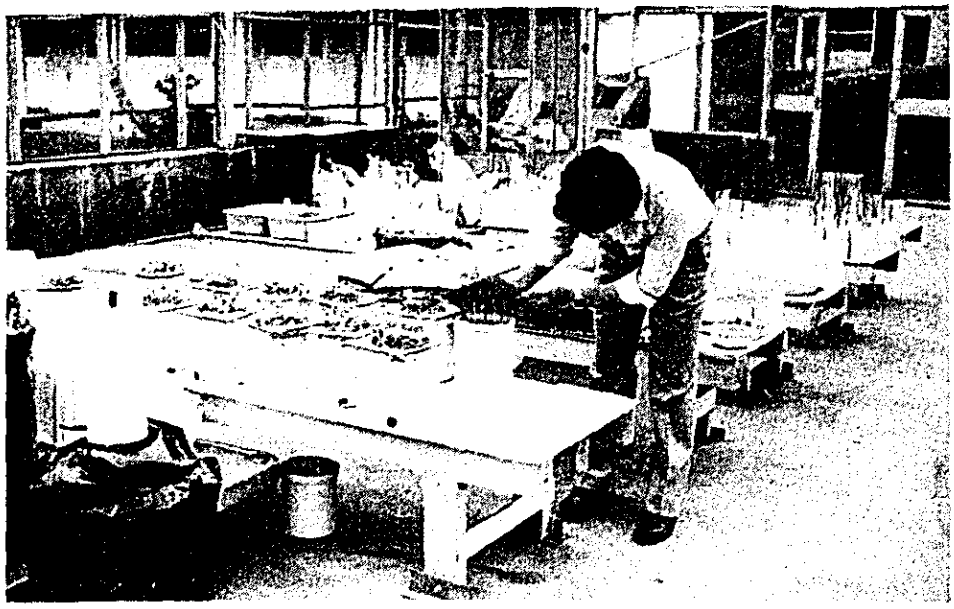

Figure 8. The greenhouse facilities used for research on zinc deficiency in problem soils at the Plant Physiology Department, BORIF.

II. 1. Studies on the germination of soybean seeds

T. Fujimoto, A. Choliluddin, M. Fatchurochim and M. Ismunadji

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.31-37
* Seminar at CRIFC, Bogor, March 1981

Experiments were conducted to elucidate the effects of internal and external factors related to the germination of soybean seeds. Changes in seed viability as affected by the place of production and storage were investigated with the seeds stored in 3 substations of CRIFC, namely Pacet, Kuningan, and Muara (Bogor). The maximum and the minimum temperatures in the storeroom were 27-19, 29-23 and 32-26 degrees C, respectively. It was clarified that the seed longevity was influenced by the place of storage, and the varietal difference in seed longevity was recognized. For practical use, the limit of seed storage was 4 months in Bogor and 6 months in Kuningan for the 3 varieties tested. In Pacet, it was 8 months for Orba and No. 945 and 10 months or more for No. 29. The place of production also affected the seedling vigor. Factors influencing the seedling emergence were investigated. The relative placement of fertilizer to avoid injury was at least 5 cm below the seed level and 2 cm to the side of the seed.

II. 2. Effect of urea application on growth, yield and nitrogen uptake of soybean

T. Fujimoto, A. Choliluddin, M. Fatchurochim and M. Ismunadji

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.85-90 (English with Japanese summary)

Pot and field experiments were carried out in order to investigate the effect of nitrogen fertilizer application on the growth and nitrogen uptake of soybean plants using urea labelled with 15-N. The absorption rate of nitrogen ranged between 57 and 75 %, when urea was applied at the rate of 0.3-2.1 g N/pot at intervals of 0.3 g N. Seed yield increased almost linearly up to 1.2 g N/pot, and increased slightly from 1.5 to 2.1 g N/pot. The yield increase was attributed to the increase of pod number. There was a positive correlation between seed yield and nitrogen accumulation at the flower-initiation stage. This suggests the importance of basic dressing of urea. Basic dressing of urea effectively increased yields, though applications of 30 and 60 kg N/ha produced similar effects. Top dressing of urea was not effective.

II. 3. Varietal difference in plant growth and nutrient uptake of soybean in Indonesia

T. Fujimoto, A. Choliluddin, M. Fatchurochim and M. Ismunadji

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.91-97 (English with Japanese summary)

Five soybean varieties (Orba, No. 945, No. 29, Balong, and Ijo) were grown in the field with and without fertilizer application. The varietal differences in plant growth and nutrient uptake were investigated. The growing period ranged between 86 and 108 days. The rate of dry matter accumulation varied with variety. The growth characteristics of recommended varieties (Orba, No. 945) was characterized by a shorter growing period with higher crop growth rate (CGR) in the early growth stage. With fertilizer application, the recommended varieties took up more nutrients than the other varieties. The recommended varieties also absorbed more nutrients than local varieties without fertilization.

II. 4. Estimation of nitrogen fixation by soybean root nodules

T. Fujimoto, M. Kuwahara, A. Choliluddin, M. Fatchurochim and M. Ismunadji

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.99-101 (English with Japanese summary)

This pot experiment used a pair of nodulating and non-nodulating soybean isolines (A 62-1 and A 62-2) to estimate the quantity of nitrogen fixed by root nodules. Soybean variety Orba was used as a comparison. At 30 days after sowing, there was no significant difference in the nitrogen accumulated by the three varieties. Nodule development was still poor at this stage. At 60 days after sowing, the wieght of seed of the nodulating isoline A 62-1 was 40 % greater than that of A 62-2, because of its larger number of pods per plant. A 62-1 had 287 mg N/hill (2 plants) more than the non-nodulating isoline A 62-2. This corresponded to 43 % of the total nitrogen accumulated by A 62-1. This figure (43 %) is lower than the proportion of nitrogen generally thought to be fixed by nodulation (around 66 %), possibly because the two isolines are not adapted to growth in Indonesia.

II. 5. Behavior of nitrogen in dryland soils

A. Hidayat, F. Fujimoto and M. Ismunadji

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.103-110
"Perilaku nitrogen pada tanah kering" (Indonesian with Japanese summary)
* Seminar at CRIFC, Bogor, March 1981

A series of field and laboratory experiments was conducted to clarify the behavior of nitrogen in dryland soils. Both urea and ammonium sulphate were rapidly leached out of the topsoil by rainfall. In the rainy season, all the N applied may be lost in 30 days. The deeper the mixing of N fertilizer in the soil, the faster it was leached away. Nitrification of inorganic N fertilizer began in the first week after application. Nitrification was most rapid in the 2nd-3rd weeks in an andosol from Pacet, and in the 1st-2nd weeks in a latosol from Muara. The rate of nitrification was very slow at low (33 %) soil moisture contents, but was rapid at higher moisture contents (55 % and 80 %). Mineralization was faster at 40 degrees C than at 30 C.

II. 6. Influence of the application on the behavior of nitrogen in latosol at Muara experiment station

A. Hidayat, M. Zaini, T. Fujimoto and M. Ismunadji

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.111-118
"Pengaruh penempatan urea terhadap perilaku nitrogen pada lahan kering latosol Muara" (Indonesian)

Three laboratory and greenhouse experiments were conducted to test the effect of urea placement on the behavior of nitrogen in a latosol from Muara, Bogor. The method of urea placement affected the dry matter weight of corn (Arjuna variety) at the early growth stage. Application of urea by dibbling created high nitrogen concentrations in the rhizosphere and inhibited the root growth and development at the young stage. This caused low nitrogen absorption and deficiency. There was more NO3-N than NH4-N in the upper soil layer (0-7 cm), while in the lower layer (7-14 cm) the reverse was true. The deeper urea was mixed with the soil the more nitrogen was leached away by rain. The nitrogen leaching intensity depended on the soil type. Increased soil humidity lowered the NO3-N content and inceased that of NH4-N. Nitrification was slow at low soil moisture (30 %) and increased at higher moisture contents.

II. 7. Excessive absorption by crops of iodine and bromine accumulated in soils measured using radioisotope techniques

K. Yuita

* Seminar at CRIFC, Bogor, December 1982

Excessive bromine and iodine in crops can harm both the crops and humans who ingest them. A series of experiments were conducted to determine the levels of Cl, Br and I in soils, plants, and rainwater in Japan and the absorption of halides by soils and rice plants. Neutron activation analysis showed that forest and dryland cultivated soils had extremely high concentrations of I and Br, but these elements were rarely absorbed in large amounts by plants. Concentrations in wetland soils were much lower because of eluviation by irrigation water. The accumulation of I and Br, but not of Cl, varied widely. Br and I from rainwater are thought to be retained by soils, while little Cl is retained. Radioisotope tracing and neutron activation analysis supported this. Soil pH, moisture content and temperature significantly affected the solubility of these halides. Soils in the temperate monsoon climatic region provide suitable conditions for the accumulation of I and Br, since the soil moisture is maintained at relatively high levels all year around, the soil reaction is acidic, and the soil temperature is moderate. These conditions may also occur in the tropics. Submergence of wetland fields caused I to be solubilized, enabling it to be absorbed by rice plants and causing the physiological disease "Akagare". The critical I content for Akagare symptoms to appear is 40-60 ppm in the rice leaves.

II. 8. Analytical method of Cadmium (Cd) in soil and crops

K. Yuita, M. Nakashimada, A. Hidayat, Sismiyati R., and I. Nasution

* Japan-Indonesia Joint Research Project, ATA-218, Bogor, 1983, 59 p.

Cadmium is a heavy metal which may be present in significant quantities in the soil and crops, and which may seriously damage human health. This guide, written in both English and Indonesian, outlines methods of analyzing the Cd content in soil and crops. It covers the selection of sampling soil and crops, preparation of test samples, methods of Cd extraction from soil (perchlorate decomposition and extraction, 0.1 N HCl extraction), crops (wet incineration by decomposition with $HNO_3.H_2SO_4$), and Cd determination (DDTC-MIBK extraction - atomic absorption spectrophotometry, direct atomic absorption spectrophotometry).

II. 9. Improvement of production, storage and germination of soybean seed

M. Nakashimada, Murtado and Ratna Fathan

* Seminar at CRIFC, Bogor, October 1983

9.1. Relationship between harvesting time and germination of soybean seed

This experiment at Muara experiment farm aimed to find the relationship between rainfall during the production of seed of soybean variety Orba and the germination rates of the seed produced. The germination percentage was correlated better with rainfall at 15 days before harvest than with rainfall at 30 and 60 days before harvest. Harvesting during the wet season (January - March) gave 53-63 % germination, while that during the dry season (May - September) gave 83-93 % germination percentage. It can be concluded that soybean produced during the dry season is better for seed.

9.2. Relationship between place of production and germination of soybean seed

Experiments conducted in Pacet (altitude 1100 m) and Muara (260 m) indicated that seeds produced at Pacet gave a higher germination percentage (97 %) than seeds produced at Muara (81 %). Seeds produced in Pacet were viable longer (12 months) than those produced in Muara and stored in Pacet (6 months). Seeds stored in Pacet showed longer viability (6 months) than those stored in Bogor (4 months). These results suggest that soybean seeds produced and stored at higher altitudes are better.

9.3. Effect of drying on the viability of soybean seed

Two experiments were conducted to test the viability of soybean seed of different varieties stored at different moisture contents and temperatures. The viability increased with lower moisture contents down to about 10 % relative humidity. Moisture contents of 7-9 %, or relative humidities of 40-50 % are recommended for stored seed. Orba variety seed can be used after 10 months' storage under such conditions. Two days of sun-drying effectively dried the seed and gave the same germination percentage as drying in a dessicator.

9.4. Effect of sowing methods on germination percentage of soybean

The germination rates of soybean seeds purchased from markets in Central and West Java were investigated using three sowing methods. Seed emergence using dibbling followed by straw mulching (74.6 %) was greater than with broadcasting followed by covering with soil (68.0 %) or straw mulching (11.0 %).

9.5. Storage method to maintain low moisture content of soybean seed

This experiment tested various containers for storage of soybean seed at a moisture content of 7-8 %. Plastic bags of 0.05 mm thickness were not suitable even if up to 6 layers of plastic were used, since they allowed moisture absorption from the atmosphere. Two layers of 0.2 mm plastic bags were suitable. A metal can was the best container tested.

9.6. Quality of soybean seed purchased at the market

Twenty-nine lots of soybean seed were purchased at markets in Central Java, and their germination percentage under different sowing methods was tested. Dibbling of carefully selected seed, followed by rice-straw mulching gave acceptable germination rates, while broadcasting followed by mulching gave low germination. Farmers are therefore recommended to produce and store their own seed.

9.7. Improvement of soybean germination by pesticide coating

Broadcasting of soybean seed followed by mulching with rice straw gives low germination rates. This experiment tested the effect of coating the seeds with 8 different types of pesticide or germination using this sowing method. Topzin-M was the most effective of the pesticides tested. Soil sterilization did not improve germination, while soaking the seed before sowing gave inconclusive results.

9.8. Seed-rot and damping-off of soybean

Soil pathogenic fungi causing severe damage to soybean seed were isolated and identified. The fungi found were : Fusarium solani, Sclerotinia sclerotirum, Rhizoctonia solani Kuhn, Corticium rolfsii Cursi, and Pytrium rot.

II.10. Studies on the response of soybean to fertilizer

M. Nakashimada, Ratna F. and Sismiyati R.

* Seminar at CRIFC, October 1983

10.1. Difference in growth and nutrient absorption of soybean varieties

This experiment at Pacet experiment farm in the 1981/1982 wet season tested 4 soybean varieties (No. 29, Orba, Galunggung and No. 945). Variety No. 29 had the highest nitrogen content in the leaf at flowering and the highest N absorption, but gave the lowest yield because of insufficient N translocation and low 100-grain weight. The medium-maturing variety Galunggung gave a lower yield than Orba (also medium-maturing),

because of low N content in the leaf and a smaller leaf area. The most suitable varieties for planting at Pacet in the wet season were Orba and No. 945.

10.2. Response of soybean variety Orba to N, P, K, Ca and Mg

In separate experiments, the response of soybean variety Orba to low medium and high levels of various elements was tested at Muara experiment farm (latosol). Basic dressings of N increased yields, but differences between 20, 40, and 60 kg N/ha were not clear. The number and weight of root nodules decreased as the N application increased. Top-dressing did not increase yield. For soybean cultivation after wetland rice, a basal dressing of 20 kg N/ha (urea) is thus recommended. P and K applications did not increase yields, because the soil had accumulated these elements over many years of wetland rice cropping. Ca and Ma application raised yields; application of 1000-2000 kg lime/ha and a magnesium-containing phosphorus fertilizer are recommended for soybean cultivation on latosol wetland fields.

II.11. Diagnosis of nutritional status in legume crops

M. Imanishi, Murtado, S. Ningrum and M. Nakashimada

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.139-147 (Japanese with English summary)
* Seminar at CRIFC, Bogor, February 1983

Two experiments were carried out to ascertain the typical symptoms of macro-nutrient deficiencies in soybean and peanut using sand culture, and to diagnose the nutrition status of abnormal peanut crops in the field. Symptoms of K, Ca and Mg deficiencies did not appear on the leaves of soybean and peanut grown in pots using a podzolic soil from Jasinga. Symptoms of K deficiency symptoms were observed in the leaves of a peanut crop in Surade, Cianjur.

II.12. Appraisal of the existence of the arable land pollution of cadmium, zinc and copper, and the content level of these heavy metals in Java

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K. Yuita, M. Nakashimada, A. Hidayat, Sismiyati R., and I. Nasution

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.149-161 (Japanese with English summary)

Environmental pollution in Indonesian agriculture seems to be increasing. Among the pollutants, cadmium is of great potential concern since it causes "itai-itai" disease. This study investigated the presence of cadmium (Cd), zinc (Zn) and copper (Cu) in arable soils, especially in lowland fields, in Java. The average Cd, Zn and Cu contents of the

plowed horizon of the paddy fields were 0.16, 4.5 and 5.9 ppm. These values are lower than in Japanese unpolluted paddy fields (Cd 0.4, Zn 12.1, Cu 7.2 ppm). The maximum Cd content in Java was only 0.27 ppm. The Cd, Zn and Cu contents in the lower river courses were almost the same as those in the upper courses. The average Cd, Zn and Cu contents of the plowed horizon of upland fields were 0.11, 4.7 and 3.5 ppm. These values were also lower than, or almost the same as, in Japanese unpolluted upland fields. The contents of the Cd, Zn and Cu in crops were almost same as in Japanese unpolluted crops. It can thus be concluded that the districts investigated were still entirely unpolluted by Cd, Zn and Cu.

II.13. Effect of Mo and B on the growth and acetylene reducing activity of legumes

J. Ishizuka, MPurtado, F. Yazawa and M. Ismunadji

* Mimeograph report, November 1984
* Seminar at CRIFC, Bogor, November 1984

Peanut, soybean and mungbean grown on red-yellow podzolic soil were inferior to those grown on latosol and grumusol. Mungbean was stunted and died 2 weeks after planting. The nodule weights and acetylene-reducing activities decreased in the order of grumusol, latosol and podzolic soil. Molybdenum application increased the nodule weights and the acetylene-reducing activity of soybean grown on latosol. Molybdenum concentration in the root nodules without Mo was not less than 10 ppm, except in soybean grown in latosol which was about 7 ppm, below the critical level of Mo for soybean. Boron application did not influence plant growth and acetylene-reducing activity.

II.14. Mo and B nutritional status of soybean in West and Central Java

J. Ishizuka, Murtado, F. Yazawa and M. Ismunadji

* Mimeograph report, 1984
* Seminar at CRIFC, Bogor, November 1984

Based on 16 soybean samples collected from West and Central Java, it was found that molybdenum concentration of soybean depends on the soil type. It is highest in grumusols, and successively lower in alluvial, regosol and latosol soils. Only plants grown in latosols are molybdenum-deficient. Boron was not deficient in plants grown in all locations.

II.15. Effect of nitrogen application on the physiological characteristics of corn and soybean varieties

Ratna Fathan and F. Yazawa

* Mimeograph report, 1984
"Pengaruh pemberian nitrogen terhadap sifat-sifat fisiologis kedelai dan jagung" (Indonesian with English summary)

Wilis and Orba soybean varieties grown on 4 soil types and fertilized with nitrogen had the same leaf color. Among the 4 soil types tested (red-yellow podzolic, hydromorphic, grumusol and latosol), Muara latosol had the lowest nitrogen level. The chlorophyll content of corn and soybean depended on the soil type; it was lower for red-yellow podzolic and hydromorphic soils than for latosol and grumusol. Nitrogen application increased the chlorophyll content, except for Wilis variety grown in red-yellow podzolic and hydromorphic soils. The root activity of Orba variety was higher than that of Wilis. Nitrogen application increased the root activity by 13 %. The root activity of H-C1 corn was higher than Arjuna variety. Nitrogen application increased the root activity by 39 % for Arjuna variety and 54 % for H-C1. Nitrogen application increased the nitrogen absorption of both corn and soybean.

II.16. Diagnosis of nitrogen status in soybean and rice by leaf color

M. Ismunadji, I. Zulkarnaini, S. Partohardjono and F. Yazawa

* The Strengthening of Legumes in Relation to Cropping Systems Research Project, ATA-218, 1985
"Diagnosis status hara nitrogen kedelai berdasarkan warna daun" (Indonesian)

This book provides a scale containing 9 colors ranging from light yellowish-green (coded 0) and dark bottle-green (coded 8). Using this scale, it is possible to estimate the nitrogen content of soybean and rice leaves, and thus determine approximately the nitrogen fertilizer requirement of the crop.

II.17. Physiological disorders, especially of aluminium, in soybean on acid soil

S. Akao, I. Nasution and F. Yazawa

* Mimeograph report, September 1985
* Seminar at CRIFC, Bogor, September 1985

The objectives of this experiment were to investigate the soybean plant symptoms of Al and Mn toxicity and Fe deficiency, to elucidate the relationship between liming, fertilizer application, soil acidity, Al concentration in plant parts and plant growth, and to measure the differ-

ential tolerance to Al between young and old seedlings. Decreasing Al concentrations in plant tops and roots were most apparent with high applications of phosphorus, followed by liming. The standard recommended fertilizer application increased the Al concentration in the tops and roots. Tolerance to Al toxicity differed with plant age. Young seedlings (one day after germination) suffered severe damage in a solution containing 10 ppm Al, but older seedlings (6 days after germination) showed tolerance to Al. Al concentrations in leaves of soybean grown in the field in West Java varied between 47 and 323 ppm.

II.18. Relationship between leaf color and growth, yield and yield components, chlorophyll content and nitrogen content in paddy rice

R. Suhadi, I. Zulkarnaini, F. Yazawa and I. Nasution

* Mimeograph report, 1985
  "Hubungan antara warna daun dengan pertumbuhan, hasil kandungan klorofil dan kadar nitrogen dalam tumbuhan padi sawah" (Indonesian with English summary)
* Seminar at Bogor, October 1985

The relationship between leaf color and some growth parameters is difficult to evaluate in young rice plants. Significant correlations were found between chlorophyll content, stem weight, weight of leaves, weight of filled grains, number of panicles and number of grains per panicle and the nitrogen content at 28 days after transplanting. It was suggested that the best time for diagnosis of the nitrogen status of paddy rice by using color was aroud 28 days after transplanting.

II.19. Physiological disorders of soybean

F. Yazawa

* Mimeograph report, 1985
* Seminar at CRIFC, Bogor, October 1985

Various tests were conducted centering on the physiological disorders of soybean in Java and southern Sumatra. Chemical analyses of soils and soybean leaves have shown that fertilization influences the growth of soybean and the occurrence of soybean disorders in infertile and strongly acidic soils. Growth disturbances, including damage by light, may be triggered by nutritional problems. Even soybean fields that had been limed were found to be deficient in calcium; this is caused by faulty fertilization methods. The elements calcium, magnesium and potassium may be in imbalance during the growth of soybean. Potassium deficiency due to excess calcium was observed on grumusols. Soybean may suffer if any of Ca, Mg or K are deficient. Soybean grows well even in high Ca conditions if sufficient of other essential elements are available. The molybdenum availability in soils was estimated from the molybdenum content of soybean seeds: latosol soil was found to be deficient in Mo. This could be counteracted by coating the seed with a small amount of 250

ppm Mo solution. The chemical composition of soybean seeds after storage was investigated for 4 soybean varieties: Orba, Wilis, No. 29 and Galunggung. Seeds showed almost no change in the fraction of soybean protein, suggesting that they had remained stable during storage. No conspicuous differences or definite tendencies were found between new and old seeds in crude protein, fat and sugar contents. The sugar content of Orba was lower in older than in new seed. A minor difference was observed in leucine, lysine, arginine, aspartic acid, glumatic acid, and serine contents. These results indicate that the seed viability is lowered by denatured enzyme systems associated with the vital activity of soybean.

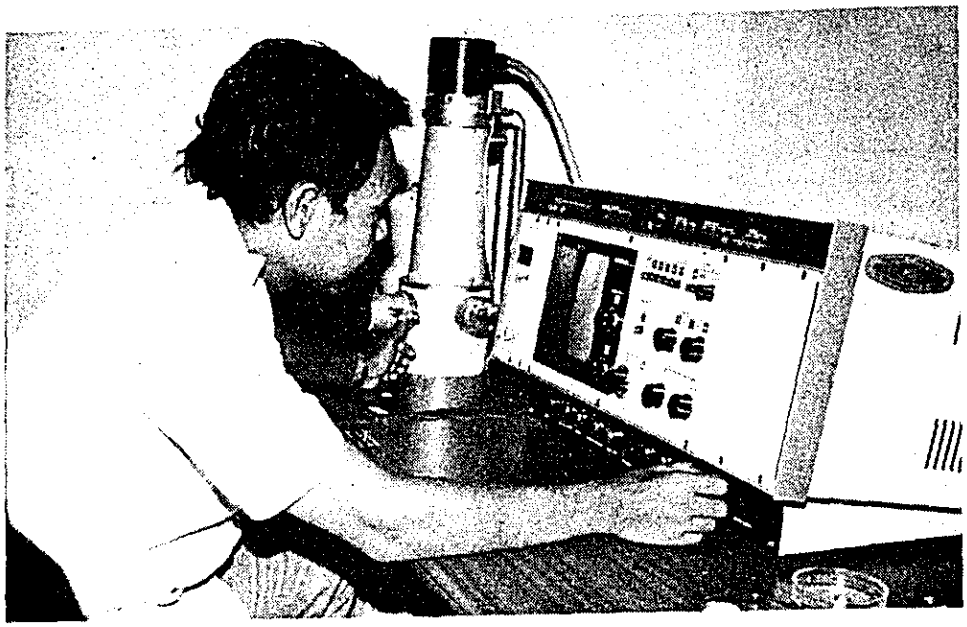

Figure 9. Observation using the scanning electron microscope in the Cell Biology Laboratory, Pests and Diseases Department, BORIF.

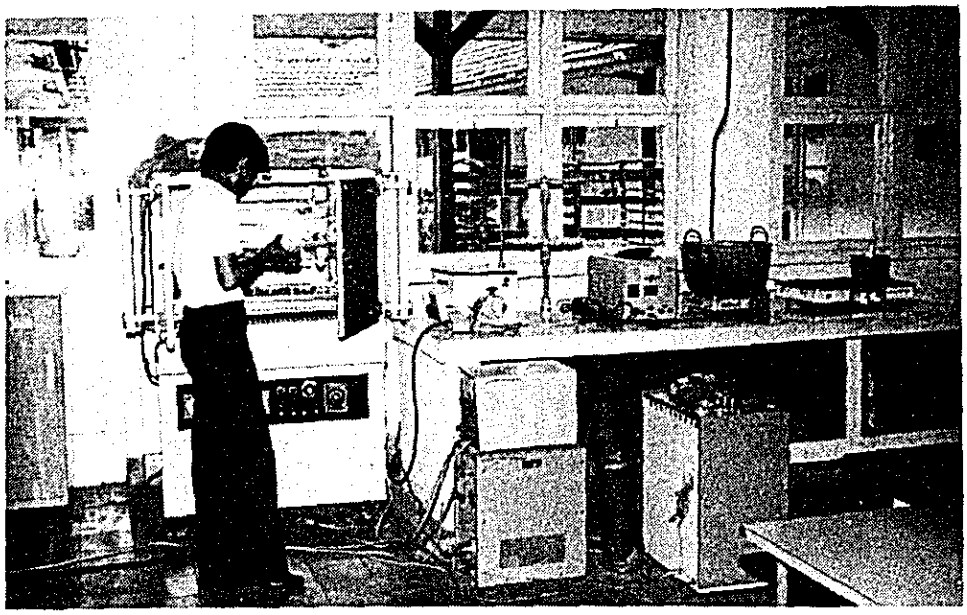

Figure 10. Growing plant pathogens in the Mycology Laboratory, Pests and Diseases Department, BORIF.

III. 1. Causal agents of cassava bacterial wilt in Indonesia

K. Nishiyama, Nunung H. Achmad, Suparman and T. Yamaguchi

* Contributions, Central Research Institute for Agriculture, Bogor, no. 59, p.1-19, 1980
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.157-168 (English with Japanese summary)

The symptoms of so-called bacterial wilt of cassava in Indonesia were divided into three types; dropping, severe defoliation with remaining immature living leaves at the top, and die-back. The former two types of symptoms were usually accompanied by affected roots, while the last was not. Bacteria isolated from the plants showing the former two types of symptoms were identified as Xanthomonas campestris pv. manihotis by their bacteriological characterictics and pathogenicity. These results indicate that two distinct diseases are included in what has been called "bacterial wilt" of cassava; bacterial wilt in the narrow sense caused by Pseudomonas solanacearum, and bacterial die-back caused by X. campestris pv. manihotis.

III. 2. Survey on the occurrence of soybean and mungbean disease in Indonesia

T. Yamaguchi, Mukelar Amir, M. Herman, Nasidar Bustaman, Hartini R. Hifni, Nunung H. Achmad, Roechan Hartoatmodjo, H. Djumanto, Otjim Sumantri and D.M. Tantera

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.199-122 (English with Japanese summary)

The following 11 kinds of soybean diseases were found in farmers' fields and fields of CRIFC experiment farms in Java, Sumatra and Bali: bacterial pustule, Cercospora leaf spot, purple stain of seed, anthracnose, rust, southern blight, witches' broom, soybean stunt, soybean dwarf, bean yellow mosaic, and root-knot nematode. Judging from their occurrence severity of damage and distribution, rust, bacterial pustule, southern blight, witches' broom, soybean stunt, and soybean dwarf seem to be extremely important in Indonesia. The occurrence of the following 12 kinds of diseases affecting mungbeans was observed in Java, Sumatra, and Bali: scab, powdery mildew, Cercospora leaf spot, southern blight, damping off, leaf blight, Rhizoctonia rot, anthracnose, rust, witches' broom, bean yellow mosaic, and mungbean mosaic. Scab, Cercospora leaf spot, anthracnose, southern blight, bean yellow mosaic, and mungbean mosaic seem to be very important diseases of mungbean in Indonesia.

III. 3. Rhizoctonia rot on mungbeans

T. Yamaguchi, Mukelar Amir and D.M. Tantera

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.127-131 (English with Japanese summary)

In 1980, leaf blight, foot-root and stem-rot symptoms were observed on mungbean plants at Tagineneng in Lampung, and at Muara and Citayam experiment farms of CRIFC in West Java. Rhizoctnia solani Kuhn was the main pathogen isolated from diseased leaf and stems of mungbean. Other fungi, such as Sclerotium rolfsii spp., Trichoderma sp., Pythium sp., and Setodochium sp. were also isolated. Inoculation tests indicated that R. solani was the pathogen of this disease. Isolates of R. solani recovered from diseased plants fell into two groups, namely AG-1 and AG-4 groups. Pathogenicity tests on mungbean showed that leaf blight symptoms caused by R. solani isolates belonged to AG-1 group, and were not induced by isolates belonging to AG-4 group. Foot-rot or stem-rot symptoms were caused by both AG-1 and AG-4 groups. Leaf-blight, stem-rot and foot-rot symptoms on soybean were induced by inoculation of all the R. solani isolates tested. Sclerotium rolfsii caused typical southern blight symptoms on mungbean and soybean, and Pythium sp. caused damping off, but they did not cause the same symptoms as those observed in the field. Fusarium sp., Trichoderma sp., and Setodochium sp. did not exhibit any pathogenicity to mungbean or soybean.

III. 4. Treatment and storage of seed corn for the control of Java corn downy mildew

Masdiar Bustaman, Yusuf and T. Yamaguchi

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.145-156 (English with Japanese summary)

The purpose of this experiment was to determine how long after storage seeds treated with Ridomil could protected from infection with Java corn downy mildew (Peronosclerospora maydis). Two corn varieties, Harapan (susceptible) and Harapan Baru (resistant), were used in the test. Three kinds of seed treatments were prepared as follows: 1) untreated seed, 2) seed dressed with Ridomil at a rate of 3 g formulation/kg, 3) seed dressed with Ridomil at a rate of 6 g/kg. After treatment each lot of seed was divided into four groups, which were kept under four different conditions as follows: 1) laboratory room, 2) refrigerator, 3) desiccator, 4) desiccator within the refrigerator. The seeds thus treated and stored were planted on 21 March 1981 (experiment A), and 25 May 1981 (experiment B) in the field of Cikeumeuh experiment farm in Bogor. The experiment fields were surrounded by infected corn plants planted two weeks before and inoculated with the pathogen. Germination and infection were investigated weekly from two to five weeks after planting. Plants affected by the disease were observed only in the plots which were planted with untreated seeds. The percentage of infection of the susceptible variety ranged from 0 % to 72 % (average

33 %) in experiment A, and from 0 to 80 % (average 60 % in experiment B, whereas that of the resistant variety ranged from 0 to 20 % (average 5.5 %) in experiment A, and from 0 to 19 % (average 9.2 %) in experiment B. Seeds treated with Ridomil were not infected with downy mildew in experiment A. In experiment B, only two out of 2410 plants of the susceptible variety treated at a rate of 3 g/kg seed became infected. It was thus demonstrated that seed treatment with Ridomil effectively controlled Java corn downy mildew even after 9 months of storing treated seeds. The germination ability of seeds stored at room temperature and humidity decreased rapidly with time. Seeds kept under such conditions lost their germination ability after 3-5 months. However, the seeds kept at low temperature, low humidity, or under both conditions, were able to maintain their germination ability even after 6-9 months.

III. 5. Interim report of the research on races of Pyricularia oryzae and the varietal resistance of rice in Indonesia

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R. Yoshino and Otjim Sumantri

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.169-183 (English with Japanese summary)

5-1. Distribution of physiological races of Pyricularia oryzae and varietal resistance in Indonesia, from literature previously published

R. Yoshino

The 73 isolates of P. oryzae collected from West Java and South Sumatra in 1964 belonged to 2 different groups. The first group could not infect Chinese-type rice varieties such as Chokoto, Yakeiko, Kanto 51, CI 5309 and Dylar. This group was common in Southeast Asia. The second group could infect these varieties and was widely distributed in India. When these results was converted to new international race numbers it was found that most of these isolates belonged to ID-3 (29/73) and ID-I (12/73).

5-2. Identification of physiological races of Pyricularia oryzae and selection of temporary standard isolates

R. Yoshino and Otjim Sumantri

Seed of international differential rice varieties were tested against 50 P. oryzae isolates of Indonesian origin which were collected from upland areas in Tamanbogo, Lampegan, Ciparai, Ciamis, Bogor, Palembang, Rambatan, Kendari, Payakumbuh, and Maros. Sixteen P. oryzae races were identified : IB-63, IC-1, IC-15, IC-17, ID-5, ID-9, ID-11, ID-13, ID-14, ID-15, ID-16, IF-1, IG-1, IG-2, IH-1, and II. The predominant races were found to be IG-1, IG-2, ID-15 and ID-13. Eight isolates were selected as temporary standard isolates for the grouping of Indonesian varieties.

5-3. Grouping of Indonesian rice varieties based on reaction to temporary standard isolates

R. Yoshino and Otjim Sumantri

Based on 8 temporary standard isolates of P. oryzae, Indonesian rice varieties could be grouped as follows : Klemas, Asahan, IR 36 (000); Rantai Emas, IR 34, IR 36, IR 42, IR 45 (000); Laka, Lagos (002); IR 20, IR 26, IR 28, IR 32 (003); Gati, Cisadane (006); Cimandiri, Bicol (007); Remaja, Dewi Ratih, Gemar, Sigadis, IR 8, IR 30 (017); Sirendah (022); Palembang Darat (023); Kastri (033); C 22 (035); Ayung (042); Bathara, Arimbi, Jelita, Syntha, Pelita I/1 (057); Java 14 (073); Cempo Turi (077); Podi Buluh (103); Urag-uragan (121); Pulut Bandrahuya (123); IET 1444 (177); Semariti (220); Semeru (301); Seratus Malam (335); Papah Aren (363); Kencana Bali, Kencana (377).

5-4. Observation, isolation and inoculation test of Pyricularia sp. on weeds

Otjim Sumantri and R. Yoshino

Weeds with typical blast lesions were collected from the field and monoconidial isolates were derived from them. Isolates from Leersia hexandra showed pathogenicity only to Kencana rice variety, and did not infect any of the other international differential varieties. Isolates from Digitaria sanguinalis and Panicum repens did note infect any of the rice varieties tested.

III. 6. Nematode survey on upland fields in Java with special reference to soybean

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T. Nishizawa and M. Herman

* Abstract, 27th annual meeting, Japanese Society of Applied Entomology and Zoology, April 1983
T. Nishizawa and M. Herman
* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.165-185 (Japanese with English summary)
T. Nishizawa

The following parasitic nematode genera were isolated from samples of soil taken in a survey trip of West, Central and East Java in April-May 1982: Helicotylenchus (63 % of samples), Hoplolaimus (37 %), Tylenchorhynchus (29 %), Meloidogyne (26 %), Rotylenchus (24 %), Pratylenchus (18 %), Hemicycliophora (16 %). A cyst nematode, Heterodera was detected in a soybean field in Purworejo (Central Java). This species was identified as race No. 1 of the soybean cyst nematode, Heterodera glycines Ichinohe. This is the first recorded occurrence of the cyst nematode at a low altitude in the tropics. Rotylenchus was found in large numbers in a cowpea field in Jatibarang (West Java). The population of nematodes in

plots planted to Crotalaria at Muara substation was much lower than that in soybean plots. Cultivation of Crotalaria spp. is clearly effective in reducing the population of these harmful nematodes. Soybean varietal resistance tests for root knot nematode (Meloidogyne incognita) indicated that variety No. 27 seems to be rather resistant. Other varieties e.g. No. 499, 1005, 1012, 1313, 1321, 1355 were susceptible.

III. 7. Chemical control of rice sheath blight in Indonesia

M. Herman, Wagiman and T. Yamaguchi

* Contributions, Central Research Institute for Food Crops, Bogor, no. 72, p.12-23, 1984
* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.133-144 (English with Japanese summary)
* Seminar at CRIFC, August 1981

Three greenhouse experiments and two field experiments using artificial inoculation methods were conducted at the Subdivision of Plant Pathology and at Kuningan and Citayam experiment farms of Bogor Research Institute for Food Crops from December 1980 to August 1981. They compared the efficacy of three chemicals (Validamycin, Rovral, and Folicur) in controlling rice sheath blight caused by Rhizoctonia solani. Throughout these experiments, all the chemicals reduced the incidence of infection and subsequently increased the grain yield of rice. In all the experiments (except one field experiment conducted at Citayam), Rovral and Folicur gave better control of the disease than Validamycin. Rovral application, at the reduced rate of 375 g a.i./ha with 2 sprayings, provided good control of the disease and increased the grain yield of rice. Comparison of the timing of application showed that when one spray of Rovral was applied at a rate of 750 g a.i./ha at 1-4 weeks before or at the same time as disease inoculation, efficacy of the disease control was higher when Rovral was applied 2 weeks after inoculation. Two sprays of Folicur at a rate of 375 g a.i./ha also gave good control of the disease throughout all the experiments, and increased the grain yield of rice. When Folicur was applied at a rate of 375 g a.i./ha (1 spray), 1-2 weeks before or at the same time as the inoculation, effectiveness of the control of the disease was higher than when Folicur was applied 3-4 weeks before or 1-2 weeks after inoculation. From these results, it was suggested that Rovral and Folicur were superior to Validamycin for controlling rice sheath blight. It is necessary to experiment further on the rates and frequency of chemical application under natural or artificial conditions of incoulation. The efficacy of Rovral differed markedly between the two field experiments for unknown reasons. This suggests that further field experiments should be conducted in different locations.

III. 8. Hyphal anastomosis groups of Rhizoctonia solani Kuhn in Indonesia

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* Penelitian Pertanian, 4(1), p.26-28, 1984 (English with Indonesian abstract)
* Research Report of Japan-Indonesia Joint Agricultural Research Project, 1982, p.123-126 (English with Japanese summary)

Rhizoctonia solani causes a number of disease of various crops in Indonesia. Grouping of R. solani with hyphal anastomosis was carried out by using Ogoshi's method. Almost all the isolates of R. solani from various crops in Indonesia belonged to the AG-1 of AG-4 groups, while isolates belonging to the Ag-2-1 group could not be detected. Out of 180 isolates from rice, 151 belonged to the AG-1 group, while 71 isolates from legumes were roughly divided into two groups: 39 isolates were in the AG-1 group and 30 isolates in the AG-4 group. It seems that the isolates suited to comparatively high temperatures were distributed in Indonesia. It is suggested that weeds are one of the inoculum sources of the Rhizoctonia diseases of rice and legumes.

III. 9. Primary infection sources of Cercospora leaf spot of mungbean

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N. Narizawa and Mukelar Amir

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.187-195 (Japanese with English summary)
* Seminar at CRIFC, Bogor, January 1984

Mungbean leaves infected with Cercospora were buried in soil in the greenhouse at 0, 10, and 20 cm depth under dryland and flooded conditions. The diseased leaves in the dry soil were more infectious to mungbean seedlings than those under flooding. In the dry soil, diseased leaves on the soil surface were more infectious than those buried in the soil. Leaves buried for 220 days did not infect the seedlings in either dryland or flooding. Infected seeds as well as diseased leaves were shown to be important primary sources of infection. Field observation showed that cowpea and soybean were not host plants of the fungus.

III.10. Effect of seed dressing with Topsin-M to control powdery mildew of mungbean

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N. Narizawa and Mukelar Amir

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.197-203 (Japanese with English summary)
* Seminar at CRIFC

Seed dressing with Topsin-M (80 g product/kg seed) was very effective to control the development of powdery mildew of mungbean under greenhouse conditions. The control effect lasted for more than 2 months after sowing, possibly through its systemic action.

III.11. Effect of seed dressing with Topsin-M and Benlate-T to control leaf spot and southern blight of peanut

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N. Narizawa and Otjim Sumantri

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.205-207 (Japanese with English summary)
* Seminar at CRIFC, Bogor, January 1984

The fungal diseases Cercospora leaf spot and southern blight (Corticium rolfsii) on peanuts may be controlled effectively by seed dressing using Topsin-M (12.5 g/kg seed) or Benlate-T (5g product/kg seed).

III.12. Computerized weather database systems for 10 Indonesian food crops experiment farms

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K. Matsumoto, Edi Sutarwo, Irsal Las, Muladi, Soerodjo, S. Okuda, Mukelar Amir and Otjim Sumantri

* Mimeograph report, 1984
* Seminar at CRIFC, Bogor, December 1985

Weather conditions such as rainfall, humidity, evaporation, solar radiation, and temperature, are important factors affecting disease development on plants. These factors have been compiled in a computerized weather data system at Bogor Research Institute for Food Crops. Using this system it is easy to identify and use each component of the weather data. The data are draw out by an XY plotter, and 5-and 10-day and monthly, sums and means computed automatically. The data set covers Muara, Tamanbogo, Sitiung, Pusakanegara, Jakenan, Mojosari, Maros, Lanrang, Margahayu, and Handilmanarap experiment farms. This weather data system is open for use by researchers enganged in epidemiology and other agricultural research topics.

III.13. Virus diseases of soybean in Indonesia

N. Iizuka

* Mimeograph report, 1984
* Seminar at CRIFC, Bogor, October 1984

A survey in Java in 1984 showed that the incidence of virus diseases on soybean was serious in East Java and some areas of Central Java, but few or no virus diseases were observed in West Java. Compared to a similar survey in 1982, it seems there is an increasing intensity of virus disease attacks on soybean. The reasons for this are not known, but it is suspected to be due to increased soybean cropping with uniform cultivars and modern cultural practices. Cowpea mild mottle virus, a

disease known already to occur in Africa, India and Thailand, and transmitted by whitefly (Bemisia tabaci) and through seed, was most prevalent in Java. Other virus diseases already known to occur in Java, but found to occur locally, were soybean stunt virus, Indonesian soybean dwarf, bean yellow mosaic, soybean mosaic, and peanut mottle-R type on soybean.

III.14. Survey on soybean viral diseases in Java

K. Matsumoto, N. Iizuka and Mukelar Amir

* Mimeograph report, 1984

Three viral diseases were identified on soybean plants in Central and East Java by electron microscopy observation, immune-electron microscopical survey method with antiserum, and inoculation tests on soybean plants. They were soybean mosaic virus, peanut mottle virus and cowpea mottle virus.

III.15. Bakanae disease of rice caused by Fusarium sp.: a survey

K. Matsumoto and Mukelar Amir

* Mimeograph report, 1985

During a survey in Central Java in August 1984, rice seedlings with bakanae disease symptoms (elongation) caused by Fusarium sp. were observed. Pathogenicity tests on seeds by smearing of inoculum caused damping-off or death of the seedling after germination, but without elongation. The causal fungus of this disease seems to be Fusarium fushikoroi (Gibberella fushikuroi).

III.16. Cercospora leaf spot of peanut, mungbean and cowpea in Indonesia

T. Inaba, M. Amir, M. Sudjadi and K. Matsumoto

* Mimeograph report, October 1985
* Seminar at CRIFC, Bogor, October 1985

This study aimed to identify the causal pathogen species of Cercospora leaf spot on various legumes, and to review the taxonomic position of the fungus. The fungi infecting peanut were identified as Cercospora arachidicola Hori and Cercospora personata (Buk et Curt) Ellis et Everhart. That infecting mungbean was identified as Cercospora canescens Ellis and Martin, while those on cowpea were Cercospora cruenta Sacc and Cercospora canescens Ellis and Martin. Varietal resistance of peanut was evaluated in the field of Citayam substation (West Java) against C. personata. Out of 100 lines tested, 22 lines/cultivars showed resistance.

IV. Entomology

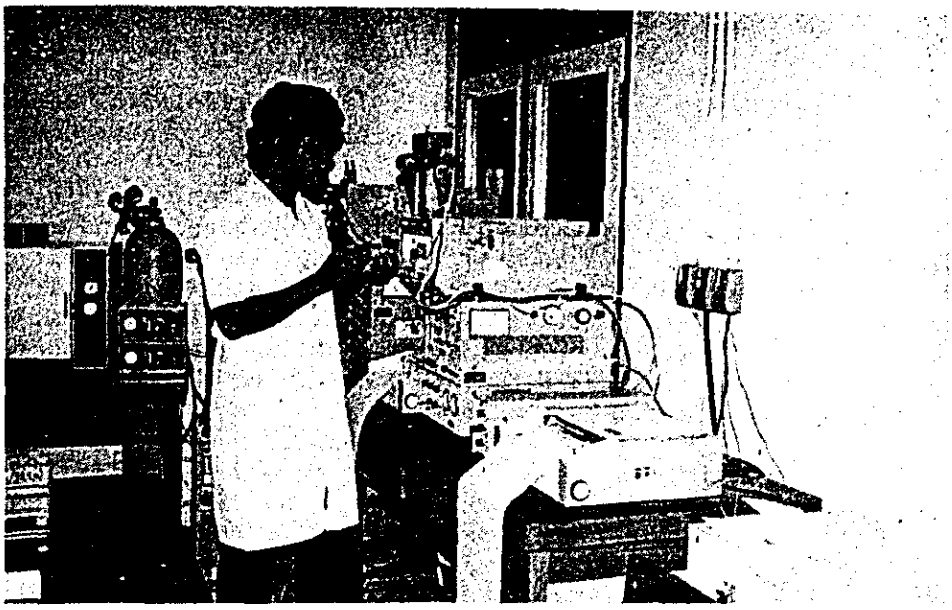

Figure 11. The Toxicology Laboratory in the Pests and Diseases Department of BORIF is equipped with gas liquid chromatographic apparatus. Pesticide residues in crops are analyzed using this equipment.

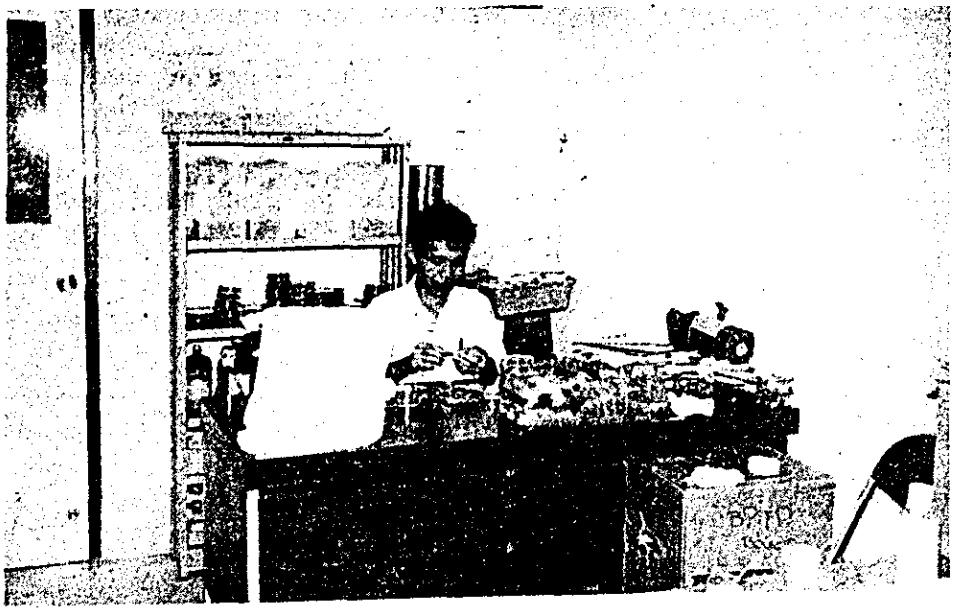

Figure 12. The biology of soybean pod- and leaf-eaters are studied in entomology laboratories in the Pests and Diseases Department of BORIF.

IV. 1. Studies on the seasonal prevalence, damage and control of the beanfly, Ophiomiya phaseoli (Tryon) as a pest of soybean

M. Okada, S. Abdurachman, M. Arifin and K. Nakayama

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.195-206 (English with Japanese Summary)

Two experiments were carried out in Muara experiment farm in 1979-1980, to study the seasonal prevalence of Ophiomiya phaseoli and cultural practices for controlling this beanfly. The prevalence study was executed by planting soybean 6 times at regular intervals between 23 July 1979 and 23 May 1980. An insecticide-treated plot was included at each planting date. The highest O. phaseoli population density occurred in the May planting, with peaks on the 6th and 25th to 26th days after planting. The second highest population density was observed in the July planting, with a peak on the 7th to 11th days after sowing. The beanfly was more abundant in the dry season than in the wet season. Large differences were observed on the growth between the insecticide-treated plot and the control plot at all planting times. Those plants that survived in untreated plots were shorter and had fewer nodules than those in the treated plots. Treated plots gave higher yields than the untreated plots. Six cultural practices were studied as follows: (1) plowing and rice stubble removed, (2) without plowing, stubble removed, (3) without plowing, rice stem cut 10 cm above ground and straw removed, (4) without plowing rice harvested with ani-ani hand-knife and rice stem left in the field, (5) without plowing, soil mulched with rice straw, (6) without plowing, soil mulched with straw for one week. These practices were compared to (7) plowing, with granular application of Furadan and (8) plowing and soybean plants sprayed with Azodrin. Damage to the soybean plants by O. phaseoli was assessed at 23 days after sowing. The lowest damage was observed in the Azodrin-treated plots, followed by the unplowed plots harvested with ani-ani, the Furudan-treated plots, and lastly in the plots with rice-straw mulching. Seedlings survived best in the Azodrin-treated plots, followed by the ani-ani-harvested plots. High yields were obtained from the plots with Azodrin-treatment and mulching with rice straw.

IV. 2. Comparative rearing test of common armyworm, Leucania separata Walker, on artificial diet and host plant, and pathogenicity of Leucania separata Nuclear polyhidrosis virus to the common armyworm

M. Okada and M. Arifin

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.207-215 (English with Japanese Summary)
* Seminar at CRIFC, Bogor, March 1981

Leucania separata larvae were collected from a corn field in Cikeumeuh experiment farm, Bogor. The armyworm was reared on an artificial diet and 9 different crops: corn, sorghum, sugarcane, rice, wheat, grass I, grass II, soybean and peanut. The following characteristics were observed: larval duration, number of larval instars, larval mortality, leaf area consumed by larva, larval weight, and width of capsule. The fastest larval development was observed in larvae reared on wheat (14.6 days) and the artificial diet (14.3 days). Six instars were observed in larvae fed on sorghum, wheat, soybean and the artificial diet, while on the other host plants the larvae had more than six instars. Larval mortality on the artificial diet was low compared to on the host plants. The largest leaf area eaten was observed on grass II. No significant difference among the host plants was observed in the larval weight, preoviposition and oviposition period, number of eggs per female, and longevity of adult female and male. The nuclear polyhidrosis virus (NPV) tested was Leucania separata NPV from Hiroshima Prefecture, Japan, collected in 1975. Serial ten-fold dilutions of the polyhedral suspension were made by using 0.1 % triton x-100 solution; 100 000 000 - 100 (PIBs)/ml of these were inoculated perorally to 1st to 5th instar larvae. Results showed that the LD50's of 1st, 2nd, 3rd, 4th and 5th instar larvae were respectively 4 x 1000, 4 x 1000, 8 x 1000, 4 x 10 000, and 4 x 100 000 (PIBs)/ml. The 1st to 3rd instars were the most susceptible. The 4th instar was resistant to the higher dosages of the polyhedro, while the 5th instar larvae showed 100 times greater resistance than the 1st instar larvae.

IV. 3. Some preliminary experiments for the studies on the population dynamics of the rice field rat, Rattus argentiventer, in Indonesia

S. Shiraishi

* Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA, 1982, p.217-228 (Japanese with English Summary)

In January to February 1981 when the rice plants were young, the population of rats in paddy fields near Sukamandi (West Java) was low. However a few rats were caught by digging their burrows in the dikes of irrigation channels. These rats were dissected to examine their reproductive status. It was confirmed that both male and female rats were in high breeding activity, and that their reproduction was synchronized with

the ripening period of rice in the field. Sixteen kinds of dye were tested for preference by rats and for their effect after ingestion. There was no sign of abnormal behavior or toxicity in any of the animals. As a result of these experiments the Japanese blue food dye (Kiriya, brilliant blue) was selected as being most suitable for tracking rat movements in the rice field.

IV. 4. Current problems of insect pests in major soybean-producing areas in Indonesia

A. Naito, Harnoto and Agus Iqbal

* Seminar at CRIFC, Bogor, 1983

In 1981, 1982 and 1983 surveys of pests in major Indonesian soybean-producing areas were conducted. These included field visits and interviews with agricultural extension staff and farmers in Java, West Sumatra, Aceh and South Sulawesi. The following were considered as important pests: Spodoptera litura, Etiella podborers, aphids, and Heliothis. Spodoptera outnumbered the other insect pests in almost all soybean areas. The Etiella population was high in Central Java (Brebes and Banyumas). E. hobsoni was also found in Sumatra and South Sulawesi. In Aceh no serious insect pest damage was found. There were indications that farmers did not always correctly use pesticides in terms of the proper choice of insecticide, dosage, time of application, and way of spraying.

IV. 5. Ecology of the soybean podborers Etiella zinckenella (Treitschke) and Etiella hobsoni (Butler)

A. Naito and Harnoto

* Contributions, Central Research Institute for Food Crops, Bogor, no.71, p.15-33, 1984
* Seminar at CRIFC, Bogor, October 1983

The ecology of Etiella zinckenella Treitschke and Etiella hobsoni Butler was studied in 1982-1983 at Bogor Research Institute for Food Crops. The development periods of E. zinckenella and E. hobsoni were about the same. Newly hatched larvae of E. zinckenella moved around on the pod for a longer time and covered a greater distance with more complex movements than E. hobsoni. There was a tendency for higher mortality at higher populations, especially with E. hobsoni. The two species were reproductively isolated. Most eggs obtained from the mating between insects of the same species hatched normally. A field survey showed the host plants of Etiella to be soybean, Crotalaria and Tephrosia. The population of Etiella larvae was low in the wet season (January to May) at Muara and Cikeumeuh experiment farms, Bogor.

IV. 6. Control of Etiella podborers on soybean

A. Naito, Harnoto and Agus Iqbal

* Penelitian Pertanian, 4(3), p.124-127, 1984 (English with Indonesian Abstract)
* Seminar at CRIFC, Bogor, October 1983

Two possible methods of controlling Etiella sp. podborers with resistant varieties and timely insecticide applications were studied. Orba and No. 29 soybean varieties were compared for their reaction to Etiella zinckenella and E. hobsoni. No evidence was found of resistance in either variety to podborers. Various times of insecticide application with monocrotophos were tested, i.e. 1, 2, 3, or 4 weeks after flowering and at combinations of these times. In a wet-season trial, two weeks after flowering was the best time for a single application, while in the dry season test a spraying at one week after flowering was the best. Two early sprayings were effective, resulting in 15 % less damage at high borer populations. Three and four sprayings at one-week intervals gave the lowest damage. The best times of application were two sprayings within 3 weeks after flowering.

IV. 7. Notes on the thrips (Thysanoptera) occurring on the soybean in Indonesia

M. Miyazaki, I. Kudo and Agus Iqbal

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.253-258 (Japanese with English Summary)
* Kontyu, Tokyo 52(4): 482-486, December 1984

Eight species of thrips collected in Java (West, Central and East Java) in March to May 1982 were as follows : (1) Scirtothrips dorsalis Hood, (2) Ayyaria chaetophora Karny, (3) Bathrips melanicornis (Schumsher Singh), (4) Franklinella schultzei (Trybom), (5) Megalurothrips usitatus (Bagnall), (6) Thrips orientalis (Bagnall), (7) Thrips palmi Karny, and (8) Haplotthrips gowdeyi (Franklin).

IV. 8. Aphids infesting leguminous crops in Indonesia, (Homoptera: Aphididae)

M. Miyazaki

* Report on Japan-Indonesia Joint Agricultural Research Project, JICA, 1984, p.253-258 (Japanese with English Summary)
* Seminar at CRIFC, Bogor, May 1982

Survey were made of aphid species and their relative abundance on soybean plants and other leguminous crops in Java in April-May 1982. Only one species, Aphis glycines, was found on soybean. Aphis craccifora

was found on Phaseolus, Dolichus and Phosphocarpus sp. A. craccifora population was high on mungbean, kidney-bean and winged-bean. Gliricida maculata (Leguminosae) is considered to be one of the important wild host plants of A. craccifora, while the wild hosts of A. glycines are unknown. Several natural enemies of Aphis glycine were also collected, comprising: Coccinelledae 8 species, Syrphidae 2 species, Chemaemyiidae 1 species, Chrysopidae 1 species, Aphidiidae (Hymenoptera) 1 species.

IV. 9. Natural enemies of soybean pests in Indonesia

K. Yamagishi and Agus Iqbal

* Mimeograph report, April 1985
* Seminar at CRIFC, Bogor, April 1985

A study of natural enemies of soybean pests was done by collecting (sweeping and use of yellow pan trap) in the field and by breeding the hosts in the laboratory. The parasites and predators collected were: Hymenoptera 16 species, Diptera 3 species, Coleoptera 3 species and Araneae 2 species. Parasites emerging from hosts bred in the laboratory were: one Selionidae from eggs of Piezodorus; one Braconidae and one Elasmidae from larvae of Lamprosema; two Braconidae, one Ichneumonidae and one Tachinidae from larva of Etiella; two Tachinidae from Heliothis larvae; two Braconidae from larvae of Agromizidae; and one Eurytomidae and one Eupelmidae from larvae of Asphondylia. The midge Asphondyllia was found in abundance in Muara and Cikeumeuh (Bogor), and it was assumed that it is also important on soybean. More attention should be paid to this insect.

IV.10. Improved rearing method of Etiella spp.

K. Honma, Toto Djuwarso and Harnoto

* Seminar at BORIF, Bogor, May 1985

After they emerge from soybean pods, Etiella larvae go into the soil to pupate. Using soil for rearing Etiella in the laboratory is unsuitable because the soil may clod when dry. A new method of Etiella rearing has been developed using sawdust instead of soil. The cocoons can then be obtained by sifting. They are then put into a simple screen cage (16 x 23 x 25 cm) made of nylon gauze, and closed with a rubber band. After emergence, the moths are transferred to another cage using a small test tube. These gauze cages can also be used for oviposition tests, with soybean pods placed in the cage and replaced every day. Three days after oviposition, pods with eggs are placed in a petridish with new pods, and the newly-hatched larvae burrow into them. A week later, the pods are opened and the larvae are transferred to a small container with some moistened soybean seed and covered with plastic wrap. One week after this, the container is placed into the sawdust in a plastic box, and most larvae enter the sawdust to pupate.

IV.11. Standardization of yellow sticky traps for survey of Bemisia tabaci (white fly)

K. Nakazawa, Toto Djuwarso and K. Honma

* Mimeograph report, October 1985
* Seminar at CRIFC, Bogor, October 1985

Several experiments and observations were carried out to obtain basic data for the standardization of yellow sticky traps as a tool in monitoring white fly (Bemisia tabaci) populations. Based on experiments conducted, we recommend that the trap should be made of plastic plate, painted lemon yellow with a high specific reflectance in the wavelengths greater than 500 nm. The size should be 20 cm x 25 cm x 3 mm, the shape rectangular, and tanglefoot should be applied on the surface only. The trap should be positioned vertically near the ground, but may be raised as the crop grows. The catch should be counted between 12.00-14.00 every 5 days or twice a week. Using such a trap, other insect species may also be caught, such as Agromyza sp. and Empoasca sp.

IV.12. Notes on the morphology and distribution of Etiella hobsoni (Butler), a new soybean podborer in Indonesia, with special reference to comparisons with Etiella zinckenella (Treitschke) (Lepidoptera: Pyralidae)

A. Naito, Harnoto, Agus Iqbal and I. Hattori

* Appl. Ent. Zool. 21(1): p.81-88, 1986
* Seminar at CRIFC, Bogor, June 1983
"Podborer Etiella hobsoni (Butler) of soybean in Indonesia"

This paper deals with the identification of a new podborer of soybean, Etiella hobsoni, its morphology and its geographical distribution in Indonesia. Externally E. hobsoni cannot be clearly separated from E. zinckenella, because they have the same morphological characters and cause similar damage. The shape and position of the adfront and the vertical triangle are an easier character by which to distinguish E. hobsoni from E. zinckenella. E. hobsoni is abundant in West and Central Java but rather rare in East Java. This insect is also distributed in Sumatra and Sulawesi and is assumed to be found also in other Indonesian islands, while E. zinckenella is known to be distributed in all over Indonesia.

IV.13. Mechanism of resistance to pod borers in the soybean variety No. 29

K. Honma, T. Djuwarso, Harnoto and Agus Iqbal

* Mimeograph report, January 1986
* Seminar at CRIFC, Bogor, January 1986

In order to analyze the mechanism of resistance to podborers (Etiella spp.), a series of experiments was carried out using two soybean varieties, No. 29 (resistant) and Orba (susceptible). In a field experiment, No. 29 had fewer damaged pods and seeds, despite a larger number of total pods and seeds than Orba, even though their flowering times were regulated to coincide. Therefore, the mechanism of resistance in No. 29 seems to be independent of the number of pods or seeds and the later maturity of this variety. The mortality of larvae, and their failure to penetrate the surface of the pods of both varieties showed no significant difference. The preference of oviposition in E. zinckenella seemed to be a probable factor of resistance; however, this was not detected in E.hobsoni.

IV.14. Time of emergence of Etiella zinckenella and E. hobsoni

K. Honma and Harnoto

* Mimeograph report, January 1986

The emergence time of Etiella zinckenella (Treitschke) and E. hobsoni from the cocoon were observed under natural light cycles in the laboratory and in the field. Both species emerged beginning from slightly before 17.00 each evening, and 74-87 % of the moths had emerged before 01.00. No moths emerged between sunrise and the following afternoon. No differences in behavior were detected between the two species.

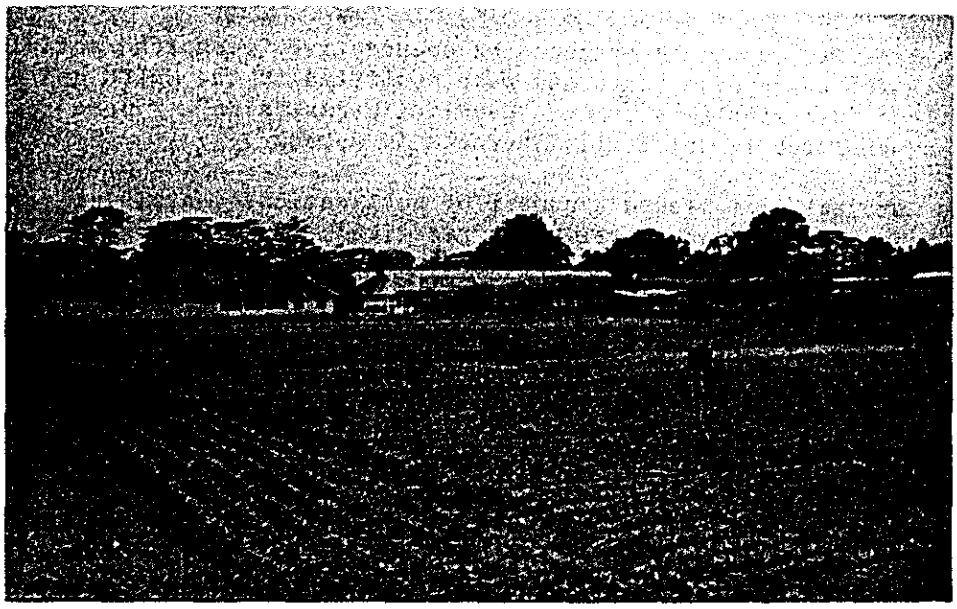

Figure 13. Part of Cikeumeuh experiment farm, which required a sprinkle-irrigation system. Such a system was installed by the Project in 1981.

Figure 14. A crop of soybean for seed production at Cikeumeuh experiment farm of BORIF.

Presentation and publication of research results

The results obtained through the cooperative research activities were presented through seminars and were submitted to the CRIFC and BORIF publications "Contributions", and "Penelitian Pertanian". Some results were also submitted to scientific journals in Japan.

The project also issued a number of publications containing results and guidelines considered important to practical aspects of agriculture. These have been distributed to researchers and persons in various fields related to agricultural production. The following is a list of these publications :

1. Analytical method for cadmium (Cd) in soil and crops (Analisa Kadmium (Cd) tanah dan tanaman)
   by Yuita, M. Nakashimada, A. Hidayat and Irwan Nasution
   4 April 1983

2. Standards of soybean survey (Standard survey kedelai)
   by S. Nakamura, S. Somaatmadja and Y. Hozyo
   4 April 1983

3. Diagnosis of nitrogen status in soybean and rice by leaf color (Diagnosis status hara nitrogen kedelai dan padi berdasarkan warna daun)
   by M. Ismunadji, I. Zulkarnaini, S. Partohardjono and F. Yazawa
   1985

4. Illustrated guide to soybean pest and disease identification in Indonesia (Petunjuk bergambar untuk identifikasi hama dan penyakit kedelai di Indonesia)
   by M. Ismunadji, S. Partohardjono, M. Fathan, Sismiyati Roechan, Siti Ningrum, A.K. Makarim, Murtado, F. Yazawa, Harnoto, Agus Iqbal, K. Honma, A. Naito, K. Yamagishi, D.M. Tantera, Mukelar Amir, M. Machmud, Roecham Martoatmodjo, M. Sudjadi, Nasir Saleh, Edi Soetarwo, K. Matsumoto, M. Iwaki and N. Iizuka
   October 1985

   (This book describes the distribution, occurrence, symptoms, and control methods of 16 physiological disorders, 16 pests, and 11 diseases of soybean in Indonesia, It is written in Indonesian, and contains 113 illustrations. It is aimed at field staff of the Ministry of Agriculture, students, and the general public.)

5. Research Report of Japan-Indonesia Joint Agricultural Research Project, JICA
   April 1982

   (Contains 2 articles in Japanese, 21 articles in English, 2 articles in Indonesian.)

6. Report on Japan-Indonesia Joint Agricultural Research Project, JICA
   November 1982
   (Contains 16 articles in Japanese with English summaries.)

LIST OF SEMINARS AND PUBLICATIONS

I AGRONOMY

No.	Title	Name of Expert and Counterpart	Publication
I-1.	Effect of sowing dates on rice seedling characters	S.Partohardjono, Hendrik V., L. Sukarno and N. Ishikura	* Contr.Centr.Res.Inst. Agric., Bogor, no.62, p.1-11, 1980 * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.55-60 (English with Japanese Summary) * Seminar, Bogor, February 1981
I-2.	Effect of nitrogen application on yield and yield components of lowland rice following soybean	S.Partohardjono, Hendrik V., L. Sukarno and N. Ishikura	* Contr.Centr.Res.Inst. Food Crops, Bogor, no.65, p.12-24, 1981 * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p. 49-54 (English with Japanese Summary)
I-3.	Effect of transplanting time on yield and yield components of lowland rice	S.Partohardjono, Hendrik V., and N. Ishikura	* Contr.Centr.Res.Inst. Food Crops, Bogor, no.66, p.13-20, 1981 * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p. 61-65 (English with Japanese Summary) * Seminar, Bogor, February 1981

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
I-4.	Status of agriculture and soybean cultivation in Java	K. Nakayama	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.1-18 (Japanese)
I-5.	Studies on drainage during the ripening of lowland rice	S.Partohardjono, Hendrik V., and N. Ishikura	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.45-47 (English with Japanese Summary)
I-6.	Effect of 2,4-D on the growth of indica and japonica rice varieties in different temperature conditions	M. Sundaru and K. Nakayama	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.75-84 (English with Japanese Summary)
I-7.	Cultivation method of soybean planted after lowland rice	K. Nakayama, S.Sumadi, S. Abdurahman, Adisarwanto, and M. Okada	* Contr.Centr.Res.Inst. Food Crops, Bogor, no.70, p.1-21, 1983 * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p. 19-30 (English with Japanese Summary) * Seminar at CRIFC, Bogor, May 1981
I-8.	Effect of tillage, fertilization and irrigation on weed occurrence in soybean	K. Nakayama, Sudiman, and Adisarwanto	* Penelitian Pertanian 4(1) p.40-43, 1984 (English with Indosian abstract) * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p. 67-73 (English with Japanese Summary) * Seminar at CRIFC, Bogor, May 1980

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
I-9.	Achievements in soybean breeding	S. Nakamura, S. Somaatmadja, and Y. Hozyo	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.31-39 (Japanese with English Summary)
	9-1. Standard of soybean survey		* Japan-Indonesia Joint Agroc. Res. Project, ATA-218, Bogor, April 1983, 55 p. * Seminar at BORIF, Bogor, April 1983
	9-2. Investigation of simple selection for Al-tolerance in soybean based on seedling root growth in Al-solution		* Seminar at BORIF, Bogor, April 1983
	9-3. Variety test for breeding of high yielding soybean		
I-10.	Growth of soybean as affected by plant density	H. Takagi and S. Sumadi	* Penelitian Pertanian 4(2) p.83-86, 1984 (English with Indonesian Abstract) * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p. 39-43 (Japanese with English Summary)
I-11.	Productive characters of sweet potato (Ipomoea batatas Lam.)	Y. Hozyo, M. Megawati and Wargiono Hadi	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.41-53 (Japanese with English Summary) * Seminar at CRIFC, Bogor, June 1983

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
I-12.	Productive characters of soybean (G. max Merr)	Y. Hozyo and Djuber Pasaribu	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.54-67 Japanese with English Summary) * Seminar at CRIFC, Bogor, June 1983
I-13.	Effect of soil moisture content during the ripening period of lowland rice	H. Kobayashi, S. Partohardjono and E. Kosman	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.80-86 (Japanese with English Summary)
I-14.	Difference of growth and yield of lowland rice following soybean crop among locations, amounts of nitrogen fertilizer and varieties	H. Kobayashi, S.Partohardjono, E. Kosman and Ruchiat Damanhuri	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.87-102 (Japanese with English Summary)
I-15.	Effect of varieties, locations, and cropping seasons on growth periods of lowland rice	H. Kobayashi, S. Partohardjono and E. Kosman	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.103-113 (Japanese with English Summary)
I-16.	Salvinia molesta, a floating aquating weed in Indonesia and response to some paddy herbicides	H. Pane, M. Sundaru and J. Harada	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.114-119 (Japanese with English Summary)
I-17.	Distribution and some characteristics of Mimosa weed species in Indonesia	J. Harada, H. Pane and M. Sundaru	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.121-135 (Japanese with English Summary)

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
I-18.	Simple screening method against to Al-toxicity of soybean cultivars	H. Mikoshiba, and S. Somaatmadja	* Mimeograph report, December 1984 * Seminar at CRIFC, Bogor, December 1984
I-19.	Plant production and potential productivity of cassava (Manihot esculenta Crantz)	Y. Hozyo, M. Megawati and J. Wargiono	* Contr.Centr.Res.Inst. Food Crops, 1984 * Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.68-79 (Japanese with English Summary) * Seminar at CRIFC, Bogor, June 1983
I-20.	Root development of soybean in acid soil with different exchangeable aluminium contents	H. Mikoshiba, S. Somaatmadja and I.V.Sutarto	* Mimeograph report, April 1985 * Seminar at CRIFC, Bogor, April 1985
I-21.	Chemical nature of acid soils and Japanese experience to ameliorate them	A. Tanaka	* Seminar Pengapuran Tanah Masam untuk Peningkatan Produksi Tanaman Pangan, Jakarta, September 1985
I-22.	Techniques of liming for soybean production on acid soil	Y. Izumiyama, S. Sumadi, Djuber Pasaribu and Novianti S.	* Mimeograph report, October 1985 * Seminar at CRIFC, Bogor, October 1985

II PLANT PHYSIOLOGY

No.	Title	Name of Expert and Counterpart	Publication
II-1.	Studies on the germination of soybean seeds	T. Fujimoto, A. Choliluddin, M. Fatchurochim and M. Ismunadji	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p. 37-37 (English with Japanese Summary) * Seminar at CRIFC, Bogor, March 1981
II-2.	Effect of urea application on growth, yield and nitrogen uptake on soybean	T. Fujimoto, A. Choliluddin, M. Fatchurochim and M. Ismunadji	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.85-90 (English with Japanese Summary)
II-3.	Varietal differences in plant growth and nutrient uptake of soybean in Indonesia	T. Fujimoto, A. Choliluddin, M. Fatchurochim and M. Ismunadji	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.91-97 (English with Japanese Summary)
II-4.	An estimation of nitrogen fixation by soybean root nodules	T. Fujimoto, M. Kuwahara, A.Choliluddin, M.Fatchurochim and M. Ismunadji	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.99-101 (English with Japanese Summary)
II-5.	Behavior of nitrogen in dryland soil	A. Hidayat, T. Fujimoto and M. Ismunadji	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.103-110 (Indonesian with Japanese Summary) * Seminar at CRIFC, Bogor, March 1981
II-6.	Influence of urea application on the behavior of nitrogen in the latosol at Muara experiment station	A. Hidayat, M. Zaini, T. Fujimoto, and M. Ismunadji	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.111-118 (Indonesian)

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
II-7.	Excessive absorption by crops of iodine and bromine accumulated in soils measured using radioisotope techniques	K. Yuita	* Seminar at CRIFC, Bogor, December 1982
II-8.	Analytical method of Cadmium (Cd) in soil and crops	K. Yuita, M. Nakashimada, A. Hidayat, Sismiyati R., and I. Nasution	* Japan-Indonesia Joint Agric. Res. Project, ATA-218, Bogor, 1983, 59 p.
II-9.	Improvement of production storage and germination of soybean seed	M. Nakashimada, Murtado and Ratna Fathan	* Seminar at CRIFC, Bogor, October 1983
II-10.	Study on the response of soybean to fertilizer	M. Nashimada, Ratna F., and Sismiyati R.	* Seminar at CRIFC, Bogor, October 1983
II-11.	Diagnosis of nutritional status in legume crops	M. Imanishi, Murtado, Siti Ningrum and M. Nakashimada	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.139-147 (Japanese with English Summary) * Seminar at CRIFC, Bogor, February 1983
II-12.	The appraisal for the existence of arable land pollution of cadmium, zinc and copper, and the content levels of these heavy metals in Java	K. Yuita, M. Nakashimada, A. Hidayat, Sismiyati R., and I. Nasution	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.149-161 (Japanese with English Summary)
II-13.	Effect of Mo and B on the growth and acetylene-reducing activity of legumes	J. Ishizuka, Murtado, F. Yazawa and M. Ismunadji	* Mimeograph report, 1984 * Seminar at CRIFC, Bogor, November 1984

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
II-14.	Mo and B nutritional status of soybean in West and Central Java	J. Ishizuka, Murtado, F. Yazawa and M. Ismunadji	* Mimeograph report, 1984 * Seminar at CRIFC, Bogor, November 1984
II-15.	Effect of nitrogen application on the physiological characteristics of corn and soybean varieties	Ratna Fathan and F. Yazawa	* Mimeograph report, 1984 (Indonesian with English Summary)
II-16.	Diagnosis of nitrogen status in soybean and rice by leaf color	M. Ismunadji, I. Zulkarnaini, Soetjipto Ph, and F. Yazawa	* The Strengthening of Legumes in Relation to Cropping Systems Research Project, (ATA-218), 1985, 10p. (Indonesian)
II-17.	Physiological disorders, especially aluminium in soybean on acid soil	S. Akao, I. Nasution, and F. Yazawa	* Mimeograph report, 1985 * Seminar at CRIFC Bogor, September 1985
II-18.	Relationship between leaf color and growth, yield and yield components, chlorophyll content and nitrogen content in paddy rice	R. Suhadi, I. Zulkarnaini, F. Yazawa and I. Nasution	* Mimeograph report, 1985 (Indonesian with English Summary) * Seminar, Bogor, October 1985
II-19.	Physiological disorders of soybean	F. Yazawa	* Mimeograph report, 1985 * Seminar at CRIFC, Bogor, October 1985

III PLANT PATHOLOGY

No.	Title	Name of Expert and Counterpart	Publication
III-1.	Causal agents of cassava bacterial wilt in Indonesia	K. Nishiyama, Nunung H.Achmad, Suparman W., and T. Yamaguchi	* Contr.Centr.Res.Inst. Agric., Bogor, no.59, p.1-9, 1980 * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.157-168 (English with Japanese Summary)
III-2.	Surveys on the occurrence of soybean and mungbean disease in Indonesia	T. Yamaguchi et al.	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.119-122 (English with Japanese Summary)
III-3.	Rhizoctonia rot on mungbean	T. Yamaguchi, Mukelar Amir and D.M. Tantera	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.127-131 (English with Japanese Summary)
III-4.	Treatment and storage of seed corn for the control of Java corn downy mildew	Masdiar B., Yusuf S., and T. Yamaguchi	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.145-156 (English with Japanese Summary)
III-5.	Interim report of the research on races of Pyricularia oryzae and the varietal resistance of rice in Indonesia	R. Yoshino and Otjim Sumantri	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.169-193 (English with Japanese Summary)
III-6.	Nematode survey on upland fields in Java with special reference to soybean fields	T. Nishizawa	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.165-185 (Japanese with English Summary)

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
III-7.	Chemical control of rice sheath blight in Indonesia	M. Herman, Wagiman and T. Yamaguchi	* Contr.Centr.Res.Inst. Food Crops, Bogor, no.72, p.12-23, 1984 * Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.133-144 (English with Japanese Summary) * Seminar at CRIFC, Bogor, August 1981
III-8.	Hyphal anastomosis groups of Rhizoctonia solani Kuhn in Indonesia	T. Yamaguchi, Kosim Kardin, Wagiman and D.M. Tantera	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.123-126 (English with Japanese Summary) * Penelitian Pertanian 4(1) p.26-28, 1984 (English with Indonesian abstract)
III-9.	Primary infection sources of Cercospora leaf spot of mungbean	N. Narisawa and Mukelar Amir	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.187-195 (Japanese with English Summary) * Seminar at CRIFC, Bogor, January 1984
III-10.	Effect of seed dressing with Topsin-M to control powdery mildew of mungbean	N. Narisawa and Mukelar Amir	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.197-203 (Japanese with English Summary) * Seminar at CRIFC, Bogor, January 1984
III-11.	Effect of seed dressing with Topsin-M and Benlate-T to control leaf spot and southern blight of peanuts	N. Narisawa and Otjim Sumantri	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.205-207 (Japanese with English Summary)

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
III-12.	Computerized weather database systems for 10 Indonesian food crops experiment farms	K. Matsumoto and Edi Sutarwo	* Mimeograph report
III-13.	Virus diseases of soybean in Indonesia	N. Iizuka	* Mimeograph report, 1984 * Seminar at CRIFC, Bogor, October 1984
III-14.	Survey on soybean viral diseases in Java	K. Matsumoto, N. Iizuka and Mukelar Amir	* Mimeograph report, 1984
III-15.	Bakanae disease of rice caused by Fusarium sp.: A survey	K. Matsumoto and Mukelar Amir	* Mimeograph report, 1984
III-16.	Cercospora leaf spot of peanut, mungbean, and cowpea in Indonesia	T. Inaba, Mukelar Amir, Sudjadi M., and K. Matsumoto	* Mimeograph report, 1985 * Seminar at CRIFC, Bogor, October 1985

IV ENTOMOLOGY

No.	Title	Name of Expert and Counterpart	Publication
IV-1.	Studies on the seasonal prevalence, damage and control of the beanfly, Ophiomyia phaseoli (Tryon) as a pest of soybean	M. Okada, S.Abdurachman, M. Arifin and K. Nakayama	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.195-206 (English with Japanese Summary)
IV-2.	Comparative rearing test of the common armyworm, Leucania separata Walker on artificial diet and host plant, and pathogenicity of Leucania separata Nuclear Polyhidrosis virus to the common armyworm.	M. Okada and M. Arifin	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.207-215 (English with Japanese Summary) * Seminar at CRIFC, Bogor, March 1981
IV-3.	Some preliminary experiments for the studies on the population dynamics of the rice field rat, Rattus argentiventer, in Indonesia	S. Shiraishi	* Research Report of Japan-Indonesia Joint Agric. Res. Project, JICA, 1982, p.217-228 (Japanese with English Summary)
IV-4.	Current problems of insect pests in major soybean	A. Naito, Harnoto and Agus Iqbal	* Seminar at CRIFC, Bogor, June 1983
IV-5.	Ecology of the soybean podborers Etiella zinckenella Treitschke and Etiella hobsoni Butler	A. Naito and Harnoto	* Contr.Centr.Res.Inst. Food Crops, Bogor, no.71, p.15-33, 1984 * Seminar at CRIFC, Bogor, October 1983
IV-6.	Control of Etiella podborers on soybean	Harnoto, A. Naito and Agus Iqbal	* Penelitian Pertanian 4(3) p.124-127, 1984 (English with Indonesian abstract) * Seminar at CRIFC, Bogor, October 1984

List of seminars and publications (continued)

No.	Title	Name of Expert and Counterpart	Publication
IV-7.	Notes on the thrips (Thysanoptera) occurring on the soybean in Indonesia	M. Miyazaki, I. Kudo and Agus Iqbal	* Kontyu, Tokyo 52(4): 482 - 486 December 1984
IV-8.	Aphids infesting leguminous crops in Indonesia, (Homoptera: Aphididae)	M. Miyazaki	* Report on Japan-Indonesia Joint Agric. Res. Project, JICA, 1984, p.253-258 (Japanese with English Summary) * Seminar at CRIFC, Bogor, May 1982
IV-9.	Natural enemies of soybean pests in Indonesia	K. Yamagishi and Agus Iqbal	* Mimeograph report, April 1985 * Seminar at CRIFC, Bogor, April 1985
IV-10.	Improved rearing method of Etiella spp.	K. Honma, Toto Djuwarso and Harnoto	* Seminar at BORIF, Bogor, May 1985
IV-11.	Standardization of yellow sticky traps for survey of Bemisia tabaci (white fly)	K. Nakazawa, Toto Djuwarso and K. Honma	* Mimeograph report, October 1985 * Seminar at CRIFC, Bogor, October 1984
IV-12.	Notes on the morphology and distribution of Etiella hobsoni (Butler), a new soybean podborer in Indonesia, with special reference to comparisons with Etiella zinckenella (Treitschke)	A. Naito, Harnoto, Agus Iqbal and I. Hattori	* Appl. Ent. Zool. 21(1): p.81-88, 1986 * Seminar at CRIFC, Bogor, June 1983
IV-13.	Mechanism of resistance to podborers in the soybean variety No. 29	K. Honma, Toto Djuwarso,	* Mimeograph report, January 1986 * Seminar at CRIFC, Bogor, January 1986
IV-14.	Time of emergence of Etiella zinckenella and E. hobsoni	K. Honma and Harnoto	* Mimeograph report, January 1986

CONCLUSION

The technical cooperation between Indonesia and Japan in the project "Strengthening of Legumes in Relation to Cropping Systems Research" (ATA-218) was implemented from 1978 to 1985. It has successfully achieved its objectives.

This project involved the appointment of 19 long-term and 24 short-term Japanese experts in CRIFC and BORIF. Facilities and working conditions at these institutes have much improved through the construction of laboratory and greenhouse facilities, provision of instruments and machines, and the training of Indonesian research staff in Japan in various fields.

A total of 39 Indonesian researchers have been trained, 2 of whom have obtained doctoral degrees, one in agronomy (weed science) and one in plant pathology (mycology). Other training has covered a variety of activities, including agricultural machinery, crop cultivation, communication, research management, agronomy, plant pathology, entomology, plant physiology, analysis of pesticide residues, weed control, etc. This training has enable a better understanding and cooperation between researchers in the two countries. It has given a valuable chance for the Indonesian personnel to work in intensive research using advanced technology in Japan. The Japanese researchers have obtained valuable experience in working with tropical crops grown in their natural environment.

Many research findings have been obtained during the period of cooperation. These have been reported in seminars and symposia, and in scientific publications. Valuable information has been obtained in the fields of agronomy, physiology, biology and control of diseases and pests, and breeding methodology. New techniques have been implemented in research. Much scientific and practical information has been contributed on various aspects of legume production.

This 7-year program further deepened the understanding between scientists of both countries. We hope that this kind of cooperation will be continued in the future.

APPENDICES

I. The Record of Discussions between the Japanese Project Formulation Team and the authorities concerned of the Republic of Indonesia on the technical cooperation for the Strengthening of Legumes in Relation to Cropping Systems Research Project (ATA-218).

II. The Record of Discussions on extension of the period of the technical cooperation for the Strengthening of Legumes in Relation to Cropping Systems Research Project.

III. Dispatch of Japanese experts.

IV. Study/training in Japan.

APPENDIX I

RECORD OF DISCUSSIONS
between the Japanese Project Formulation Team
and the authorities concerned of the Republic of Indonesia
on the technical cooperation for the Strengthening of Legumes
in Relation to Cropping Systems Research Project (ATA-218)

The Japanese Project Formulation Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as JICA) and headed by Mr. Shigeo Kitano visited the Republic of Indonesia from 5 to 12 October 1978 for the purpose of working out the details of the technical cooperation program concerning the Strengthening of Legumes in Relation to Cropping Systems Research Project in the Republic of Indonesia.

During its stay in the Republic of Indonesia, the Team exchanged views and had a series of discussions with the Indonesian authorities concerned in respect of the desirable measures to be taken by both Governments for the successful implementation of the above-mentioned Project.

As a result of the discussions, the Team and the Indonesian authorities concerned considered that Japan-Indonesia Joint Food Crop Research Program under the Agreement between the Government of Japan and the Government of the Republic of Indonesia signed at Jakarta on 23 October 1970 has achieved its expected results and accordingly agreed to recommended to their respective Governments the matters referred to in the document attached hereto.

Jakarta, 12 October 1978

S. Kitano

Shigeo Kitano
Leader
Japanese Project
Formulation Team

Rusli Hakim
Director
Central Research Institute
for Agriculture

ATTACHED DOCUMENT
to the Record of Discussions

I. Cooperation between the Government of Japan and the Government of Indonesia for the Strengthening of Legumes in Re;ation to Cropping Systems Research Project

1. The Government of Japan and the Government of the Republic of Indonesia will cooperate with each other in implementing the Strengthening of Legumes in Relation to Cropping Systems Research Project (hereinafter referred to as "the Project") for the purpose of strengthening research activities on legumes and other food crops (rice, corn, tuber crops) as component in cropping system.

2. The Project will be implemented with the Master Plan which is given in Annex I.

3. The Project will be managed by the Joint Committee referred to in VI-2, in accordance with the annual work plan to be formulated in line with the Master Plan referred to in (2) above.

II. Dispatch of Japanese Experts

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expenses services of the Japanese experts as listed in Annex II through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The Japanese experts referred to in (1) above and their families will be granted in the Republic of Indonesia the privileges, exemptions and benefits no less favorable than those accorded to experts of third countries working in the Republic of Indonesia under the Colombo Plan Technical Cooperation Scheme, and will include the following :

(1) Exemption from income tax and charges of any kind imposed on or in connection with the living allowances remitted from abroad

(2) Exemption from import and export duties and any other charges imposed in respect of personal and household effects which may be brought into from abroad or taken out of the Republic of Indonesia

(3) Exemption from import tax, import sales tax, sales tax, and other taxes and charges of any kind imposed on or in connection with the purchase in the Republic of Indonesia by the Japanese Experts of one motor vehicle per each expert

(4) Free local medical services and facilities to the Japanese Experts and their families.

III. Provision of Machinery and Equipment

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense such machinery, equipment and other materials necessary for the implementation of the Project as listed in Annex III, through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The articles referred to in (1) above will become the property of the Government of the Republic of Indonesia upon being delivered c.i.f. to the Indonesian authorities concerned at the ports and/or airports of disembarkation, and will be utilized exclusively for the implementation of the Project in consultation with the Japanese Team Leader referred to in Annex II.

IV. Training of Indonesian Personnel in Japan

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive its own expense the Indonesian personnel connected with the Project for technical training or observation tours in Japan through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The Government of the Republic of Indonesia will take necessary measures to ensure that the knowledge and experience acquired by the Indonesian personnel from technical training in Japan will be utilized effectively for the implementation of the Project.

V. Measures to be Taken by the Government of the Republic of Indonesia

1. In accordance with the laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to provide at its own expense :

(1) Services of the Indonesian counterpart personnel and administrative personnel as listed in Annex IV

(2) Land, buildings and facilities as well as incidental facilities thereto for the Project as listed in Annex V

(3) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than those provided through JICA under III above

(4) Transportation facilities and travel allowance for the Japanese experts for official travel within the Republic of Indonesia

(5) Existing suitably furnished accommodation for the Japanese experts and their families.

In addition, all equipment and machinery available at the Central Research Institute for Agriculture as well as those provided through JICA may be used for implementing the Project.

2. In accordance with the laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to meet:

(1) Expenses necessary for the transportation within the Republic of Indonesia of the articles referred to in III above as well as for the installation, operation and maintenance thereof

(2) Customs duties, internal taxes and any other charges imposed in the Republic of Indonesia on the articles referred to in III above

(3) All running expenses necessary for the implementation of the Project.

VI. Administration of the Project

1. The Director of the Central Research Institute for Agriculture of the Agency for Agricultural Research and Development will be responsible for the administration and implementation of the Project, and the Japanese experts will provide necessary technical guidance and advice for implementation of the Project.

2. For the effective implementation of the Project, a Joint Committee consisting of the members as listed in Annex VI, will be established and meet at least once a year. The Committee will formulate details of the Master Plan referred to in paragraph I and the annual operation work plan of the Project. The details of the Master Plan and of the annual operation work plan will be submitted to the authorities concerned of the two Governments for the approval.

3. The Project will be implemented with close cooperation extended by the related agencies and institutions concerned of the Republic of Indonesia.

VII. Claims against Japanese Experts

The Government of the Republic of Indonesia undertakes to bear claims, if any arise, against the Japanese experts engaged in the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the Republic of Indonesia except for those claims arising from the wilful misconduct or gross negligence of the Japanese experts.

VIII. Mutual Consultation

There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

IX. Term of Cooperation

The duration of the technical cooperation for the Project under this Attached Document will be five (5) years from 23 October 1978.

ANNEX I MASTER PLAN

1. With a view to developing package of technology on food crops production suitable for agro-climatic conditions in the Republic of Indonesia, the Project will be carried out for strengthening research activities on legumes and other food crops (rice, corn, tuber crops) as components in cropping systems at the Central Research Institute for Agriculture, Bogor (hereinafter referred to as "CRIA").

2. The Project will consist of the following activities:

   (1) Research work on the component technology of cropping system through an interdisciplinary approach on the following themes:
   - (a) Breeding techniques of legumes and other secondary crops
   - (b) Cultivation practices for legumes and other secondary crops
   - (c) Water management
   - (d) Application methods of fertilizer, conservation and improvement of soil productivity
   - (e) Weed control
   - (f) Plant physiology
   - (g) Plant protection

   (2) Exchange of information, samples, materials and research reports

   (3) Development of research capabilities of the Indonesian researchers in the fields mentioned in (1) above

   (4) Other activities to be agreed upon between the authorities concerned of the two Governments

3. The activities mentioned in (2) above will also be conducted at appropriate experimental stations of CRIA and farmers fields.

ANNEX II JAPANESE EXPERTS

1. Leader

2. Researchers covering the following fields:
   (1) Upland/secondary crops cultivation
   (2) Rice agronomy/cultivation
   (3) Plant physiology
   (4) Plant pathology
   (5) Entomology

3. Coordinator/liaison officer

Note: Some additional short-term experts in the fields noted in (2) above and other fields when necessities arise.

ANNEX III ARTICLES TO BE PROVIDED BY THE GOVERNMENT OF JAPAN

1. Equipment, machinery, instruments, tools, spare parts and other materials for laboratory work
2. Equipment, machinery, instruments, tools, spare parts and other materials for field work
3. Fertilizers, pesticides and materials for chemical control
4. Audio-visual aids and articles
5. Vehicles
6. Books and other necessary printed matter
7. Other necessary minor equipment and materials

ANNEX IV LIST OF INDONESIAN STAFF

1. Project Leader
2. Counterpart researchers to the Japanese researchers
3. Laboratory assistants
4. Field workers
5. Clerical and service personnel including typists, clerks, drivers, etc.

ANNEX V LIST OF LAND, BUILDINGS, AND OTHER INCIDENTAL FACILITIES

1. Plant protection research building
2. Offices for Japanese experts
3. Laboratories
4. Glasshouses and greenhouses
5. Experimental farm land
6. Garages
7. Facilities for storing equipment, machinery and other materials for the implementation of the Project.

ANNEX VI COMPOSITION OF THE JOINT COMMITTEE

1. Chairman: Director of the Central Research Institute for Agriculture of the Agency for Agricultural Research and Development

2. Indonesian side:

   (1) Project leader
   (2) Heads of divisions of CRIA related to the Project
   (3) Other personnel appointed by the Chairman

3. Japanese side:

   (1) Team leader
   (2) Experts designated by team leader
   (3) Coordinator/liaison officer
   (4) Representative of Japan International Cooperation Agency

Note: Officials of the Embassy of Japan may attend the Joint Committee as observers.

APPENDIX II

RECORD OF DISCUSSIONS
on Extension of the Period of the Technical Cooperation
for the Strengthening of Legumes in Relation to
Cropping Systems Research Project

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), with regard to the recommendation made by the Indonesian and Japanese Joint Evaluation Team which conducted the evaluation survey from 2 to 9 August 1983, had a series of discussions, through the Resident Representative of JICA in Indonesia, Mr. Hiroshi Yamamura, with the authorities concerned of the Government of Indonesia in view of the extension of the period of the technical cooperation for the Strengthening of Legumes in Relation to Cropping Systems Research Project (ATA-218) based on the Record of Discussions (hereinafter referred to as "R/D") which was signed in Jakarta on 12 October 1978 and will be terminated on 22 October 1983.

As a result of the discussions, JICA and the authorities concerned of the Government of Indonesia agreed to recommend to their respective Governments to amend Annex I, II, and III of the above-mentioned R/D as attached hereto and to carry out a follow-up cooperation and to extend the project on the basis of this amended R/D until 22 October 1985 in order to attain the anticipated objectives of the technical cooperation. In addition, both sides also agreed the Central Research Institute of Agriculture referred to in the above-mentioned R/D should be interpreted as the Central Research Institute for Food Crops (hereinafter referred to as "CRIFC").

Jakarta, 14 September 1983

Dr. Bernard Hendrik Siwi

Director, Central
Research Institute
for Food Crops

Hiroshi Yamamura

Resident Representative
Japan International
Cooperation Agency

ANNEX I MASTER PLAN

1. With a view to developing packages of technology on food crops production suitable for agro-climatic conditions in the Republic of Indonesia, the project will be carried out for strengthening research activities on legumes and other secondary crops as components in cropping systems at CRIFC, Bogor.

2. The Project will consist of the following activities:

   (1) Research work on the component technology of cropping systems through interdisciplinary approach on the following themes:
   - (a) Breeding techniques of legumes and other secondary crops
   - (b) Cultivation practices for legumes and other secondary crops
   - (c) Plant physiology
   - (d) Plant protection

   (2) Exchange of information, samplesa, materials and research reports

   (3) Development of research capabilities of the Indonesian researchers in the fields as mentioned in (1) above

   (4) Other activities to be agreed upon between the authorities concerned of the two Governments.

3. The activities mentioned in (2) above will also be conducted at appropriate experimental stations of CRIFC and farmers' fields.

ANNEX II JAPANESE EXPERTS

Researchers covering the following fields :

1. Upland crops cultivation
2. Upland crops agronomy
3. Plant physiology
4. Plant pathology
5. Entomology

Note:
(1) A team leader and a coordinator/liaison officer will be nominated from among the experts mentioned above.
(2) Short-term experts may be dispatched when necessity arises, for the smooth implementation of the Project.

ANNEX III ARTICLES TO BE PROVIDED BY THE GOVERNMENT OF JAPAN

1. Equipment, spare parts and other material for laboratory work
2. Equipment, spare parts and other materials for field work
3. Other necessary equipment and material to be mutually agreed upon.

Appendix III. Dispatch of Japanese Experts

	1979	1980	1981	1982	1983	1984	1985	1986
1 Leader	22 Feb–30 Nov S. MATSUMI							
		1 Apr ———			22 Oct			
		S. TODA						
					9 Nov ———		8 Nov	
					Y. IZUMIYAMA			
2 Plant breeding and cultivation of upland crops	15 Feb ———		14 May			3 Oct–25 Dec H. MIKOSHIBA		
	K. NAKAYAMA							
			24 Jun ———		23 Jun		28 Feb–27 Apr H. MIKOSHIBA	
			Y. HOZYO					
		18 Jul–25 Aug H. TAKAGI			12 Jan–11 Apr K. NAKAMURA		3 Sep–23 Sep A. TANAKA	
					5 Jul–4 Oct Y. IZUMIYAMA			
					17 Oct ———			31 Mar
					S. OKUDA			
					9 Nov ———		8 Nov.	
					Y. IZUMIYAMA			
3 Rice cultivation	15 Feb ———		14 Feb					
	N. ISHIKURA							
				6 Mar–14 May J. HARADA				
			4 Mar ———		3 Mar			
			H. KOBAYASHI					

Appendix III. Dispatch of Japanese Experts (continued)

	1979	1980	1981	1982	1983	1984	1985	1986
4 Plant physiology	28 Mar ——— 27 Mar T. FUJIMOTO				21 Oct ——— 22 Oct F. YAZAWA			
		4 Oct–28 Nov M. KUWAHARA		20 Oct–20 Dec K. YUITA		10 Oct–9 Nov J. ISHIZUKA		
			8 Apr ——— 22 Oct M. NAKASHIMADA				21 Aug–18 Sep S. AKAO	
				1 Dec —— 28 Feb M. IMANISHI				
5 Plant pathology	22 Feb ——— 21 Aug T. YAMAGUCHI					16 Mar — 22 Oct K. MATSUMOTO		
			25 Feb–23 May R. YOSHINO			22 Aug–21 Oct N. IIZUKA		
		7 Feb–26 May K. NISHIYAMA					5 Sep–9 Oct T. INABA	
			22 Jul ——— 22 Jan N. NARISAWA					
6 Entomology	28 Mar ——— 27 Mar M. OKADA					20 Jan ——— 20 Jan K. HONMA		
		8 Dec —— 7 Mar S. SHIRAISHI					14 Feb–29 Apr K. YAMAGISHI	
			3 Jul ——— 22 Oct A. NAITO				5 Sep–22 Oct K. NAKAZAWA	
				19 Mar–30 May M. MIYAZAKI				
				7 Apr–6 Jun T. NISHIZAWA				

Appendix III. Dispatch of Japanese Experts (continued)

	1979	1980	1981	1982	1983	1984	1985	1986
7 Coordinator	14 May ——— 13 May M. HABU							
			1 May ——— 22 Oct Y. NIHEY					
					17 Oct ——— 31 Mar S. OKUDA			
8 Guidance for degree study		9 Mar–15 Mar H. FUJII			28 Feb–9 Mar T. KAJIWARA			
		6 Mar–15 Mar T. BABA						
9 Other experts		12 Feb–22 Feb M. MAEJIMA		6 Mar–3 Jun S. MORI		11 Jun–25 Jun M. MASAKI		
		27 Feb–17 Mar G. SAKURAI		20 Mar–23 Apr M. NISHIKAWA				
		27 Feb–17 Mar A. OGAWA		20 Mar–23 Apr K. SAITO				
		28 Apr–27 Jun M. MIZUNOE		24 Apr–8 May M. MAEJIMA				
		28 Apr–27 Jun N. MORI			30 Sep–9 Oct K. MURAKAMI			
			23 Apr–7 Jun S. KAWAKUBO		30 Sep–9 Oct M. MASAKI			
			23 Apr–7 Jun Y. SAKATA					
				21 Oct–13 Nov M. NISHIKAWA				
				21 Oct–13 Nov K. SAITO				

Appendix IV. Study/training in Japan (1978-1985)

Major field	1979	1980	1981	1982	1983	1984	1985	1986
1 Plant breeding and agronomy		13 Mar-12 Sep Sutoro H.			30 Mar-20 Sep Melina M.		7 Feb-30 Nov Ruchiat D.	
			5 Jun-4 Dec Tateng S.			30 May-31 Aug Ukup S.		
		8 Aug-7 Nov Sutarto D.			30 Mar-20 Sep Trip A.		1 Jul-20 Nov Suprapto S.	
			5 Jun-4 Dec Ruchiat D.					
2 Plant Physiology	1 May-20 Dec Widji S.		5 Aug————2 Feb Irwan N.			1 Feb-6 Sep M. Djazuli		
		24 Apr-23 Oct Nanang P.		17 Mar-14 Sep Murtado			1 Jul————12 Feb Mono Rahardjo	
				1 Jul————30 Jun Ayub Warma G.		21 Feb-26 Oct A. Cholliuddin		
						20 Jun-26 Dec Ratna Fathan		
3 Plant pathology	1 May-31 Oct M. Herman			20 May-19 Nov Nasir S.		1 Mar-11 Oct Djumanto H.		
		1 May-30 Oct. Masdiar B.					28 Feb-11 Sep Haeni P.	
4 Entomology	1 May-31 Oct Djatnika K.		5 Jun-4 Dec Agus Iqbal		17 Mar-20 Sep Harnoto			
				24 Jun-23 Dec Sutrisno		20 Jun-26 Dec Toto Djuwarso		
					30 Jun-27 Dec Rochman			

Appendix IV. Study/training in Japan (continued)

Major field	1979	1980	1981	1982	1983	1984	1985	1986
5 Study tour	20 May–10 Jun Paransih I.				1 Jun–18 Jun Soegiyanto		25 Aug–4 Sep B.H. Siwi	
		14 May–3 Jun Bambang S.						
	20 May–10 Jun Djam'an							
		31 Jul–20 Aug Soehardjan						
6 Degree study	10 Jun–9 Sep Mukelar Amir				17 Mar————20 Mar Mukelar Amir			
		1 Jun–30 Nov M. Sundaru						
	27 Jun–26 Sep M. Sundaru