

**REPORT
OF
THE MASTER PLAN STUDY
ON
MULTIPLICATION AND DISTRIBUTION OF
IMPROVED SOYBEAN SEED AND SEED POTATO
IN
THE REPUBLIC OF INDONESIA.**

MAIN REPORT

December 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団		
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Area of three-crop system
(rice-soybean-soybean)

Stripe seeding orderly in advanced farmer's field can be seen after harvest of rice without land preparation.

Jember, East Java

Soybean field after one month from seeding

Growing condition seems to be good and the production will be 1.0 - 1.2 tons per ha. If everything goes on smoothly.

Jember, East Java



Weeding

As it is good climate and soil fertility in the production area of soybean in East Java, the yield of production depend upon how carefully weeding and pest control are conducted.

Jember, East Java

Soybean field in transmigrant area

Upland soybean just before harvesting is in danger of being attacked by wild animals.

Musi Rawas, South Sumatra





Sun-drying of soybean after reaping
Drying scene in upland area
(the above scene can't be seen in
lowland because land preparation
should be done for next crop right
after soybean harvest)

Musi Rawas, South Sumatra



Threshing work

After well dried, threshing
done by stick and the work is
for men due to heavy labor.

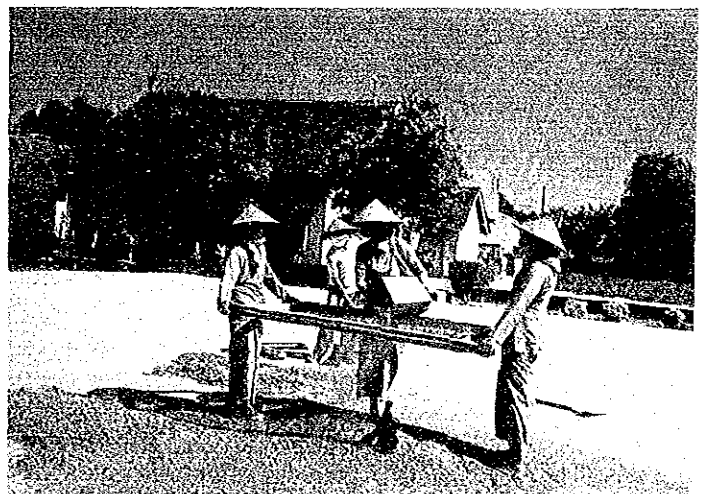
Musi Rawas, South Sumatra



Cleaning by hand sorting

Scene of removing the unsuitable kernels
for seed soybean such as the kernels of
other classes, damaged kernels and
immatured kernels especially discoloured
kernels after the cleaning have done by
the machines.

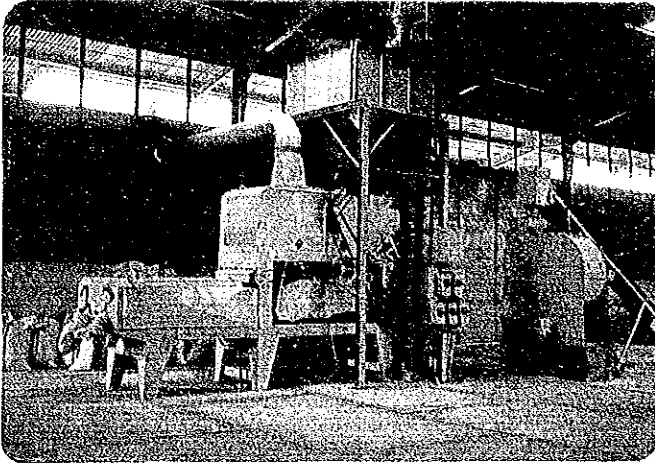
Muara Bungo, Jambi



Cleaning work

Generally wind cleaning is
applied to soybean cleaning,
therefore the scene of using
sieve is not usual.

Jember, East Java



Seed processing center constructed by and cooperated by the World Bank in the schedule of Seed II. Capacity is 1,000 - 2,000 tons/year.

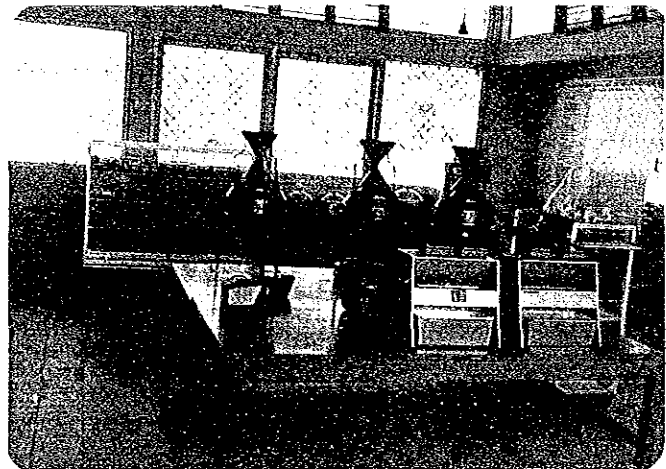
Munggu, Bali



Bag for seed of soybean (50 kg)

The bag is double fold and made by polyethylene and another synthetic fiber.

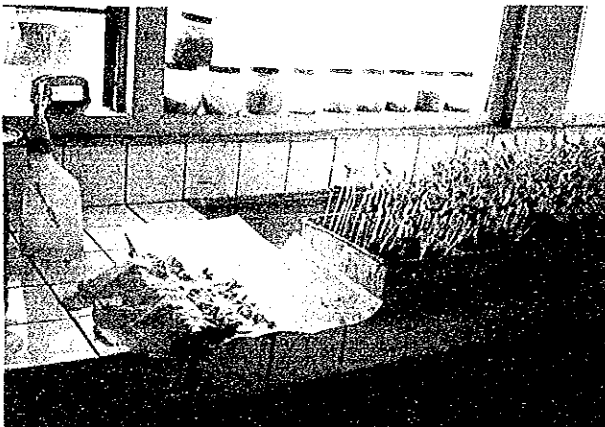
Muaraenim, South Sumatra



Laboratory of BPSB

The equipments for seed inspection in the laboratory of BPSB can be seen, such equipments are required in some other laboratory in BPSB.

Denpasar, Bali

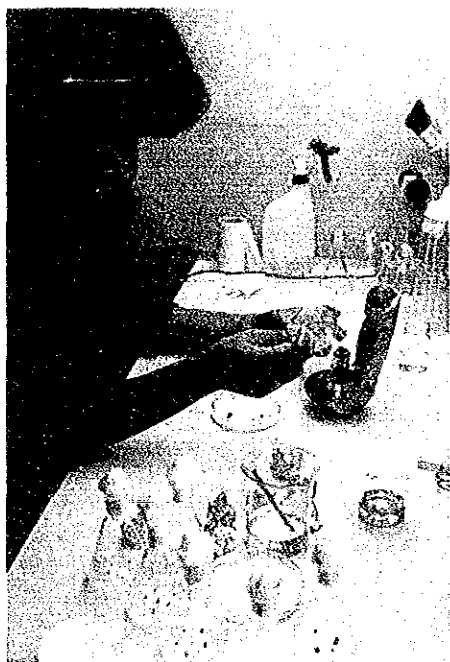


Germination test of soybean

Germination rate of soybean seed is the most important factor to evaluate the value of seed.

Special blotting paper is used.

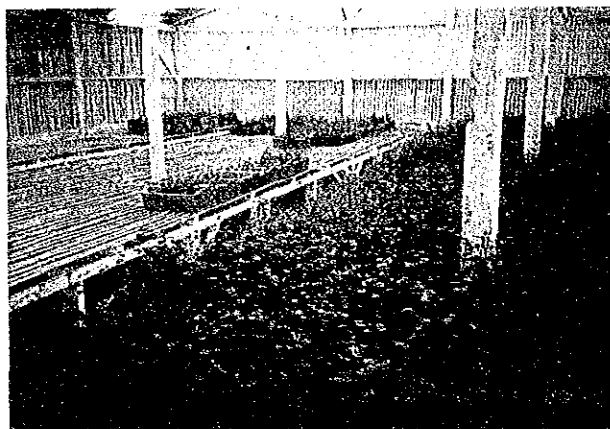
Malang, East Java



The process in planting of chips of shooting apex into the flask in the clean room.

The alcohol lamp is for sterilization of pincette.

Bandung, West Java



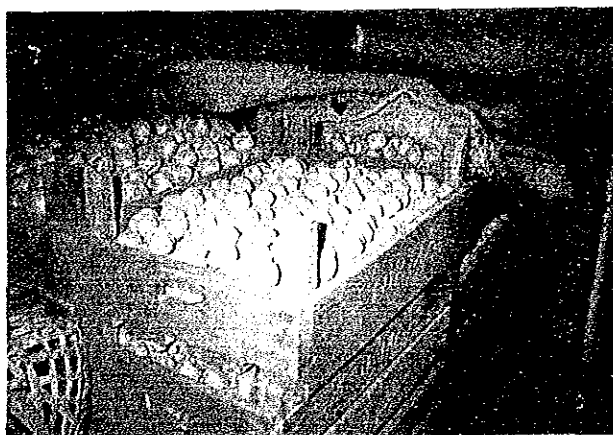
Seedlings from cuttings by rapid multiplication method in the net house.

Pangalengan, West Java



Net houses ($200 \text{ m}^2 \times 2$) for cutting of rapid multiplication method owned by the advanced seed potato farmer incorporated by LEHRI and USAID technically and financially.

Wonosobo, Central Java



Storage of seed potato by advanced potato farmer

Evaporation from potato in dry season is prevented by covering with jute bag.

Bandung, West Java



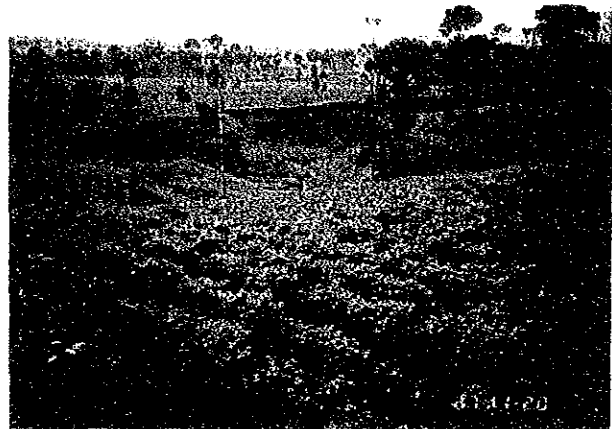
Typical potato field

An expert of the study team is checking the rate of incidence in the field where the growing condition is good and it seems to be about 50 days after planting.

Probolingo, East Java

Main producing area of potato
Pangalengan is the main producing area of potato, located 1,300 m from sea level, three-crop system is available.

Bandung, West Java



Potato Production in mountainous area

As the market price of potato is higher than that of other crops, such mountainous fields also used for potato production.

Wonosobo, Central Java



Infested Plant

Through our study, actual condition of disease have been known clearly, and its yield ranged from 8 to 30 tons by the degree of damage.

Probolingo, East Java



FOREWORD

It is with great pleasure that I present the "Master Plan Study Report on Multiplication and Distribution of Improved Soybean Seed and Seed Potato" to the Government of the Republic of Indonesia.

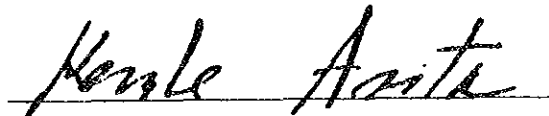
This report embodies the results of a study which was carried out in eight provinces of Indonesia from July to September, 1987, by a Japanese study team commissioned by the Japan International Cooperation Agency following the request of the Government of the Republic of Indonesia to the Government of Japan.

The study team, headed by Mr. Makoto Yamada, Overseas Merchandise Inspection Co., Ltd., had a series of close discussions on the Project with the officials concerned of the Government of Indonesia and conducted a wide-ranging field survey. After the study team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will be useful as a basic reference for development of the Project, and will contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the Japanese team.

December, 1987



Keisuke Arita

President

Japan International Cooperation Agency

CONTENTS

	Page
SUMMARY AND RECOMMENDATIONS	i
CHAPTER 1 PREFACE	
1.1 Background of the Study	1-1
1.2 Study Schedule	1-3
CHAPTER 2 BACKGROUND OF THE PROJECT	
2.1 National Development Plan	2-1
2.2 Agricultural Development Plan	2-4
2.3 The Position of Agriculture in the National Economy	2-9
CHAPTER 3 SOYBEAN PRODUCTION	
3.1 Government Policy of Soybean Production	3-1
3.2 Foreign Aid Projects for Secondary Crop Development and Seed Production	3-4
3.3 Actual Conditions of Soybean Production	3-7
3.3.1 Production Circumstances	3-7
3.3.2 Cropping System	3-23
3.3.3 Variety	3-29
3.3.4 Technologies on Soybean Cultivation	3-37
3.3.5 Diseases & Insects	3-54
3.3.6 Production Cost	3-56
3.3.7 Marketing and Processing of Soybean	3-60
3.4 Multiplication and Distribution of Seeds and Its Problems	3-66
3.4.1 Seed Multiplication	3-66
3.4.2 Techniques of Seed Production	3-72

	Page
3.4.3 System and Organization for Multiplication and Distribution of Seeds	3-83
3.4.4 Seed Inspection System	3-91
3.4.5 Equipment and Facilities for Multiplication and Distribution of Soybean Seeds	3-100
3.4.6 Problems in Multiplication and Distribution System for Soybean Seeds and Their Countermeasures	3-121
3.4.7 Demand Forecasting of Improved Soybean Seeds	3-126

CHAPTER 4 DEVELOPMENT PLAN FOR MULTIPLICATION AND
DISTRIBUTION OF QUALITY SEEDS OF SOYBEAN

4.1 Basic Concept for Development and Planning	4-1
4.2 Areas to Be Improved	4-2
4.3 Items to Be Improved	4-3
4.4 Evaluation of Items to Be Improved	4-6
4.5 Summing Up of Items to Be Improved	4-11
4.6 Alternatives to Improvement Plan, and The Study	4-12
4.7 Priority Plan	4-19
4.7.1 Most Effective Improvement Plan	4-19
4.7.2 Application of Improvement Plans	4-20
4.7.3 Selection of The Province Where a Pilot Project Is to Be Implemented ...	4-23

4.8	Outlines of Pilot Projects to be Implemented in East Java Province	4-27
4.8.1	Plan to Organize Soybean Seed Grower Groups.....	4-36
4.8.2	Plan to Provide Seed Processing and Storage Facilities for Soybean Seeds	4-39
4.8.3	Plan to Develop Soybean Seed Distribution System.....	4-49
4.8.4	Plan to Reinforce Functions and Activities of Soybean Seed Multiplication and Distribution	4-50
4.9	Economic Evaluation	4-58

CHAPTER 5 POTATO PRODUCTION

5.1	Government Policy of Potato Production	5-1
5.2	Related Development Projects and Foreign Aids.....	5-3
5.3	Actual Conditions of Potato Production	5-8
5.3.1	Production Circumstances	5-8
5.3.2	Cropping Pattern	5-13
5.3.3	Varieties	5-15
5.3.4	Farmer's Practices	5-16
5.3.5	Pests and Diseases	5-19
5.3.6	Production Cost	5-26
5.3.7	Marketing and Processing	5-27
5.4	Multiplication and Distribution of Seed Potato and Its Problems	5-33
5.4.1	Seed Potato Multiplication	5-33

	Page
5.4.2 Producing Techniques for Seed Potatoes ..	5-35
5.4.3 System and Organization for Multiplication and Distribution of Seed Potatoes.....	5-38
5.4.4 Quarantine and Inspection System	5-44
5.4.5 Facilities for Multiplication and Distribution of Seed Potatoes	5-49
5.4.6 Problems in Multiplication and Distribution of Improved Seed Potatoes and Their Countermeasures	5-62
5.4.7 Demand Forecasting of Improved Seed Potato	5-67

CHAPTER 6 DEVELOPMENT PLAN FOR MULTIPLICATION AND
DISTRIBUTION OF QUALITY SEED POTATOES

6.1 Basic Concepts for Development and Planning	6-1
6.2 Areas to Be Improved	6-1
6.3 Items to Be Improved	6-2
6.4 Evaluation of the Items to Be Improved	6-3
6.5 Planning	6-7
6.5.1 Introduction of the Rapid Multiplication Method	6-7
6.5.2 Improvement Plans	6-8
6.5.3 Priority Plans	6-9
6.5.4 Selection of a Province to Implement a Pilot Project	6-10

6.6	Outlines of Pilot Projects Implemented in West Java	6-13
6.6.1	Plan to Establish a Multiplication System of Basic Seeds.....	6-19
6.6.2	Organization of Seed Grower Groups	6-32
6.6.3	Reinforcement of Administrative Functions and Activities for Multiplication and Distribution of Quality Potato Seeds.....	6-36
6.7	Economic Evaluation	6-41

CHAPTER 7 RECOMMENDATIONS

ABBREVIATION

AARD	Agency for Agricultural Research and Development
ADB	Asian Development Bank
BAPPENAS	National Planning Agency
BBI	Central Seed Farm (CSF)
BBU	Main Seed Farm (MSF)
BIMAS	National Extension and Credit Programme
BORIF	Bogor Research Institute for Food Crops
BPS	National Statistics Bureau
BPSB SCCS	Seed Control and Certification Services
BS	Breeder Seed
BULOG	National Logistics Organization for Procurement Food
BUMN	Semi-government Autonomous Enterprise
CIP	Centro de International Potato (International Potato Center)
CRIFC	Central Research Institute for Food Crops
DGFCA	Directorate General for Food Crops Agriculture
DLS	Diffused Light Storage
EEC	European Economic Community
ES	Extension Seed
FAO	Food and Agricultural Organization
FS	Foundation Seed
HYV	High-yielding Varieties
IBRD	International Bank for Reconstruction and Development
INSUS	Special Intensification Programme
IRRI	International Rice Research Institute

Jabal System	Field to Field Interchange
JICA	Japan International Cooperation Agency
KUD	Village Cooperative Unit
LEHRI	Lembang Horticulture Research Institute
MARIF	Malang Research Institute for Food Crops
MINI-SPC	Mini Seed Processing Center
NSB	National Seed Board
OECE	The Overseas Economic Cooperation Fund
PIU	Project Implementation Unit
PMDC	Potato Multiplication and Distribution Centre
PPL	Field Extension Workers
PPM	Middle Level Extension Workers
PPS	Subject Matter Specialist
REPELITA IV	Five Year Development Plan IV
SAPPRAD	Southeast Asian Programme for Potato Research and Development
SPC	Seed Processing Center
USAID	United States Agency of International Development
SS	Stack Seed

Money Exchange Rate

¥1 ≙ Rp 11 (October '87)
 \$1 ≙ ¥144 (October '87)

SUMMARY AND RECOMMENDATIONS

SUMMARY AND RECOMMENDATIONS

I SUMMARY

1. [Agricultural Development]

Indonesian agriculture has developed remarkably in recent years. At the beginning of the Fourth Five Year Development Plan (1984/85-1988/89), Indonesia has attained self-sufficiency in rice through numerous government efforts, such as intensification, extensification and diversification programmes.

Indonesian Government has been encouraging secondary crop production. Major Food Crop Production Programme was launched for the following purposes of supplying products to meet rapid increase of demand for food and feed, reducing payments in foreign currencies for importation and increasing farmers' income.

2. [Production of Soybean]

Among the major food crops, the soybean has received considerable attention from the Government because of its significant role in the Indonesian diet. In spite of the recent increase of soybean production, it is not enough for attaining self-sufficiency yet. The gap between production and demand must be fulfilled by importing certain amount of soybeans, while this crop has a great potentiality to be exploited in this country.

In 1968, the year before the First Five Year Development Plan, domestic soybean production was 419,000 tons and the average yield was 0.62 t/ha. In 1986, domestic production was dramatically increased to about 1,140,000 tons and the average yield was around 1.0 t/ha. The government intends a sustained growth of soybean production at least 6.5% a year and also expects 2,017,000 tons of soybean production in 1993, the ending year of the Fifth Five Year Development Plan.

3. [Production of Potato]

The potato is one of the best balanced foods. The potato produces more proteins and calories per unit area, per unit time, and is a

labor-intensive crop, ideal for small land holders as a cash crop. In Indonesia current production areas, totaling about 30,000 ha, are located in West, Central and East Java, West and North Sumatra and South Sulawesi with a harvest of about 280,000 tons in 1985. In accordance with the modernization of the way of life, potato consumption is increasing especially in urban areas and expansion of potato production is required.

4. [Need of Quality Seed]

The quality seed is a key element of production of both crops and has an important role as a forerunner in agricultural development. The supply of quality seeds, practiced by an efficient multiplication and distribution system, will contribute to production in the case where it is combined with complementary measures, such as fertilizer, irrigation and plant protection.

Presently only a few farmers can get quality seeds through the government channels for multiplication and distribution of both soybean and potato. There is an urgent need to develop an adequate and constant stream of seed supply in the country.

5. [Technical Problems in Multiplication and Distribution of Quality Seeds]

There are many problems as described in this report with regard to a technical aspect of multiplication and distribution of quality seeds. The remarkable instances are as follows:

Soybean

- 1) Sharp decrease of germination viability three months after harvest,
- 2) Difficulty in collecting a sound material from farmers for processing into quality seeds.
- 3) Sales of seed to farmers who lack willingness to use quality seeds.

Potatoes

- 1) Heavy infestation by various kinds of virus, fungus and pests of the presently available seeds, resulting in a poor yield,
- 2) No functional, and stable systems for multiplication and distribution of pathogen free and good quality seed potatoes,
- 3) High cost of seeds caused by low rate multiplication.

6. Administrative Matters to Be Improved

The Government is obliged to bring into action the following functions and activities for multiplication and distribution of quality seeds.

1) Production of basic seeds in BBI farms

Almost all BBIs are in a difficult situation in maintaining seed production activities due to poorly equipped farms, and thus resulting in seed supply of poor quality in an inadequate quantity.

They have also received inadequate financial support from the central and the local governments for implementing many seed production programmes. Proper countermeasures and/or new arrangements for management of BBI farms including participation of the private sector shall be taken into consideration to cope with the difficult situations.

2) Inspection of seeds

It is necessary to strengthen BPSB functions and activities in order to assure constant supply of quality of seeds to farmers. For this purpose, means of transportation and equipments for field inspection and laboratory analysis shall be properly arranged.

3) Provision of training

Technical training on a certain theme shall be provided regularly to the personnel involved in multiplication and distribution of quality seeds in both government and private sector including seed growers.

7. [Master Plan]

The following are required as a comprehensive concept of the development of the system for multiplication and distribution of quality seeds, which may be applied commonly for both crops as a Master Plan:

- 1) Development of improved varieties suitable for different agro-ecological conditions,
- 2) Steady supply of Breeder Seed (BS) and Foundation Seed (FS), by the government seed farms,
- 3) Making a better system for production of Extension Seeds (ES) through the private sector, including public corporations and seed growers,
- 4) Promotion of organization and activities of seed growers' to prepare sound material of seeds, and amelioration of their skills for pre and post-harvest practices,
- 5) Proper arrangements for facilities for processing, storage and distribution,
- 6) Reinforcement of BPSB activities for quality control of seed,
- 7) Development of a distribution system to make farmers fully understand the benefits of using good quality seeds of improved varieties,
- 8) Provision of necessary training for advanced technology in multiplication and distribution of quality seeds.

8. [Priority Project]

Based on the above concepts and study results, the priority projects are proposed to improve existing conditions and to prepare successful projects for implementation of multiplication and distribution of quality seeds for both crops:

Soybean

1) Plan to organize soybean seed grower groups

To implement seed programmes under the improved Jabal System while promoting seed grower groups of a high technical level to prepare sound material of seeds, and leveling up of their skills for pre and postharvest practices.

- 2) Plan to provide soybean seed processing facilities
To provide soybean seed processing facilities, having an appropriate capacity of processing in central areas of soybean production, making use of the existing facilities in common with paddy.
- 3) Plan to provide storage for soybean seed
To provide storage facilities at a hilly area that is easy of access, and keep seed in a cool ambience to maintain germination viability.
- 4) Plan to develop soybean seed distribution system
To develop proper distribution system so that the farmers will become willing to use quality seeds. For this purpose, quality seeds should be distributed to farmers together with fertilizer and agricultural chemicals, as a part of technical package of BIMAS and INMAS.
- 5) Plan to reinforce administrative functions and activities for multiplication and distribution of soybean seeds
 - a) Improvement of BBI farms
To improve productivity of BBI farms for palawija, especially by providing irrigation facilities, in order to conduct continuous multiplication of seeds throughout the year.
 - b) Strengthening of BPSB inspection activities
To provide necessary transport and inspection equipment to perform BPSB's duties in the field and the laboratory.
 - c) Provision of technical training
To provide proper training programmes to improve technical skills, and to transfer them to the people involved in multiplication and distribution of soybean seeds in both the government and the private sector.

Potato

- 1) Plan to establish a multiplication system of basic seeds
 - a) To strengthen basic studies on the bio-technology such as meristem tissue culture and disease indexing including potato variety improvement to ensure the implementation of the rapid multiplication method. Necessary equipment and facilities for the research are to be installed in LEHRI.

- b) To constantly produce and supply pathogen free seeds (FS) by means of the rapid multiplication method. The Foundation Seed Farm, i.e., BBI Unit which is an isolated farm against aphids shall be established.

The actual operations for seed production inevitably necessitates active participation of private sectors. A semi-government company will be formed affiliating with private sectors for the programme of multiplication and distribution of quality potato seeds and this will be provisionally called Potato Multiplication and Distribution Center (PMDC).

For the first five years, BBI Unit has charge of production of G_1 & G_2 at Foundation Seed Farm to be established anew under this project, while PMDC acts as an agency coordinating seed growers for production of G_3 & G_4 . After these five years, PMDC is supposed to take over the whole production processes of G_1 through G_4 , including management of Foundation Seed Farm instead of the Government institutions.

2) Plan to organize seed grower groups

To promote acquisition of advanced seed farming practices by potato farmers for steady supply of pathogen free seed potatoes (ES) through cooperative farming works.

3) Plan to reinforce administrative functions and activities for multiplication and distribution of quality potato seeds

a) Strengthening of BPSB inspection activities

To provide a means of transport, necessary equipment and materials for the seed quality control,

b) Provision of technical training

To provide proper training programmes to trainees from the government institutions and private enterprises to make them work more efficiently for multiplication and distribution of potato seeds.

9. [Province for Implementation of Project]

The practical method of project implementation is to select a core province and to efficiently carry out the priority projects in pilot project system, and then gradually spread the effects to the other

provinces.

The team selected East Java Province for an implementation of the priority projects of soybean, because of its strong demand for quality seeds and technical high level of seed growers, and West Java Province for an implementation of the projects of potatoes, because of strong demand for quality seeds, close location to LEHRI and large consuming areas in the province.

10. [Economic Evaluation]

Soybean

In case the project is implemented in East Java, IRR (20.4%) can be expected through the whole project life of 20 years. This economic effect contribute to decreasing unit cost of soybean production, so the Project has big economic value. But the economic effect of the Project is external and its main benefit belongs to farmers who use improved seeds. In other words the owner of this Project can get only a part of the benefit and the owner cannot get enough income, judging from the financial point of view. The income of this Project can only cover the current expenditure and cannot recover the capital expenditure. To implement the Project a large amount of fund is needed to purchase material of soybean seed, so deliberate attention must be paid to the way of procuring working capital and the way of paying interest.

Potato

Economic benefits derived from implementing the Project is substantial and net present value of 42,517.5 billion Rp, discounted by discounting factor of 12% which is equal to the lending rate of agricultural credit, can be expected through whole project life of 20 years.

Most of these economic benefits belong to seed potato growers and potato growers and income effect of the Project is also very high. But according to the result of financial analysis of the Foundation Seed Farm, the total project income can cover only current expenditure and it cannot recover capital expenditure. Nevertheless, total economic benefits are far bigger than the capital loss, so it

can be concluded that the feasibility of this project is very high as a whole.

On the other hand, because the increasing effect of potato production by implementing the Project is very large, in case production volume of potato increases too fast and the market price drops sharply, then farmers income may decrease as a result of abundant harvest. Therefore, in the process of implementing the Project well-balanced increase of production is needed according to the accurate forecasting on future demand.

11. [Conclusion]

The projects for multiplication and distribution of quality seeds of soybean and potato are justified by the Master Plan Study, based on the careful field study and evaluation. Considering the urgent necessity, the projects should get started as soon as possible.

It is also advisable that the projects should be implemented in accordance with the integrated approach in separated stage, taking account of priority of national interests, as well as managerial functions and background of technical level.

II. RECOMMENDATIONS

The following are recommended for promoting smooth and effective implementation of the proposed projects for multiplication and distribution of quality seeds of soybean and potato.

- (1) It is recommended that further supplemental study on certain fields which were not fully clarified during the Master Plan Study, shall be carried out before the implementation of the project to ensure the technical and economical feasibility.
- (2) The proposed projects are designed to play an initiating role in the achievement of effective multiplication and distribution of quality seeds. Therefore, direct participation of the government sector is indispensable at the initial stage of the project especially for preparations of project organization, project facilities and operation fund. Consideration should also be given to the willing participation of the private sector.
- (3) Lack of awareness of the necessity of the use of quality seeds on the part of farmers is a factor hampering effective development of the plan. Such negative factors should be gradually improved by activating extension works through which the quality seeds would be distributed to farmers.
- (4) This plan for multiplication and distribution of quality seeds is only one of the pillars of the increase of production of both crops. Broad-ranging plans should be accomplished, such as strengthening of crop protection, providing a good system of irrigation, improving postharvest practices and processing, providing regional application trial and demonstration of agriculture technology, and expanding of agricultural mechanization.

CHAPTER 1 PREFACE

CHAPTER 1 PREFACE

1.1 Background of the Study

The Government of the Republic of Indonesia has made its utmost efforts to increase rice production in the past several National Development Plans. The Government of Japan successfully contributed to the achievement of rice self-sufficiency in Indonesia by implementing an integrated cooperation for increasing rice production from 1981 to 1986 under the close linkage of economic and technical cooperation.

Taking into consideration the fact that rice self-sufficiency has been accomplished and the consumption of major food crops is increasing, along with the development of the national economy, the Government of Indonesia made a decision to take active measures for promotion of major food crop production in the Fourth Five Year National Development Plan (REPELITA IV) and requested that the Government of Japan extend the same type of cooperation in the increase of the production of palawija and horticulture crops on the occasion of the 10th Annual Consultative Meeting of July, 1986.

For future cooperation, the Government of Japan decided to cooperate with the Indonesian Government for the promotion of major food crop production. This activity has been entrusted to Japan International Cooperation Agency (JICA), the official agency responsible for implementation of the Japanese Government's technical cooperation programme.

A contact mission of JICA was sent to Indonesia in December, 1986. The mission held a series of meetings with the Indonesian authorities concerned in order to exchange views. It was clarified that multiplication and distribution of improved soybean seeds and seed potatoes was the most important subject, having the highest priority for the purpose of further promoting the stable food supply and rural development in Indonesia.

Based on the above findings, the Government of Indonesia requested that the Government of Japan extend its cooperation in a study of the promotion of major food crop production. The Scope of Work (S/W) for the Master

Plan Study on the "Multiplication and Distribution of Improved Soybean Seed and Seed Potato" was prepared and approved by the Government of the Republic of Indonesia and JICA on March 30, 1987.

Based on the above mentioned S/W, JICA formed a study team consisting of six experts and had them start the preparatory works in Japan and conduct studies in Indonesia from July 6 to September 25 1987.

Based on these study results, the team got down to the home office works of analysing the country's then status and the collected data, selecting a total improvement project, and elaborating priority projects in key provinces. They prepared a draft final report on the outcomes of the above works and submitted it to the Government of Indonesia.

The study team visited Indonesia to confer with the Indonesian Government over the conclusions and the suggestions of the draft final report and to hold a seminar on these matters with the people concerned of the government.

A final report was compiled by the team reflecting the results of the visit.

1.2 Study Schedule

The study was performed during the period from July 6, 1987, to September 25, 1987. The schedule was as follows.

<u>Date</u>	<u>Activities</u>
July 6	Leaving Tokyo - Jakarta (GA873)
July 7 - Jul. 12	Submission of Inception Report. Preparation for the field studies
July 13 - July 17	Field study in Jambi Province
July 17 - July 22	Field study in South Sumatra Province
July 23	Meeting and Interim Report at Jakarta
July 24 - July 28	Field study in South Sulawesi Province
July 29 - Aug. 2	Field study in North Sulawesi Province
Aug. 3 - Aug. 4	Meeting and Interim Report at Jakarta
Aug. 5 - Aug. 8	Field study in Bali Province
Aug. 9 - Aug. 16	Field study in East Java
Aug. 17 - Aug. 21	Field study in Central Java
Aug. 22 - Aug. 25	Field study in West Java
Aug. 26 - Sept. 8	Analysis of collected data and selection of priority provinces
Sept. 9 - Sept. 10	Field study II in priority provinces of potatoes (West Java Province)
Sept. 11 - Sept. 15	Field study II in priority provinces of soybean (East Java)
Sept. 16 - Sept. 24	Compilation and submission of field report
Sept. 25	Returning Jakarta - Tokyo (GA874/JL064)

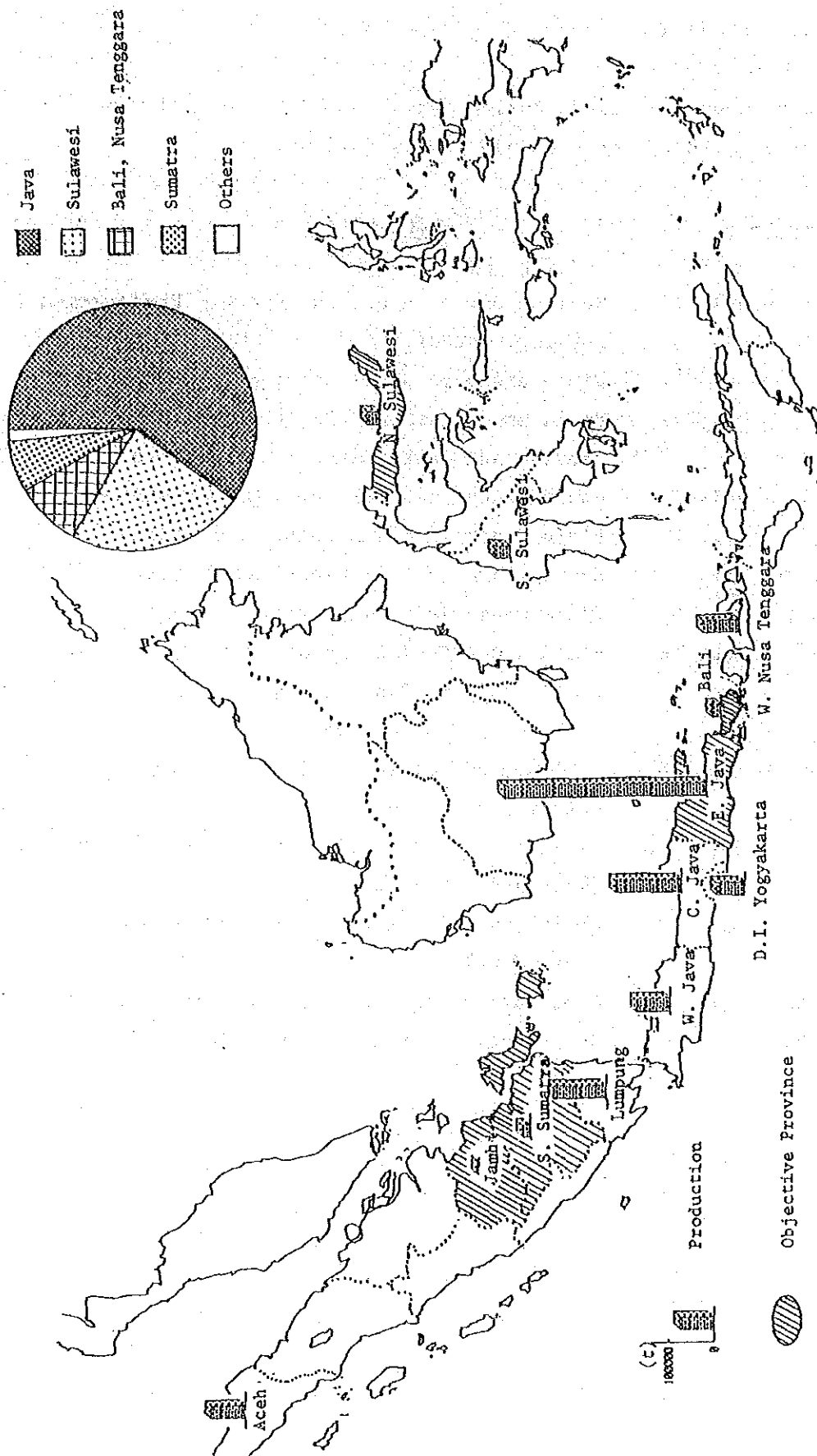


Figure 1.1 Objective Provinces for the Study and Main Production Provinces, Soybean

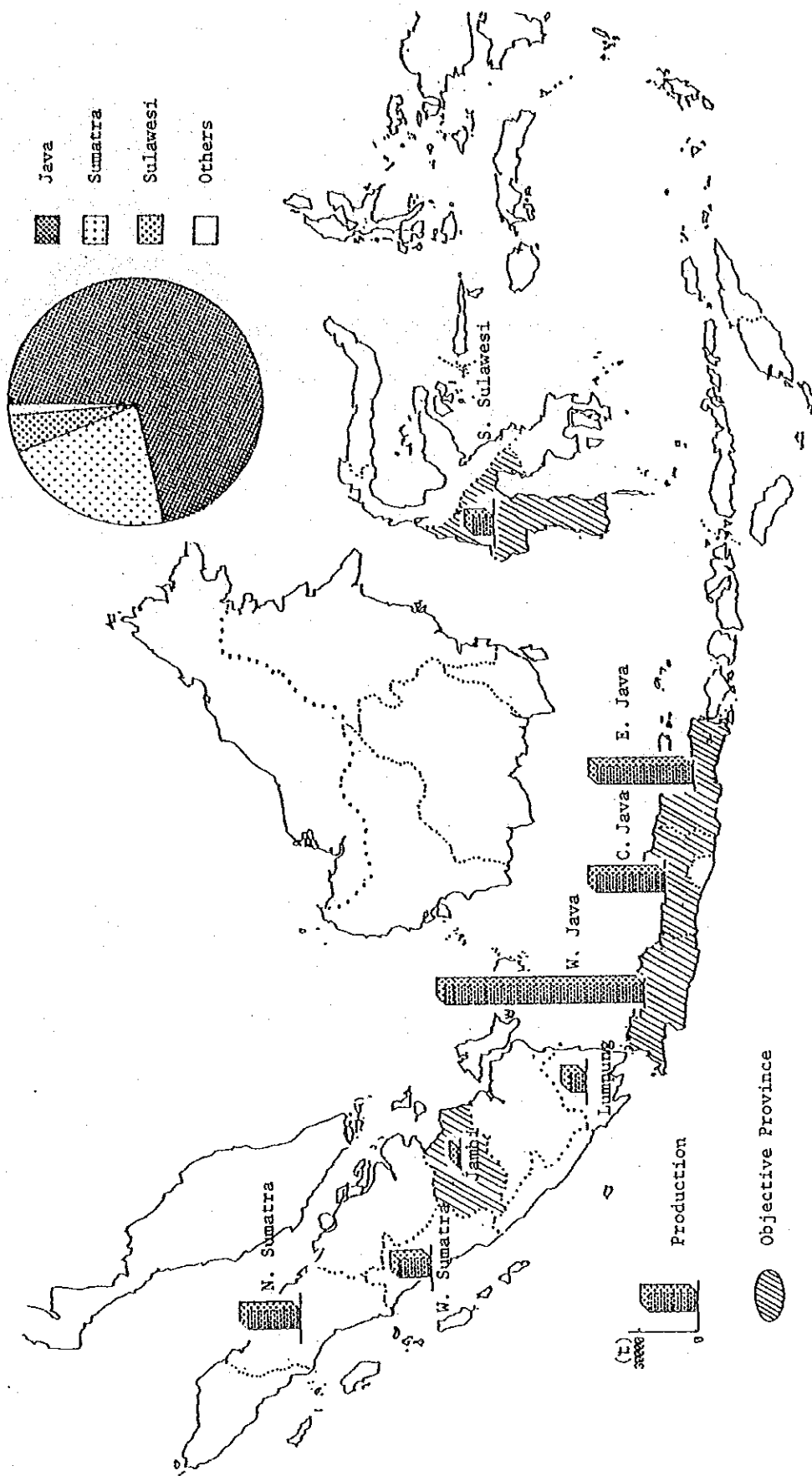


Figure 1.2 Objective Provinces for the Study and Main Production Provinces, Potato

CHAPTER 2 BACKGROUND OF THE PROJECT

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2.1 National Development Plan

2.1.1 Plan Period

Five-year Development Plan (REPELITA) is the basic framework of development policies of Indonesia. In the past, three five-year development plans (REPELITA I - III) had finished and the existing development plan (REPELITA IV) started in 1984/1985. The period of each development plan is as follows.

REPELITA I:	1969/70 - 1973/74
REPELITA II:	1974/75 - 1978/79
REPELITA III:	1979/80 - 1983/84
REPELITA IV:	1984/85 - 1988/89 (Existing plan)
REPELITA V:	1989/90 - 1993/94 (Future plan)

2.1.2 Past Development Plans

REPELITA I started under Suhaerto's new government which was eager to recover from the disorder of the national economy. It put high priority on development of the agricultural sector, while intending to spread the development effect to other sectors. Although the target rate of the annual economic growth during the plan period had been set at 5.0%, the goal of economic reconstruction was mostly attained with the annual economic growth rate resulting in 7.7% in substance.

In REPELITA II the target rate of annual economic growth was set at 7.5%. It regarded the agricultural sector as an important economic sector, but the target growth rate was 4.6% which was fairly below the overall target rate. The result of annual economic growth was only 6.8% under the plan period. Inferior performances of the agricultural sector and mining and quarrying sector were main factors that depressed the overall growth rate.

REPELITA III gave the highest priority to economic development, while stressing the importance of equal participation in the development process and the stability of the country. The target rate of the annual economic growth was set at 6.5%. In the agricultural sector, importance was put on attaining self-sufficiency in rice and set the moderate growth target rate at 3.5%. During the plan period, the achieved annual economic growth was 6.0%, while high performance of the agricultural sector helped attain the overall target growth rate.

Table 2.1 Target and Result of Annual Economic Growth by Industry in The Past Development Plans

Unit: %

	REPELITA I		REPELITA II		REPELITA III	
	Target	Result	Target	Result	Target	Result
Agriculture, forestry and fishery			4.6	3.8	3.5	4.3
Mining and quarrying			9.0	4.8	4.0	2.2
Manufacturing industries			13.0	12.7	11.0	8.6
Construction			9.2	11.1	9.0	9.3
Transportation and communication			10.0	11.3	10.0	7.7
Others			7.6	8.4	8.1	7.9
GDP	5.0	7.7	7.5	6.9	6.5	6.0

Source: REPELITA I, II, III. Statistical Yearbook of Indonesia 1984.

2.1.3 Existing Development Plan

Objectives, priorities and development strategy of REPELITA IV were decided on according to the principles of the national policies which had passed the Parliament in 1983, evaluation of the result of past development plans and pessimistic forecast on the world economy. Objectives of this plan can be summarized in the following two points.

- (1) To increase per capita national income and to keep minimum economic growth rate that can assure equal distribution of national income.
- (2) To build a solid foundation for future development. A lower target rate of annual economic growth during the plan period was set at 5.0%. Annual population growth rate was estimated at 2.0%, and this made annual growth rate of per capita national

income 3.0%. During the plan period the biggest factor which would encumber economic development of Indonesia was deficiency of foreign exchanges, whose prospect was thought to be pessimistic. The growth target rate of the agricultural sector was set at 3.0%. By realizing this target, it was predicted that self-sufficiency of foods would be attained and that industrial development and export of agricultural products would become feasible. The growth target of the industrial sector was set at the highest level and this sector was expected to play a role of leading economic growth.

Table 2.2: Target Rate of Annual Economic Growth by Industry in REPELITA IV

	Growth Target	Percentage	
		1983/84	1988/89
Agriculture, forestry and fishery	3.0	29.2	26.4
Mining and quarrying	2.4	7.4	6.6
Manufacturing industries	9.5	15.8	19.4
Construction	5.0	6.3	6.3
Transportation and communication	5.2	6.0	6.0
Others	5.0	35.3	35.3
GDP	5.0	100.0	100.0

Source: REPELITA IV.

2.1.4 Future Development Plan

REPELITA V was in the process of preparing in BAPPENAS at the time the field study was conducted.

2.2 Agricultural Development Plan

2.2.1 Past Agricultural Development Plans

During fifteen years from REPELITA I to REPELITA III (1969/70 - 1983/84) the largest target of agricultural development was realization of self-sufficiency in rice by increasing its production. They also aimed at increasing the level of farmers' income and making new job opportunities. As a practical method of rice production increase they planned; expansion of paddy land by rehabilitation and irrigation facilities, and propagation of BIMAS/INMUS Programs, i.e. intensive cultivation method by introducing a new technical package of improved seeds, chemical fertilizer and pesticide.

From 1969 to 1983 rice production of Indonesia had increased extensively and intensively and the total production had almost doubled from 10.52 million tons to 20.57 million tons. During this period the total harvested area increased by 1.3 times, intensive cultivation area increased sharply from 34.1% to 72.% and yield per hectare increased by 1.5 times. Especially introduction of intensive cultivation method contributed to the increase of rice production. But Indonesia had not been able to attain self-sufficiency in rice before 1983/84 reflecting strong domestic demand for rice due to rapid population increase.

Table 2.3: Target and Result of Rice Production in the Past Agricultural Development Plans

	Target					Result	
	Area harvested (1000 ha)	Intensification area (1000 ha)	Yield per hectare (ton/ha)	Total production (1000 ton)	Area harvested (1000 ha)	Intensification area (ton/ha)	Total Production (1000-ton)
REPELITA I							
1969	7,600	2,590	1.38	10,520	8,014	1.53	12,249
1970	7,960	2,900	1.43	11,430	8,135	1.62	13,140
1971	8,320	3,150	1.51	12,520	8,324	1.65	13,724
1972	8,760	3,480	1.58	13,810	7,898	1.75	13,183
1973	9,300	4,000	1.66	15,420	8,404	1.74	14,607
REPELITA II							
1974	8,464	4,326	1.83	15,032	8,508	1.80	15,276
1975	8,530	4,636	1.89	15,633	8,495	1.79	15,185
1976	8,599	5,095	1.96	16,383	8,369	1.89	15,845
1977	8,736	5,544	2.03	17,235	8,359	1.90	15,876
1978	8,982	6,082	2.09	18,183	8,929	1.96	17,825
REPELITA III							
1979	8,885	5,223	2.02	17,940	8,803	2.03	17,872
1980	9,065	5,541	2.03	18,442	9,005	2.24	20,163
1981	9,295	5,971	2.04	18,995	9,381	2.37	22,286
1982	9,600	6,184	2.05	19,688	8,988	2.54	22,837
1983	9,925	7,220	2.07	20,574	9,102	2.63	24,006

Source: REPELITA I, II, III. Statistical Information on Indonesian Agriculture 1968 - 1980. Statistical Yearbook of Indonesia 1984.

2.2.2 Existing Agricultural Development Plan

REPELITA IV sets the annual growth rate of rice production at the level of 4.1% but it aims at a higher increase rate of food production excluding sweet potato. This means that priority of secondary crops has risen in food Production Increase Programme. Particularly, fairly high growth rates are expected for soybean and green pea production. To attain these higher target rates it started new INSUS/INMUM programme and has planned to expand intensive cultivation areas. In this plan, the past rice-centered agricultural policy was revised and a shift to secondary crop was recommended for farmlands incompatible with rice. And the priority areas of farmland development has changed from Java island where the farmland ratio has already reached a maximum level to outer territories where there is much uncultivated land.

Self-sufficiency in rice had been long sought for in Indonesia and she attained fundamental self-sufficiency in rice in 1984/1985. After that, priority of agricultural policy changed in not only increasing rice production but also improving comprehensive self-sufficiency in secondary crops such as soybean, corn, groundnut, etc., however, still keeping the biggest policy weight on rice production. According to this change of strategy of increasing food production, it aims to propagate the intensive cultivation method, not only for rice but also for other food crops.

Comparing the target and the result of increasing food production during 1983 - 1986, rice production has increased annually and attained the production target approximately. As to corn and cassava, yearly variations of production have been fairly high, the production of sweet potato has been stagnant, increase rates of groundnut and green pea have been low and all these crops could not attain their production targets. Recently soybean production increased sharply and it exceeded the production target in 1986. But reflecting strong domestic demand, Indonesia could not attain self-sufficiency of soybean and rather large volume of it is still imported.

On the other hand, due to modernization of life style, consumption volume of potatoes has increased especially in urban areas, therefore, potato production needs to be increased.

Table 2.4 Target and Result of Rice Production in REPELITA IV

	Unit	1984	1985	1986	1987	1988
<u>Target</u>						
Intensive cultivation	1000 ha	7,747	8,073	8,402	8,865	9,240
INSUS	1000 ha	4,402	5,022	5,832	6,521	7,211
IMMUM	1000 ha	3,345	3,051	2,570	2,344	2,029
Non-intensive cultivation	1000 ha	1,432	1,287	1,146	772	486
Total area harvested	1000 ha	9,179	9,360	9,548	9,637	9,726
Yield per hectare	ton/ha	2.69	2.75	2.81	2.88	2.94
Total production	1000 tons	24,701	25,781	26,867	27,736	28,624
<u>Result</u>						
Intensive cultivation	1000 ha	8,632	8,821	9,130		
INSUS	1000 ha	4,399	4,659	4,922		
INMUM	1000 ha	4,332	4,162	4,209		
Non-intensive cultivation	1000 ha	1,132	1,081	741		
Total area harvested	1000 ha	9,764	9,902	9,871		
Yield per hectare	ton/ha	2.67	2.68	2.71		
Total production	1000 tons	25,933	26,542	26,707		

Source: Kabijaksanaan dan Langkah-Langkah Operasional Pembangunan Pertanian Tenaman Pangan REPELITA IV. Evaluasi PELITA IV Tahun Ketiga (1986/1987).

Table 2.5 Target and Result of Palawija and Potato Production in REPELITA IV

	Unit: 1,000 tons					Annual growth rate
	1984	1985	1986	1987	1988	
<u>Target</u>						
Corn	5,412	5,694	5,993	6,308	6,656	5.14
Cassava	14,702	15,408	16,145	16,919	17,756	6.08
Sweet potato	2,257	2,331	2,401	2,482	2,564	2.82
Groundnut	536	580	621	672	724	8.70
Soybean	783	885	1,003	1,086	1,179	15.24
Green pea	204	231	261	298	340	16.13
Potato	201	215	230	246	263	6.91
<u>Result</u>						
Corn	5,288	4,329	5,361			
Cassava	14,167	14,056	12,667			
Sweet potato	2,157	2,161	2,125			
Groundnut	535	528	576			
Soybean	769	870	1,177			
Green pea	187	200	209			
Potato	372	283				

Source: Kabijaksanaan dan Langkah-Langkah Operasional Pembangunan Pertanian Tenaman Pangan REPELITA IV. Evaluasi PELITA IV Tahun Ketiga (1986/1987).

2.2.3 Future Agricultural Development Plan

Agricultural development plan of REPELITA V (draft) shows the following development objectives.

- a. To achieve and maintain self-sufficiency in carbohydrate, protein (from crops), vitamins and minerals.
- b. To meet domestic demand for food and feed.
- c. To promote exports and to decrease imports of food crops
- d. To increase income, to create employments and to pursue equal distribution.
- e. To progress regional development ensuring preservation of resources and environment.

According to the plan from 1989 to 1993, the target rate of annual growth of rice production is set moderately at 2.46%, while setting higher targets as to beans, such as 9.25% for groundnut, 6.51% for soybean and 8.10% for green pea. On the other hand, a fairly high target of 7.00% is set for potato production.

Table 2.6 Production Target of Main Food Crops in REPELITA V

	Unit: 1,000 tons					
	1989	1990	1991	1992	1993	Annual growth rate
Rice	27,951	28,659	29,370	30,084	30,814	2.47
Corn	6,482	6,673	6,868	7,069	7,276	2.93
Cassava	17,666	18,277	18,908	19,556	20,233	3.45
Sweet potato	2,739	2,878	2,992	3,201	3,428	5.76
Groundnut	625	677	737	808	889	9.25
Soybean	1,567	1,668	1,779	1,891	2,017	6.51
Green pea	238	257	278	300	325	8.10
Potato	370	396	423	452	484	7.00

Source: Rancangan REPELITA V Pertanian Tanaman Pangan (Draft II).

2.3 The Position of Agriculture in the National Economy

2.3.1 Gross Domestic Production and Total Agricultural Production

GNP in 1985 is Rp.79,679.1 billion, of which the agriculture, forestry and fishery category takes 24.2%, the mining and quarrying 17.5%, the trade 15.4%, manufacturing 12.6%, and the public administration 8.1%. The percentage of agricultural sector decreased from 30.6% to 24.2% during the past five years 1980 - 1984, but is still a single largest sector in the national economy and employs about one half of total labor forces.

Indonesian agriculture has developed remarkably in recent years. Total agricultural production value in 1985 is Rp.19,301.6 billion, of which the food crops takes 63.0%, the non-food crops 13.2%, the estate crops category 2.5%, the livestock and their products 10.0%, the forestry 4.5%, and the fishery 6.8%. The percentage of the food crops is very high among the total agricultural production value.

Indonesia had been a big rice importer for a long time before it attained self-sufficiency in rice in 1985 as a result of government endeavor to increase rice production. From 1983 to 1985 rice actual production value has increased but its percentage to the total value of farm food crops decreased 49.9% to 42.8%. This means that attainment of self-sufficiency in rice encouraged diversification of food crops.

2.3.2 Foreign Trade of Agricultural Products

An eminent feature of Indonesian export composition is high dependency on crude oil export. On the other hand, total imports had increased largely from 1980 to 1982, kept this high import level in 1983 but it decreased sharply in 1984 and 1985. The percentage of food import value to total import value was over 10 percent in 1980 and 1981 and it dropped to about 5 percent in 1984 and 1985. After 1984 food import decreased sharply, while import of farm food crops fell drastically among other agricultural products. The main reason that the import of farm food crops has fallen drastically is no need of importing rice due to increase in domestic rice

Table 2.7 Gross Domestic Product by Industrial Origin
at 1983 Constant Prices

Unit: billion Rp

	1983	1984	1985
1. Agriculture, forestry and fishery	17,696.2	18,673.2	19,301.6
2. Mining and quarrying	13,967.9	14,788.7	13,962.2
3. Manufacturing	8,211.3	9,489.6	10,048.5
4. Electricity, gas and water supply	524.2	550.3	594.9
5. Construction	4,597.2	4,469.7	4,543.6
6. Trade	12,009.4	12,300.2	12,282.8
7. Transportation and communication	3,978.0	4,334.0	4,596.7
8. Banking and other financial institution	2,034.2	2,422.3	2,430.6
9. Ownership of dwelling	1,961.8	2,072.3	2,189.1
10. Public administration	5,711.5	5,996.7	6,438.5
11. Services	3,000.8	3,116.8	3,290.6
12. Gross domestic product	73,697.6	78,213.8	79,679.1

Source: Statistical Yearbook of Indonesia, 1986

Table 2.8 Gross Domestic Product of Agriculture
at 1983 Constant Prices

Unit: billion Rp

	1983	1984	1985
Farm food crops	11,057.4	11,876.2	12,164.8
Farm non food crops	2,059.5	2,349.3	2,542.9
Estate crops	610.7	445.5	481.8
Livestock and Products	1,754.3	1,841.6	1,925.7
Forestry	994.2	907.5	875.2
Fishery	1,220.1	1,253.1	1,311.2
Total	17,696.2	18,673.2	19,301.6

Source: Statistical Yearbook of Indonesia, 1986

Table 2.9 Composition of Production Value of Farm Food Crops
at 1981 Constant Prices

Unit: billion Rp

	1983	1984	1985	1986
Rice	4,482.8	4,822.5	4,914.0	4,944.5
Corn	593.9	625.7	532.0	658.7
Cassava	576.6	676.7	670.4	767.2
Groundnuts	302.4	343.5	356.3	388.5
Soybean	201.9	279.7	325.9	441.2
Green peas	78.1	83.4	80.6	84.5
Vegetables	833.4	1,223.3	1,223.3	1,223.3
Fruits	1,761.5	2,903.5	2,903.5	2,903.5
Total	8,983.3	11,117.0	11,159.5	11,562.2

Source: Rancangan REPELITA V Pertanian Tanaman Pangan (Draft II)

production. Reversely some surplus rice has been exported after 1984/1985. Recently trade balance of agricultural products improved but decrease of oil income is still eminent. Therefore Indonesian Government attaches importance to substituting domestic agricultural products for imported agricultural products and is encouraging to expand export of agricultural products.

Table 2.10 Balance of Trade

Unit: million US\$

	Import		Export		Balance
	Total	Food	Total	Crude Oil	
1980	10,834	1,285	23,950	17,785	13,116
1981	13,272	1,356	25,165	20,669	11,893
1982	16,859	1,074	22,328	18,408	5,469
1983	16,352	1,135	21,146	16,153	4,794
1984	13,882	676	21,888	16,045	8,006
1985	10,262	556	18,587	12,757	8,325

Source: Statistical Yearbook of Indonesia 1984, 1986

Table 2.11 Volume and Value of Food Import

	1983		1984		1985	
	1000 ton	million US\$	1000 ton	million US\$	1000 ton	million US\$
Food crops	3,392	878	2,423	609	1,888	469
Animal products	87	123	99	105	81	87
Prepared food- stuffs, beverages and tobacco	440	267	382	158	407	134
Animal and vegetable fats and oils	13	12	95	53	53	36

Source: Indikator Ekonomi, Augustus 1985, Ibid, Februari 1987

Table 2.12 Trade Balance of Rice

Unit: 1,000 tons

Year	Import	Export	Balance
1979/80	2,606		2,606
1980/81	1,229		1,229
1981/82	2,371		2,371
1982/83	506		506
1983/84	1,117		1,117
1984/85	187	96	91
1985/86		412	412
1986/87		101	101

Source: BULOG

2.3.3 Supply and Demand of Food Crops

According to the food balance sheet in 1984, the consumption volume of the main foods is larger in the following order; rice, cassava, corn, sweet potato and wheat flour. Indonesia is self-supporting almost all foods to meet the food demand. But the deficiency of foods is filled by import, the volume of import being large especially as to wheat and soybean. Because there is no domestic production of wheat, it is impossible to produce it by herself. After attaining self-sufficiency in rice in 1985 Indonesian Government plans to attain self-sufficiency in soybean as a next big target of increasing food production.

The table of per capita nutrition intake shows that consumption volume of rice is very large among the main food crops and it is a main source of calory and protein intake. Over one half of fats is supplied from coconut and palm oil. Indonesian people take in a large part of proteins and fats from plant foods and the consumption volume of animal foods is relatively small. Main sources of proteins are soybean and corn other than rice. Soybean is material of Indonesian typical side dishes such as Tempe, Tofu, etc. and at the same time it is the cheapest source of protein. Therefore attainment of self-sufficiency in soybean will serve not only for saving foreign exchange but also improving the nutrition level of the people.

Table 2.13 Food Balance Sheet in 1984

Unit: 1,000 tons

	Food supply balance				Domestic consumption				
	Domestic production of stocks	Change of stocks	Import Sub total	Export	Feed	Seed	For processing	Losses	For consumption
Paddy	38,136		38,136		38,136	763	408	34,906	2,059
Rice	23,736	1,166	414	22,984	22,984			575	22,409
Wheat		1,436	1,436		1,436			1,436	
Wheat flour	1,034	2	1,040		1,040			52	988
Corn	5,288	48	60	5,391	160	314	66	217	262
Fresh corn	156		156		156				
Cassava	14,167		14,167	1,121	13,046	261		1,394	1,696
Sweet potato	2,157		2,157		2,157	43			216
Groundnuts in shell	941		941	2	939			892	47
Groundnuts shelled	535		556		556		33		
Soybean	769	28	401	1,142	1,142	44			57
Green peas	187		188		188	4	8		9
Potato	372		2	374	12	362	23		18

Source: Food Balance Sheet in Indonesia 1984

Table 2.14 Per Capita Nutrition Intakes in 1984

	Consumption Volume		Calories	Proteins	Fats
	kg/year	g/day	Cal/day	g/day	g/day
Rice	140.20	384.11	1,383	26.12	2.69
Wheat flour	6.18	16.93	62	1.51	0.22
Corn	27.35	74.93	216	5.60	2.36
Fresh corn	0.98	2.68	3	0.11	0.03
Cassava	60.66	166.19	182	1.50	0.37
Tapioca	1.04	2.85	10	0.01	0.01
Sweet potato	11.88	32.55	34	0.50	0.20
Sago	0.78	2.14	8	0.01	0.00
Sugar	11.10	30.41	111	0.05	0.15
Beans & coconuts	21.77	59.65	217	10.15	17.50
(Soybean)	6.51	17.84	59	6.23	3.23
(Coconuts)	10.95	30.00	108	1.02	10.41
Fruits	25.83	70.76	35	0.46	0.17
Vegetables	17.07	46.80	14	0.80	0.16
Meats	3.43	9.40	19	1.42	1.46
Eggs	1.65	4.51	8	0.58	0.55
Milk	3.90	10.69	7	0.34	0.38
Fishes	11.09	30.38	20	3.56	0.61
Plant fats & oils	7.52	20.61	184	0.07	20.47
Animal fats & oils	0.13	0.36	3	0.00	0.35
Total			2,516	52.79	47.68
(Plant foods)			2,459	46.89	44.33
(Animal foods)			57	5.90	3.35

Source: Food Balance Sheet in Indonesia 1984

CHAPTER 3 SOYBEAN PRODUCTION

CHAPTER 3 SOYBEAN PRODUCTION

3.1 Government Policy of Soybean Production

3.1.1 The Fourth Five-Year Development Plan (REPELITA IV)

After attaining self-sufficiency in rice the Indonesian Government has been endeavoring to attain self-sufficiency in secondary crops, especially in soybean. During the plan period 1984-1988, the Government plans to increase total harvested area from 829,000 ha to 1,025,000 ha, yield per hectare from 0.95 tons/ha to 1.15 tons/ha and total production from 783,000 tons to 1,179,000 tons. The strategy of increasing soybean production to achieve above production targets is as follows.

- (1) To meet domestic demand, to increase farmers' income and to reduce soybean import.
- (2) To achieve self-sufficiency in soybean by the end of Repelita IV.
- (3) To increase the number of farmers engaged in soybean production by means of application of technical package.
- (4) To motivate farmers to adopt a more efficient cropping pattern which is based on local climate and annual rainfall.
- (5) To conserve and increase soil fertility through land rehabilitation, such as liming and soil conservation, and also to maximize utilization of water irrigation in rain-fed paddy fields.

Self-sufficiency in soybean will be attained through intensification, extensification and diversification programmes.

Intensification programme is an extension system that succeeded in increasing rice production. Under the programme, use of improved seed, chemical fertilizer and pesticide is recommended to individual farmers or farmers groups, and agricultural credit, and technical advice are given as

an institutional framework for its guarantee.

Extensification programme whose main content is land improvement through liming started in the transmigration areas and in farmland where the soil condition is not good in 1985/86.

Diversification programme aims to improve the land use ratio through planting soybean in fallow-land and in farmland unsuitable for rice production, and through intercropping of soybean with sugarcane, cotton or coconut.

Table 3.1 Production Targets of Soybean in REPELITA IV

	1984	1985	1986	1987	1988
Planted area (1,000 ha)					
Intensification	629	719	819	890	960
Extensification	200	172	131	97	65
Total	829	891	950	987	1,025
Yield per hectare (tons/ha)					
Intensification	1.05	1.08	1.13	1.16	1.19
Extensification	0.63	0.62	0.60	0.60	0.60
Total	0.9	0.9	1.06	1.10	1.15
Total production (1,000 ton)					
Intensification	659	779	924	1,028	1,140
Extensification	124	106	79	58	39
Total	783	885	1,003	1,086	1,179

Source: Kebijakan dan Langkah - Langkah
Operasional Pembangunan Pertanian
Tanaman Pangan REPELITA IV.

3.1.2 The Fifth Five-Year Development Plan (REPELITA V)

During the plan period 1989 - 1993, REPELITA V plans to increase total soybean production by 28.7% from 1,567,000 tons to 2,017,000 tons.

This target will be attained through expanding harvested land and increasing yield per hectare.

Java island is the largest producing area of soybean in the country but the land use ratio has already reached at maximum level, therefore annual growth rate of harvested area is set at 2.13% and that of total production at 5.35%. Concerning the outer territories, a wide tract of land remains intact, therefore the annual growth rate of harvested area is set at 5.96% and that of total production at 9.09%.

Table 3.2 Production Target of Soybean in REPELITA V

	1989	1990	1991	1992	1993	Annual growth rate
Harvested area (1,000 ha)						
Java island	1,026	1,048	1,072	1,092	1,117	2.13
Outer territories	456	483	511	541	574	5.96
Indonesia	1,482	1,531	1,584	1,633	1,691	3.35
Yield per hectare (tons/ha)						
Java island	1.07	1.10	1.14	1.17	1.21	
Outer territories	1.03	1.07	1.10	1.13	1.16	
Indonesia	1.06	1.09	1.12	1.16	1.19	
Total production(1,000 tons)						
Java island	1,096	1,154	1,218	1,280	1,350	5.35
Outer territories	471	514	561	611	667	9.09
Indonesia	1,567	1,668	1,779	1,891	2,017	6.51

Source: Rancangan REPELITA V Pertanian Tanaman Pangan (Draft II).

3.2 Foreign Aid Projects for Secondary Crop Development and Seed Production

3.2.1 Secondary Crop Development Projects

- (1) Secondary crop intensification project (1978 - 1981, 1982 - 1986) by FAO/Belgium.

This project is being executed by the Directorate of Food Crops Production Development in association with FAO and is being funded by Belgium bilateral aid. The project undertakes fertilizer trials and demonstration in nine provinces, that is Aceh, West Sumatra, Lampung, West Java, West Nusa Tenggara, East Nusa Tenggara, South Kalimantan, South Sulawesi and Central Sulawesi.

- (2) Assistance for increased soybean production in East Java (1982 - 1986) by FAO.

This is a technical cooperation project to increase soybean production in East Java Province. FAO had been propagating the intensive cultivation method of soybean by establishing 17 demonstration farms in Pasuruan, 12 in Lumajang, 15 in Jember and 10 in Banyuwangi. The objective group of the technical cooperation is farmers groups and the project includes a training programme for them.

- (3) Secondary food crop development project (1983 - 1988) by USAID

This USAID-financed project assists the Directorate General of Food Crops Agriculture to increase production and to improve the marketing system of secondary food crops, especially maize, soybean, groundnut and cassava in three provinces; Lampung, East Java and South Sulawesi. This is basically a pilot project to experiment with and to test new cropping systems, to improve post-harvest operations, and to develop the market for secondary crops. The main aspects of the project are: provision of a production and marketing infrastructure, extension, demonstra-

tion and field trials, and training. The first fields were planted in September 1984.

(4) Soybean Extension Project (1985 - 1989) by the Republic of Taiwan

This is a technical cooperation project by Taiwanese experts. The purpose of the project is to provide extension service for soybean production at the farmers' level. There are three project sites in Jombang, Pacitan and Sumenep in East Java. But in Pacitan and Sumenep the project is still in the preparation stage. The Taiwanese experts have been endeavoring to propagate their intensive cultivation method, organizing farmer groups with package assistance mainly composed of pesticide and fertilizer to be given to demonstration farms which are grouped into units, one unit of these farms farming 5 ha altogether. Their target of extension is about 2,000 units during 1985 - 1989.

3.2.2 Seed Production Projects.

(1) Seed II Project (1982 - 1989) by IBRD

The project aims to improve the availability of quality seeds mainly for rice and partly for palawija by providing seed processing facilities and by establishing 18 medium-sized and 6 small-scale seed processing centers (SPC's) and by improving the ten existing centers. Total cost amounts to US\$35,000,000, of which US\$15,000,000 is financed by loan, and the project covers 13 provinces: North Sumatra, West Sumatra, West Java, Central Java, Jogjakarta, East Java, South Kalimantan, South Sulawesi, North Sulawesi, Bali, East Nusa Tenggara, Riau and Jambi.

(2) Pilot project on integrated soya and Food Crops Development, Muara Bungo (1978 -) by EEC.

This pilot project at Muara Bungo, Jambi Province, was designed as a pilot farm to develop effective farming systems for transmigration settlement areas. The project aimed in particular at the development of efficient soil conservation and

identification of appropriate rotation of crops and the development of cultivation methods, and also establishment of appropriate channels to extend these findings to the farmers concerned. While these activities are still being continued, the multiplication of palawija seed has become the primary objective of the project. The necessary facilities were constructed, processing and storage equipment was installed, and in the 1982/83 fiscal year the first plantation was started for seed production. According to the original plan EEC is to cooperate in 12 provinces, but this plan was suspended because operation of the seed processing center in Muara Bungo has not been satisfactory.

3.3 Actual Conditions of Soybean Production

3.3.1 Production Circumstances

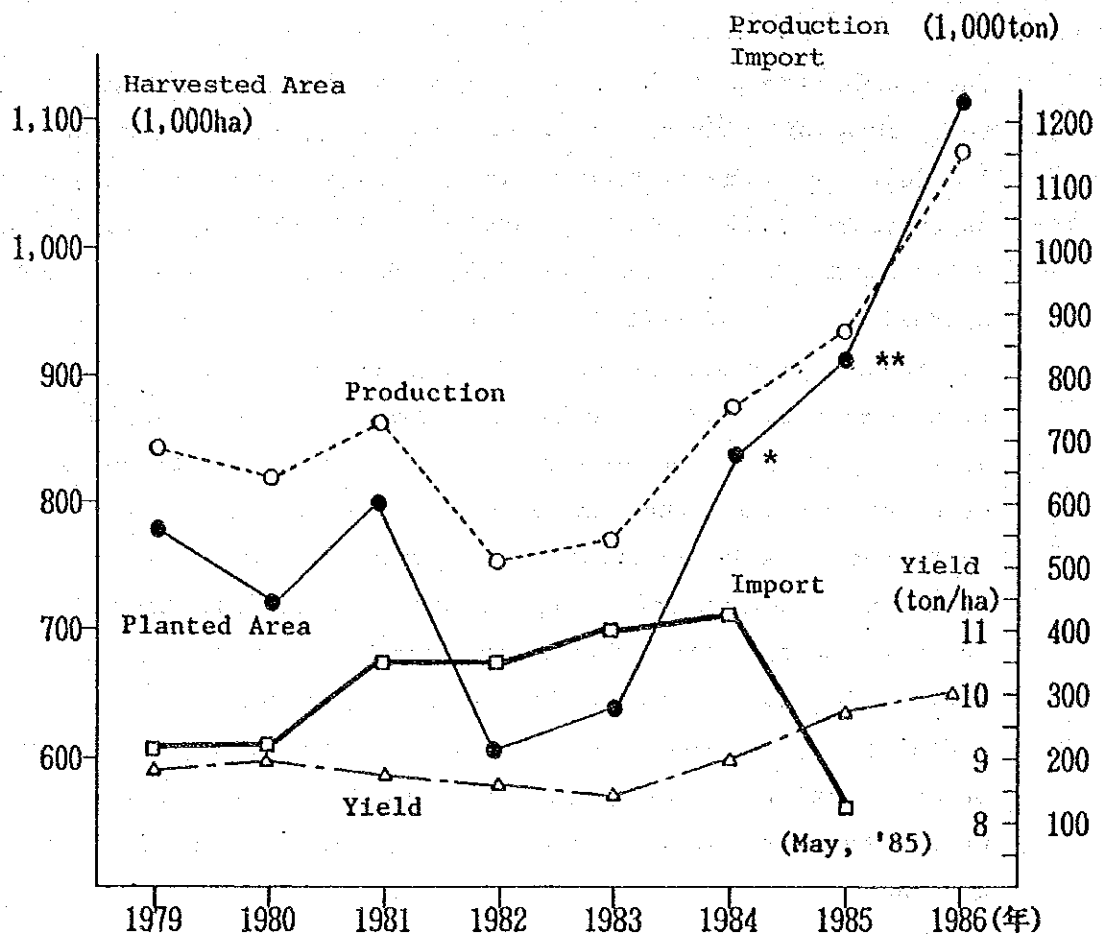
(1) Area, production and yield per unit

The annual trend of harvested area, production, and yield per unit area of soybean in Indonesia is shown in Figure 3.1. According to the figure, the harvested area increased by approximately 42%, totalling 1,120,000 ha in 1986, while it was approximately 780,000 ha, in 1979. The production also reached approximately 1,140,000 tons from 850,000 tons, representing a remarkable increase of 67%. During this same period, a rise from 0.87 ton to 1.0 ton/ha was also seen in yield per unit area, representing an increase of 15%. From this trend, it may be proper to judge that the effects of the technical improvement must have greatly contributed to production increase, combined with the expansion of cropping area. Actually, however, the domestic demand for soybean continued to remarkably increase during the same period. The imported amount rose likewise, reaching approximately 400,000 tons in 1984, and this trend seems to still be going on. Now under these circumstances, the nation has made further efforts to attain self-sufficiency in soybean.

Table 3.3 Production Condition of Soybean
in Provinces for Study

Province	Harvested Area (Ha)	%	Production (Ton)	%	Yield per Unit (Ton/Ha)
Jambi	2,616	0.2	2,718	0.2	1.04
S. Sumatra	15,455	1.4	14,651	1.3	0.95
E. Java	443,956	39.8	453,723	39.9	1.02
Bali	19,762	1.8	20,948	1.8	1.06
N. Sulawesi	20,000	1.8	21,160	1.9	1.06
Indonesia	1,116,415	100.0	1,137,152	100.0	1.019

Reference: Ramalan I Produksi Palawija Di Indonesia, 1986
Departmen Pertanian



References: Central Statistics Bureau (BPS), BULOG

Note: * Tentative figure

** Estimated figure

Figure 3-1 Production Trend of Soybean

Table 3.3 shows the harvested areas, production and yield per unit area of soybean in five provinces which were chosen for this study. According to this table, East Java Province is a major producing area, accounting for 40% of the total harvested area as well as the total production in Indonesia, followed by South Sulawesi, Bali, South Sumatra and Jambi each of which has a cropping area of around 20,000 ha or less and produces below 2% of the total. Thus, they are far below those in East Java. Actually, however, yield per unit area is almost on the same level of more than 1 ton/ha in all the provinces except in South Sumatra.

In this way, Java island accounts for 80% of the total cropping area for soybean in Indonesia, at present, with East Java Province at the first on the list, but the expansion of the cropping area has reached the limit. On the contrary, the cropping area for soybean has been steadily expanding in the outer islands, even though they have problems of land improvement, introduction of suitable varieties, multiplication of quality seeds, technical improvement and so on.

(2) Outline of production in the Provinces

1) Jambi Province

a) Major producing area

Mountains of more than 2,000 meters of altitude run through the western part of the province from north to south, and the foot of the mountains forms plateaus. There are rivers along the seacoast in the east side of the chains of these mountains. Alluvial paddy fields spread out along the rivers, where soybean has also been planted as a secondary crop for several decades. After World War II, people started immigration to hilly plateaus or peat zones along the seacoast (Pasan surut) from Java island and have planted soybean as the basic crop in the area for upland crops.

The harvested area for soybean is 2,616 ha, and the production is 2,718 tons in Jambi Province, and the major producing areas are both prefectures (Kabupaten) of Muarabungo Tebo and Sarolangun where there are lands suitable for soybean production (Refer to Figure 3.2).

Table 3.4 Status of Farmland Possession

Size (ha)	Ratio of Farm Households (%)
More than 2.0	21
1.5 - 2.0	71
1.0 - 1.5	7
0.5 - 1.0	0

Note:

Survey: July, 1987

Place : Kab. SAROLAGUN, Baki Bulan Village

b) Outline of Production Status

According to Table 3.4 which shows the status of farmland possession, the land area which farmers possess including reclaimed lands is generally large with the cropping area for soybean of 0.25 - 1.0 ha in upland crop areas and 0.5 - 2.5 ha in paddy areas per farm household.

Drill seeding (tugor1) is common for soybean cultivation (tugor1) in both paddy field and upland field. Since the upland crop areas of reclaimed lands mainly consists of laterite soil of reddish yellow color and is sterile, the yield per unit area is less than 1 ton/ha. But, the paddy area is fertile, so yield per unit area is almost 2 tons/ha in some fields.

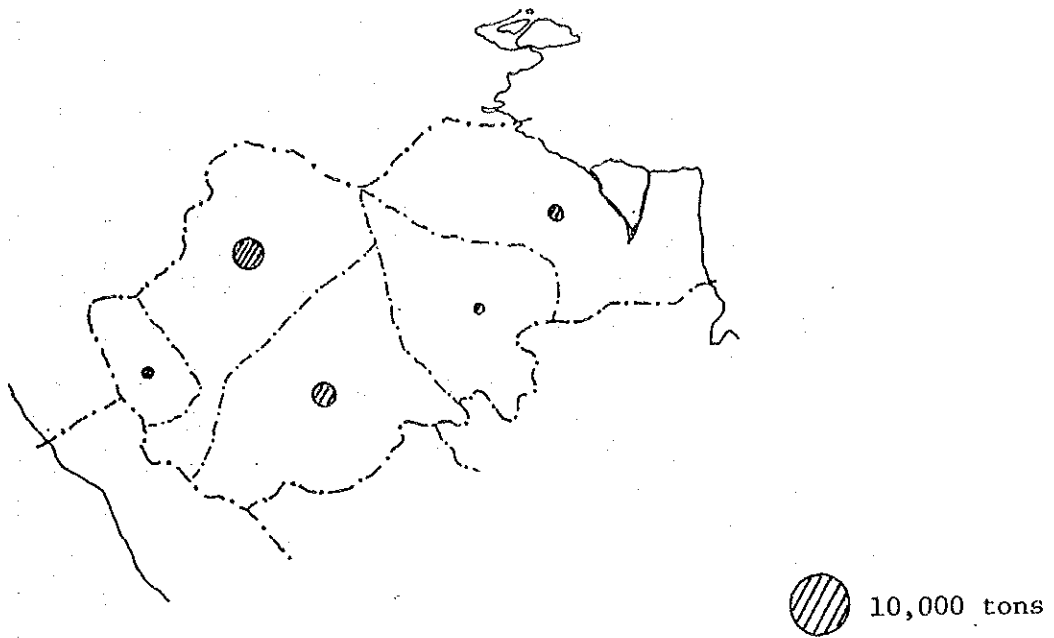


Figure 3.2 Major Producing Areas of Soybean in Jambi Province

The authorities concerned of the province had promoted a demonstration farm programme for production and extension of soybean providing necessary agricultural inputs for production (fertilizers, agricultural chemicals, root nodule bacteria) to producing areas in cooperation with EEC Seed Production Farm since 1984. The farmers of 2,425 households (area of approximately 970 ha) have participated in this programme so far, and thus the yield has steadily increased. (Refer to Table 3.5)

Table 3.5 Agricultural Input Supply Project for Soybean Seed Growers

Cropping Season	Kabupaten	Area (Ha)	No. of Farmers	Agricultural Input				Lime (Ton)	Leguminous Bacteria (Kg)	Agricultural Chemicals (Kg/Lt)				
				Fertilizer		KSL (K)	Agro-thion			Azo-drin	Sevin	Bran-tasan	Sumi-thion	
				UREA (N)	TSP (P)									Agro-thion
1. March, April (1984)	- Bungo Tebo	21.05	62	1,965	2,691	1,965	26.35	1.88	672	25.5	67.5	-	-	55
2. Sept., Oct. (1984)	- Bungo Tebo	131.35	387	3,173	6,119	3,519	19.61	18.63	5,938	34.1	314.5	-	-	-
	- Sarko	19.50	27	750	1,500	1,133	10.00	2.93	575	52	52	-	-	52
3. Sept., Oct. (1985)	- Bungo Tebo	203.73	637	-	-	-	-	-	270	186.5	311	-	95	160.5
	- Sarko	100.00	204	2,350	4,700	4,315.5	-	-	3,904	141	251	-	-	39
4. Sept., Oct. (1986)	- Bungo Tebo	194	459	-	1,000	750	-	-	2,100	268	193	276.5	-	-
	- Sarko	151	348	-	5,100	3,825	-	1.88	1,500	167	136	120	-	4.5
	- Kerinci	75	52	-	2,500	1,875	-	0.94	750	25	25	25	-	-
	- Batanghari	25	179	-	7,500	5,625	-	1.88	2,250	75	75	75	-	-
	- Tanjung Jabung	50	100	-	5,000	3,750	-	1.88	1,500	50	50	50	-	-
- Total		970.63	2,425	8,238	36,110	26,577.5	55.96	30.02	8,100	1,059	1,501.5	546.5	409.5	311

Source: SAPRODI-SARANA PRODUKSI (IN PUT)

2) South Sumatra Province

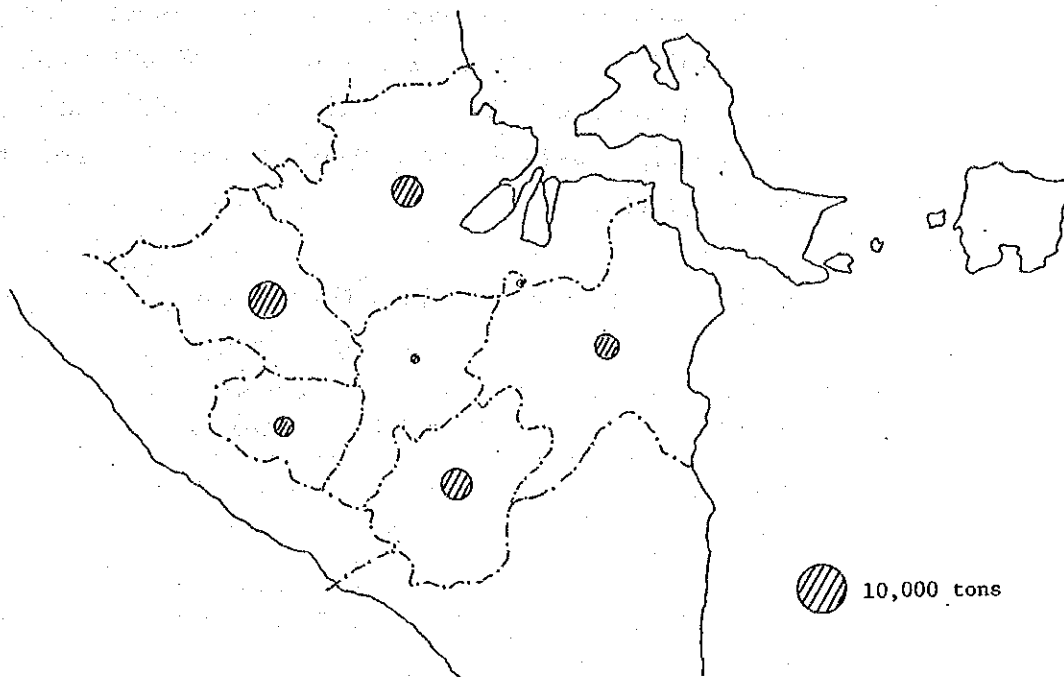


Figure 3.3 Major Producing Areas of Soybean in South Sumatra Province

a) Major producing area

South Sumatra Province resembles Jambi topographically. A chain of mountains running southward in the western part of Jambi also goes southward in the western part of South Sumatra, ranging farther into Lampung Province. Along these mountains there spread out plateaus of high altitudes. Rivers rise toward the eastern coast and alluvial paddy fields spread out on the basins, where villagers have been growing soybean as a secondary crop for off-season paddy fields. Soybean was introduced to the mountainside plateaus and was grown with the slash-and-burn method in rubber forests and they have been playing an important role for production increase of soybean. On the other hand, the plateaus of the southern part have been used for paddy as well as for upland crops, and many people immigrated there from Java island since Holland-reign. Immigrants are still

flowing into the area around and the cropping area for soybean has been expanded to the upland field and the paddy field by them.

The harvested area of soybean in South Sumatra Province is 15,455 ha, and the production is 14,651 tons. The major producing areas are the following three Kabupatens, Musi Rawas, Musi Banyuasin and Organ Komiring Ilir.

Table 3.6 Status of Farmland Possession

Size (ha)	Farm Households (%)
1.5 - 2	2
1.0 - 1.5	96
0.5 - 1.0	
0.25 - 0.5	2

Survey: July, 1987

b) Outline production status

According to Table 3.6 which shows the status of farmland possession, the farm classes of around 1 ha account for a high proportion, as is the case with Jambi. The areas of forests are not included in this table. In this area, rubber gardens are run in combination with coffee gardens, and the income from these gardens exceeds that from upland crops and rice. The immigrants from Java have adopted the same cropping system as native settlers.

Cropping area of soybean per farm household in this region is around 0.5 - 2.0 ha, while yield per unit area of soybean cropping is high for both rubber forests and paddy fields, representing the figure of 1 - 1.5 tons/ha approximately.

The seeding method is non-tillage drill seeding between rice stubbles in the case of soybean as a secondary

crop of paddy fields, while it is drill seeding after weeding in the case of soybean cropping in rubber forests. As for a round of cropping years in rubber forests, soybean is continuously cropped until growth of rubber trees makes it impossible to crop soybean underneath by shading.

The geographical situation in South Sumatra is complicated and land consolidation is very little advanced. Since it is difficult to obtain quality seeds, local varieties are used there, and the expansion programme for soybean production has been started with the areas whose land conditions have been improved.

3) East Java Province

a) Major producing areas

High mountains (volcanic mountains, etc) of the altitude of approximately 2,000 - 3,000 meters range from west to east in the southern part of East Java and rivers issue seaward from these mountains. The alluvial, fertile plains spread out on the basins and along the seacoast to form a vast paddy zone (21% of the total). The plateaus at the foot of the mountains have been used as an upland crop and horticulture crop zone (25% of the total).

The harvested area in East Java is 443,956 ha and the production is 453,723 tons, accounting for approximately 40% of the total soybean production in Indonesia. Thus, soybean has a close relationship with paddy as a secondary crop. The producing areas are widely distributed all over the province and the following are the names of Kabupatens arranged according to production:

- ① Jember
- ② Banyuwangi
- ③ Pasuruan
- ④ Ponorogo
- ⑤ Lumajang

b) Outline of production status

Table 3.7 shows village examples and the provincial average of possessed farmland. According to this table,

farmers of the scale of below 0.5 ha reach more than 50-60% and it is clear that the farming scale has been becoming smaller. Consequently, it is estimated that most of the cropping areas for soybean per farm household may be less than 0.5 ha.

The yield per unit area is on a high level, representing 1 - 2 tons/ha, since the soil is fertile and the intensive method combined with high fertilizer application has been adopted here.

As for the seeding method, which differs depending on land conditions of paddy fields and farming patterns, ridge sowing and after-tillage broadcast sowing are often seen. In dry areas where water supply is insufficient, after-tillage drill sowing or non-tillage between stubbles holes sowing are preferred. Thus, the relationship between seeding pattern and water content of the soil seems to be close.

The authorities concerned of the province have reinforced their efforts to lower the cost and to heighten the productivity, by improving the crop rotation system for secondary crops for paddy field (Demonstration Farms - 25), demonstrating group culture (USA Aid Cooperation), improving techniques and demonstrating at sites, rationalizing the application of fertilizer (Cooperation by Taiwan) and utilizing

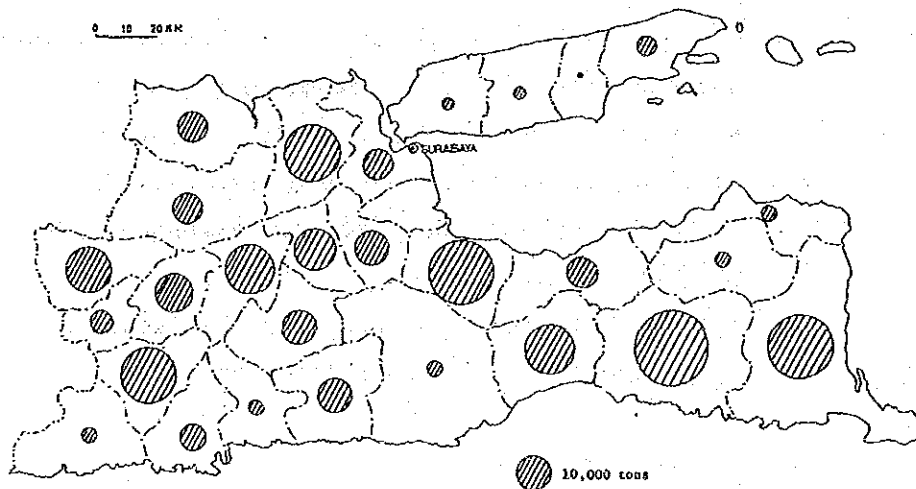


Figure 3.4 Major Producing Areas of Soybean in East Java

demonstration farms of extension centers. The expansion of cropping area has reached the limit in this province.

Table 3.7 Status of Farmland Possision

Size (Ha)	Distribution Ratio (%)	
	Number of Farm Households	Provincial Average
2.0 - 3.0	0	2
1.5 - 2.0	} 8	} 14
1.0 - 1.5		
0.5 - 1.0	40	22
0.25 - 0.5	41	26
less than 0.25	10	36

Note: Survey: August, 1987

The number of households: 80

Names of villages: Kartini

Provincial Average: Annual Report on Farmers, 1986.

4) Bali Province

a) Major producing areas

Mountains run through the central part of the province a little to the north from the west to the east and high peaks of around 2,000 meters range at the central part of the mountains, forming a watershed. Countless rivers flow down toward the seacoast in every direction from that watershed and the plains spread out on the basins. Lakes and swamps are scattered around the mountain top and rivers are separated into small branches. Thus, the region is blessed with ample rainwater and terrace paddy fields are developed from the plateaus of the mountains downward to alluvial plains from the ancient days.

A well-known systematic irrigation method has been utilized for introduction of soybean as a secondary crop of paddy field, and it covers nearly 20,000 ha of harvested area for soybean. Its production has reached as much as 20,000 tons, though Bali is a small province. Major producing areas of soybean are Badung and Gianyar Kabupatens located in the East-Central part of the

province which produce more than 50% of the total soybean production in the province.

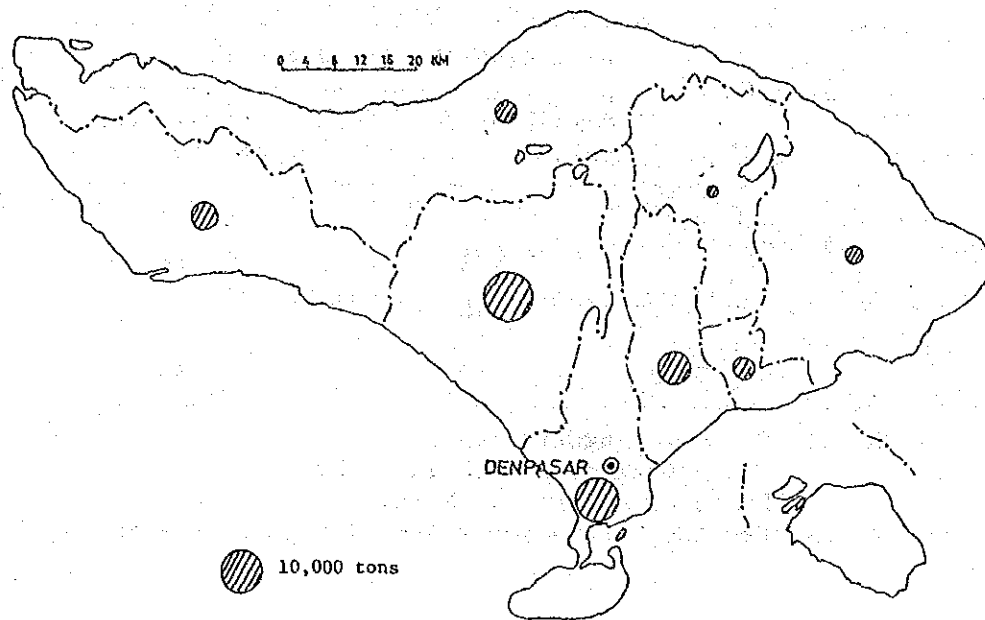


Figure 3.5 Major Producing Areas of Soybeans in Bali Province

b) Outline at production status

The following table shows a comparison between the northern and the southern parts of the distribution of farms in each class of possessed farmland broken down by size. According to the Table, the farmers of 0.5 - 1.0 ha account for nearly half in the northern part while in the southern part, since class dissolution has remarkably developed, the class of 0.25 ha accounts for as much as 94%, which mostly consists of farmers engaged in tourism as their main job. Therefore, most of the farm households possess less than 0.5 ha of farmland in the south, while many of those in the north more than 1.0 ha of farmland.

Table 3.8 Distribution of Possessed Farm Land in Villages

Size (Ha)	Distribution Ratio (%)	
	A Village (North)	B Village (South)
0.5 - 1.0	52	1
0.25 - 0.5	26	5
below 0.25	13	94
Number of Households	58 households	123 households

Note: Survey: August, 1987

Names of Villages: (A) Bkan Jati, Buleleng Kabupaten
 (B) Dlod Baryn Sayan, Badung Kabupaten

As progress of tourism pushed dissolution of full-time farm household class into the part-time ones, soybean cultivation is strongly oriented to labor-saving. Farmers in the east-central part near sightseeing spots sometimes omit work for weeding after seeding, spraying of chemicals, harvesting works and so on, and naturally it leads to production decrease in many cases. The north had been a soybean production area as a secondary crop for a long time. A cropping of soybean after paddy has been carried out for a long time by broadcasting on the ground. Although largely quickened rice cultivation cropping system made it possible to crop soybean twice following rice reaping. Problems about weeding still remain with the direct-sowing 2-cropping system of soybean, which causes per unit area yield to lower. However, since the soil is fertile, the yield per unit is shifting constantly on a high level.

As for cultivating system, soybean is cultivated twice by no-tilling, no-fertilizer and by direct seeding method for several decades in the north, while they are cultivated twice by seeding in holes between rice stubbles without tillint in the east. In both regions, there can be seen tendency to input less manpower for soybean production, and generally speaking, the required labour was less in comparison with other provinces.

5) North Sulawesi Province

a) Major producing areas

A range of mountains runs through the central part of the province and peaks 2,000 m high are scattered there. The rivers flow down to reach the sea of both the south and the north for these mountains to form alluvial plains at the basins where paddy fields spread out. These paddy area concentrate in the central part of the province and it is a producing area for soybean as a secondary crop of paddy field. The harvested area of soybean in this province is 20,000 ha and the production is 21,160 tons. The main producing areas, as shown in the following Figure, is Bolaang Mongondow Kabupaten.

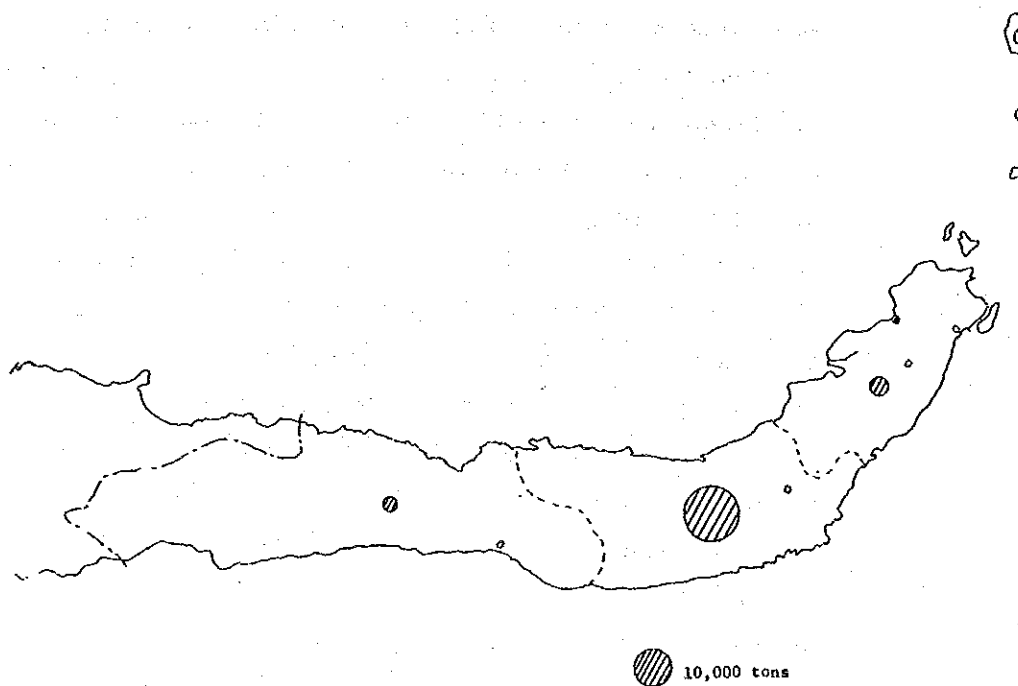


Figure 3.6 Major Producing Areas of Soybean in North Sulawesi Province

b) Outline of Production Status

Table 3.9 Status of Farmland Possession

Size (Ha)	Distribution Ratio (%)	
	Bali Immigrants Village	East Java Immigrants Village
Over 2.0	} 58	12
1.5 - 2.0		
1.0 - 1.5	7	88
0.5 - 1.0	10	10
0.25 - 0.5	25	-

Note: Names of Villages: Banyu Harapan: Immigrated from Bali (1967)
Molejaya: Immigrated from East Java (1973)
Name of Kabupaten: Bolaang Mongondow

The Table 3.9 shows the distribution of the status of farmland possession which was based on the survey of the villages.

Villages of Balinese immigrants were settled into in 1967. 58% of them belong to the class of 1.5 ha or more land possession. On the other hand, there is another class of 0.25 - 0.5 ha and this seems to suggest dissolution of the immigrants into classes. On the contrary, the farmers of 1.0 - 1.5 ha account for 88% among East Javanese immigrants and the conditions of land possession remains much the same as it used to be when they settled there in 1973. The scale of land possession in this province is, as a whole, large and it shows the same tendency as the two provinces in Sumatra. These farmers have completed reclamation of the land into paddy fields and adopted soybean as a secondary crop. The cropping area per household exceeds about 1.0 ha.

There are still many farmers in this province who cultivate crops without applying fertilizer, but, as the occurrence rate of pests and diseases is relatively low, the yield per unit shows a high figure of 1 - 2 tons/ha. As for the cultivation system, the immigrants brought in

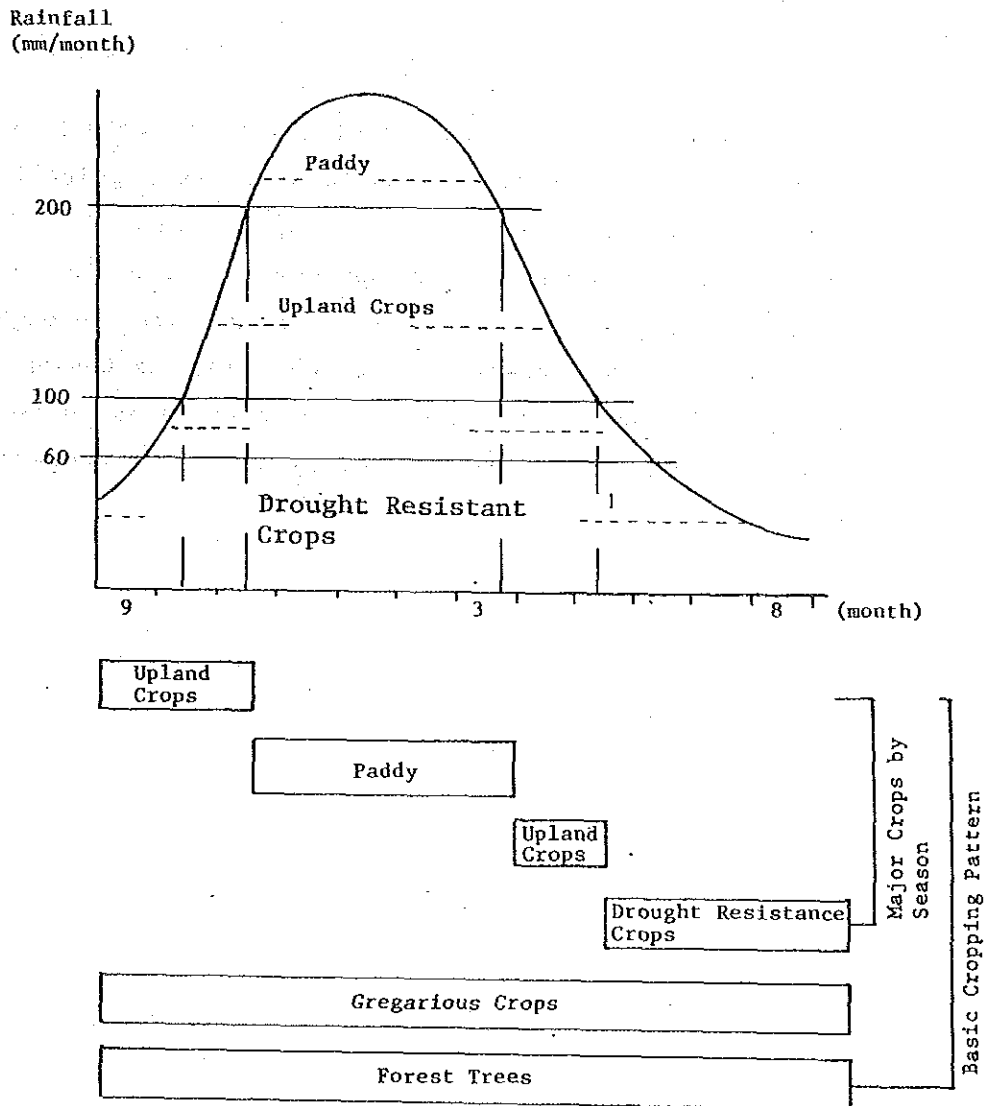
farming methods from the place they came from. In the Balinese immigrants' villages, they keep soybean seeds without threshing. Even now in the East Javanese immigrants' villages, they have managed soybean cultivation with Jabal system. As for the seeding pattern, most of the Bali immigrants have adopted the method to seed on stripes after tilling without applying fertilizer, while East Java immigrants, adopt the method to seed between rice stubbles without tilling. Since both areas have been brought under cultivation recently, the occurrence rate of insects and diseases is relatively low and less labour is required for weeding. Thus, they have gained higher yield with comparatively less labour.

The provincial Government have developed a plan in Gurontalo Kabupaten in order to promote production increase of soybean.

3.3.2 Cropping System

(1) Basic guideline for selection of crops

The Directorate of Food Crop Production Development of the Central Government recommended standards for selecting suitable crops by the amount of rainfall in each season for making basic guidelines to decide on a cropping system and a crop rotation system, as shown in Figure 3.7.



Source: Directorate of Food Crop Production Development, Ministry of Agriculture

Figure 3.7 Rainfall and Basic Standard for Planting

According to this figure, the rainy season (December - March) of 200 mm monthly rainfall is thought to be the optimum period for paddy cultivation. That of 100 - 200 mm is, likewise, indicated as the optimum period for upland crops and off-season paddy field crops, while that of 60 - 100 mm to be that for deep rooted crops such as cassava, gregarious gramineous crops, etc. The dry season (July - September) of rainfall below 60 mm is classified into the planting season for drought-resistant crops and arbor crops.

(2) Cropping pattern

In every province, an agricultural office of each Kabupaten is to present to the central Government a draft guideline and a draft plan for selection of cropping patterns for paddy and other secondary crops. After approval of the drafts by the central Government the draft plans are brought into implementation for extension through local extension offices. The Figure 3.8 shows the major cropping patterns in relation to the soybean production broken down by provinces where the study was conducted.

Transient Period			Rainy Season			Transient Period			Dry Season		
Month/Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1. Jambi											
(I)											
Soybean			Paddy			Cowpea			Sweet potatoe		
(II)											
Paddy (Tidal Swamp Fields)			Soybean			Maize					
2. South Sumatra											
(I)											
Paddy			Maize			Soybean					
3. East Java											
(I)											
Soybean			Paddy			Paddy					
(II)											
Soybean			Paddy			Paddy					
(III)											
Soybean			Paddy			Cowpea			Sweet Potatoe		
4. Bali											
(I)											
Soybean			Paddy			Cowpea					
5. North Sulawesi											
(I)											
Paddy			Soybean			Maize					
(II)											
Soybean			Paddy			Maize					

Source: Anjuran Teknolgi Produksi Padi Palawija dan Pola Tanam Tahun 1985

Figure 3.8 Guideline on Cropping Patterns

The general tendency in cropping patterns in each province is as follows.

1) Areas of Off-season Paddy Field Cropping

One or two cropping systems of soybean are practised during both transient periods (Rainy Season ↔ Dry Season).

2) Upland crop areas

Upland rice and maize are cropped in the rainy season, while pulse such as soybean etc. are cropped in both transient periods. Cassava has been grown throughout a year since it has a resistance to drought.

(3) Actual cropping patterns in each region.

Jambi Province

Pattern/Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	Soybean			Paddy				Soybean				
II	Soybean					Upland Rice						

South Sumatra

Pattern/Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	Paddy				Soybean			Soybean				
II	Soybean				Soybean				Soybean			

East Java

Pattern/Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	Soybean				Soybean/Maize				Paddy			
II	Paddy				Soybean				Paddy			
III	Soybean		Maize				Soybean		Maize			

Bali

Pattern/Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	Paddy		Paddy			Soybean						
II	Soybean			Soybean			Paddy					
III	Soybean		Maize, Others									

North Sulawesi

Pattern/Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
I	Paddy		Soybean			Soybean						
II	Soybean I			Soybean II			Paddy					
(Soybean 3 cropping + Paddy	Soybean III		Paddy		Soybean I							

Figure 3.9 Actual Cropping Patterns for Soybean of the Farmers

1) Jambi

- a) The cropping pattern for upland crops in the reclaimed region was to grow upland rice in rainy season and soybean in the shifting period toward dry season, to lay the fields fallow during dry season and to grow maize, mung beans etc. during the transient period toward rainy season (Pattern I). The rainy season in this region was known to be April - June rather later than in other regions.
- b) The paddy field region has been settled in by the natives and soybean as well as paddy has been grown by them from a few decades ago. Their cropping pattern is to single-crop paddy in the rainy season and crop soybean twice in both transient periods (Pattern II). Yield of paddy was on a high level, adding up to 8.0 tons/ha. On the other hand, rubber gardens are also run in combination with them.

2) South Sumatra

- a) The cropping pattern in the paddy field region was to single-crop paddy once in the rainy season and crop soybean twice after that in the same way as in Jambi (Pattern I). They have been also running rubber and coffee gardens.
- b) In the rubber garden region, rubber as well as coffee gardens is run by slash-and-burn system. They cut rubber trees which supply sap no more and burn them once every thirty years or so, grow upland rice twice in the first year, plant rubber trees in the second year and repeat soybean cropping under the rubber trees till the fifth year around (Pattern II). The collection of sap from rubber trees starts in around the eighth year.

3) East Java

- a) The paddy field region is divided into two types; i.e. (I) Paddy Priority Type and (II) Soybean Priority Type. In the case of (I), they crop paddy twice in rainy season and during the shifting period toward dry season, and crop soybean once during the shifting period from the dry season to rainy season, while in the case of (II), they crop paddy once in rainy season and crop soybean during both transient periods.
- b) In the upland crop region (at the altitude of 400 - 600 m), they put in maize in rainy season and grow soybean after that. They also grow maize or other crops during the transient period toward the rainy season. Cassava has been grown throughout a year.

4) Bali

- a) The paddy field region is divided into two types in the same way as in East Java.
- b) In the upland crop region, they grow soybean in rainy season and maize during the transient period toward dry season and lay the fields fallow in dry season.

5) North Sulawesi

In the paddy field region, the priority is placed on

soybean. Generally speaking, they grow paddy in rainy season and soybean after that. There is another rare cropping pattern of one rice cropping followed by 3 soybean croppings.

3.3.3 Variety

(1) Characteristics of improved varieties

The Table 3.10 describes the major characteristics of improved varieties of soybean in Indonesia. The total of 22 varieties were released as improved varieties by 1987.

Origin:

Four improved varieties were introduced from IRRI of the Philippines, 2 from the USA and Formosa. 3 were selected from among traditional ones, and 13 were bred by crossing domestic ones. Thus, it reaches 22 varieties as a total.

Grain color:

The grain color of soybean is mostly yellow and one - two varieties are colored green or yellow tinged with green. There used to be soybean of green color in Bali before the Second World War and they were highly productive and resistant to diseases and insects, but it is said that there does not exist this variety at all at present.

Stem length:

The length of shorter stems is 40 - 50 cm and that of longer ones is 85 - 90 cm. Orba corresponds to a longer stem variety. Since the crops lodge due to overgrowing in fertile areas, the number of farmers who grow this variety has been reduced recently in Jambi and other provinces.

Number of days for growing:

50 - 60 days for early varieties, while 90 - 110 days for late varieties. As the classification standards for early, medium and late varieties have not been set yet, these which were classified by technical cooperation experts of Formosa were given in Table 3.11 for reference.

Table 3.10 Characteristics of Improved Soybean Varieties

Variety	Origin	Color of Grain	Stem Length	Growing Period (day)	Resistant to Lodging	1,000 grains weight (g)	Protein (%)	Fat (%)	Yield (kg/Ha)	Year
1. Taichung	Introduced from IRRI	Yellow		75-80		105	34.3		1,300-1,500	
2. Makashima (Shakti)	Introduced from Taiwang and selected in Bogor	Yellow		60-85		120-160	41.6	16.1	1,000-1,500	
3. Clark 63	Introduced from IRRI	Yellow		80-85		145			1,200-1,500	
4. Ekonomik Garden I	Introduced from IRRI	Yellow		90-95		120	36.12		1,300-1,600	
5. No. 452 (Sumbing)	No. 27 x No. 69	Yellow		75-80		80			1,000-1,500	
6. T.K.S	Introduced from IRRI	Yellow		80-85		178	34		1,000-1,500	1918
7. Ottau	Selected from local variety	Yellow	+65	90-100		70-80	36.7	14.6	1,000-1,200	1918
8. No. 27	Selected from Ottau	Yellow	+80	90-110		70-80	40	11.7	1,000-1,200	1919
9. No. 29	Selected from No. 17	Yellow		90-110		70	43	9.3	1,000-1,500	1924
10. No. 317 (Ringgit)	No. 27 x No. 69	Green		85-90		80	39	10.4	1,000-1,500	1935
11. Merapi	Selected from local variety	Green	+60	+85		80	41	7.5	1,000	1938
12. Davros	Selected from local variety	Yellow	50-55	80-85		120	37.13	19.7	1,000-1,500	1965
13. Orba	Selected from Davros x Shakti	Yellow	85-90	50-60		120	38.5	18.6	1,500	1974
14. Galunggung	Davros x TK.5	Yellow	55-65	80-90	Strong	125	44.4	19.9	1,500	1981
15. Lokon	GM26 x GM14	Light Yellow	72-76	68-75	Weak	106		15.8	1,750	1982
16. Guntur	GM26 x GM14	Yellow	73-77	73-79	Weak	105	31.3	18.4	1,850	1982
17. Willis	No. 1682 x 143 - 1 - 10	Yellow	40-50	+88	Strong	100	37	18	1,620	1983
18. Dempo	Introduced from U.S.A.	Yellow	45-60	90-95	Strong	125	41	18	1,500	1984
19. Kurinci	Davros x No. 1682	Yellow	45-60	+87	Strong	93	42.0	14	1,600	1985
20. Raung	Davros x Shakti	Yellow	50-60	+85	Strong	130	39	14	1,600	1986
21. Miria	Selected from Orba	Yellow	40-50	83-88	Strong	125	35-36	21.5	1,800	1987
22. Merbabu	Orba x Sinyonya	Yellow	50-80	+85	Strong	100	45	20	1,600	1986

Source: DGPCA
Deskripsi, Varietas Palawija (1985 - 1987)

Table 3.11 Early and Late Varieties of Soybean Varieties

Classification	Variety	Growing Period (days)
Early	Lokon, Guntur	+80
Medium	Presi (Pasuruan): Mokat Merdeka : Manalagi Sinyonya: 1340, Orba	+95
Late	Galunggung: Willis, 29	+105

Source: Agricultural Technical Mission, Taiwan, 1985

Lodging-susceptibility:

Special attention has been paid to this factor characteristic in selection of varieties. A lodging-resistant variety was registered into improved varieties recently.

Weight of grains:

Weight of 1,000 grains ranges from 70 g to 160 g, and generally speaking, many varieties have 1,000-grain-weight of 100 - 120 g.

Protein & fat content:

Many of the varieties have high protein content of 31 - 45%. Fat content ranges from 7 to 20%.

Yielding ability:

It ranges 1,000 - 1,800 kg/ha. A remarkable number of high yielding varieties have been bred recently, but yield of these varieties largely varies according to soil and climatic conditions or to the cropping season, and a few of them excel indigenous varieties in yielding ability.

Disease & insect resistance

Special attention has been paid to anti-rust disease (Sakit Karat) resistance in breeding and selection. The varieties of excelling in this property have increased in number recently.

(2) Extension of varieties

Table 3.12 shows extension status of each variety in the 5 objective provinces.

1) Jambi:

The extension rate of Orba ranks top among quality varieties, followed by Wilis. But, it is said that the cropping area of Orba has been reduced in fertile regions, as they easily lodge.

2) South Sumatra:

The extension rate of Orba ranks top, followed by Lokon.

3) East Java:

Wilis accounts for about 42% and it has been still on the rapid rise. Wilis is followed by No. 29. Local varieties are still widely cropped.

4) Bali:

The extension rate of Wilis has reached about 51%. This seems to have resulted from the cropping system reliant on purchased seeds each time. The rate of traditional varieties is also on the level of about 50%.

5) North Sulawesi:

Extended in the order of Orba, Wilis and Lokon. Soybean has been grown in this province by immigrants from Bali and East Java, and as there is no traditional variety, the improved variety - Orba - which was introduced in the beginning has been extended in a high rate.

Table 3.12 Cultivated Varieties of Soybean in 5 Provinces, 1986

(Ha)

Variety	Jambi			S. Sumatra			East Java			Bali			North Sulawesi		
	A	B	Total	A	B	Total	A	B	Total	A	B	Total	A	B	Total
Improved Variety															
WILIS (%)	561 (21.1)	218 (49.8)	779 (25.2)	-	0 (0)	-	10,370 (9.7)	132,572 (56.4)	142,942 (41.7)	219 (8.9)	11,501 (55.8)	11,720 (50.8)	-	734 (33.0)	-
ORBA (%)	1,527 (57.5)	51 (11.8)	1,578 (51.0)	-	329 (47.0)	-	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.1)	20 (0.1)	-	938 (42.2)	-
LOKON (%)	0 (0)	1 (0.2)	1 (0.0)	-	203 (29.0)	-	467 (0.4)	1,243 (0.5)	1,710 (0.5)	0 (0)	0 (0)	0 (0)	-	352 (15.9)	-
NO.29 (%)	0 (0)	0 (0)	0 (0)	-	0 (0)	-	12,638 (11.8)	25,294 (10.8)	37,932 (11.1)	0 (0)	0 (0)	0 (0)	-	0 (0)	-
Others (%)	188 (7.1)	56 (12.8)	244 (7.9)	-	77 (11.0)	-	43,194 (40.2)	27,403 (11.6)	70,597 (20.6)	0 (0)	0 (0)	0 (0)	-	198 (8.9)	-
Local V (%)	379 (14.3)	111 (25.4)	490 (15.9)	-	91 (13.0)	-	40,651 (37.9)	48,651 (20.7)	89,302 (26.1)	2,250 (91.0)	9,085 (44.1)	11,335 (49.2)	-	0 (0)	-
Total	2,655	437	3,092	-	700	-	107,320	235,163	342,483	2,471	20,606	23,077	-	2,222	-

Source: A: Rainy Season

B: Dry Season

Source: Directorate of Food Crop Production Development. DGPCA

(3) Actual situations of extension of varieties and seed renewal of the farmers.

Table 3.13 Cropped Varieties and How to Renew Seeds

(Studied: July - August, 1987)

Item	Province	Name of Province				
		Jambi	S. Sumatra	E. Java	Bali	N. Sulawesi
1. Varieties & Yield per Unit (kg/ha)	Local (Traditional variety)	△ 900 -	○ 1,000 - 1,500	□ 800 - 1,000	□ 800 - 1,140	○ 750 - 1,200
	Dapuros (Improved variety)		△ 1,000 -			
	Orba (Improved variety)		△ 1,000 -			□ 1,000 - 1,400
	Lokon (Improved variety)					△ 1,000
	No. 29 (Improved variety)					
	Willis (Improved variety)	○ 900 - 1,800		○ 1,000 - 2,000	○ 800 - 1,850	△
	Kerinci (Improved variety)	□ 1,400 - 1,900				
2. Selection Standard for Varieties	1) High productivity	□	○	□	○	○
	2) Resistance to disease	○	□	○	□	□
	3) Quality	△	△	△	△	△
3. How to renew seeds	1) Cropping frequency of the same variety	1 - 4	1 - 5	1 - 3	1	2 - 13
	2) How to gain seeds To grow at one's fields To exchange with each other To purchase	○	○	○ △ □	△ △ ○	○ △
	4. Renewal Effects (%)	○ +10 - 20 □ +5 - 15 △ +0	□ △ △	○ +7 - 50 □ +3 - 35 △ +0 - 30	□ △	△ +50 △ +30 △
5. How to keep seeds	1) Container					
	a. Wooden box	○ a △ b	□ a □ b	○ a	△ a	△ a
	b. Bag		△ d	△ d		△ c
	c. Spread in pods					
	d. Basket					
	e. Can					
2) Place						
a. On the floor of house	□ a △ c	□ a □ b	○ a	△ a	△ a	
b. Under the floor		△ c	△ c		○ c	
c. Storage						

Province	Name of Province				
	Jambi	S. Sumatra	E. Java	Bali	N. Sulawesi
6. Seed Price (RP/kg)					
1) For purchase	600 - 700	600 - 1,000	700 - 800	700 - 800	500 - 550
2) For sale	400 - 600	550 - 800	550 - 700	600 - 700	450 - 500
7. Sources of Supply					
a. Seed farm	<input type="checkbox"/> c <input type="checkbox"/> Δa	<input type="checkbox"/> d <input type="checkbox"/> Δe	<input type="checkbox"/> a <input type="checkbox"/> b	<input type="checkbox"/> e <input type="checkbox"/> Δc	<input type="checkbox"/> a
b. Agricultural cooperative	<input type="checkbox"/> Δb		<input type="checkbox"/> Δc	<input type="checkbox"/> Δd	
c. Extension centre					
d. Farmers					
e. Market					

Note: ○ - Many

□ - Medium

Δ - Few

Number of Visited Farmers 10 in East Java Province and
5 in other provinces, totalled 30

Table 3.13 shows the study results of the actual fact finding study on varieties and seed renewal of the farmers of the region.

- 1) Varieties cropped by farmers reflects a tendency of extension of quality soybean varieties in each of the provinces shown in Table 3.12.
- 2) As for standards for selection of varieties by farmers, they generally give the priority to productivity. But, in East Java and Jambi where disease and insects come out frequently, many farmers place top priority on the resistance to diseases and insects in selection of varieties. In the reclaimed regions or in the areas where fewer diseases and insects come out, they give priority to productivity.
- 3) As for the means to renew seeds, there are a larger number of people who buy seeds in East Java and Bali, which are major producing provinces of soybean, while in other provinces most of the farmers grow seeds by themselves. It is difficult to gain new varieties and it is also not easy to renew seeds in North Sulawesi where only one soybean variety is more repeatedly cropped.

- 4) As for renewal effects, some farmers described yield increase to be 10 - 50% in the first cropping, 5 - 30% in the second and 0 - 30% in the third. But, the fluctuation of yield according to cropping seasons is large as is shown in the following Table 3.14. But generally speaking, the renewal effect is high in the first year and seems to be on the same level till the third year.

Table 3.14 Soybean Yield According to Cropping Season
(Examples of farmers)

Classification	South Sumatra		North Sulawesi	
	kg/Ha	%	kg/Ha	%
Rainy Season Cropping (January - April)	900	60	1,800	90
Shifting Period Cropping toward Dry Season (April - July)	800	53	1,500	75
Shifting Period Cropping toward Rainy Season (September - December)	1,500	100	2,000	100

- 5) Seeds are generally kept in airy and dry places in bags or in boxes after dried, threshed and cleaned. In immigrants' villages from Bali in North Sulawesi (immigrated in 1963), they spread soybean seeds in pods after harvest, and thresh, clean, sort and sow them when they use them. It is said that they can gain high germination rate by this method.
- 6) Many farmers are feeling that the purchasing price of seeds is generally too high.

3.3.4 Technologies on Soybean Cultivation

(1) Cultivating techniques of soybeans in the country.

As for the cultivating techniques of soybean, the authorities concerned of the Central Government show the basic pattern decided in the Central Food Crop Research Institute in Bogor to the related organizations of each province and each province compiles them based upon it with the guidance and advice from the central organization. The central organization published the finally decided guidelines by the title of "Proposals on Producing Techniques and Cropping Patterns for Paddy and Palawija" and distributed to the related organizations for the implementation of the decided techniques. Table 3.15 shows the summary of guidelines on soybean culture which was compiled in Central Food Crop Research Institute in Bogor. This is explained below in brief.

Table 3.15 Guidelines on Soybean Cultivation

1. Varieties	22 improved varieties were registered by 1987.
	Early and late varieties
	Early varieties - Growing period <u>+80</u> days (5 varieties)
	Plateaus - optimum for large grains
	Medium varieties - Growing period <u>+95</u> days (14 varieties)
	Low-land - optimum for small grains
	Late varieties - Growing period <u>+105</u> days (3 varieties)

2. Improved varieties	Attentions to be paid to grow quality seeds.
	(1) To grow from among newly harvested ones.
	(2) Cleanliness, maturity, brilliance, purity
	(3) More than 80% in germinating power

Table 3.15 Guidelines on Soybean Cultivation (Cont'd)

3. Soil conditions	<ul style="list-style-type: none"> (1) Soybean does not need surplus water. (2) Soil should be wet. (3) Soil should be soft. PH - 5.8 - 7.0
4. Planting time	<ul style="list-style-type: none"> (1) Attentions to be paid to decide the planting time: water facility, generative conditions of disease and insects, rainfall after harvest (2) Water content in soil in seeding time. (3) These should not be too much rainfall in early rainy season. (4) Farms should be well-drained. (5) The period from August to the following May is the optimum season for secondary crops of rice.
5. Plowing, land preparation	<ul style="list-style-type: none"> (1) Soybean does not need fine plowing. (2) To plow with hoes or spades in the case of dense clayish soil. (3) To plow lightly in the case of soft soil. (4) To make ground after plowing.
6. Use of module bacteria	<p>To mix 5 - 10 g of module bacteria and 100 - 250 g/10 a of soil to use at farms where soybeans are introduced for the first time.</p>
7. Seeding pattern	<p>Seeding density depends on soil as well as climatic conditions and varieties, still,</p> <ul style="list-style-type: none"> (1) Dense planting 20 x 20 cm (2) Normal 40 x 15 cm (3) Rough 50 x 15 cm (4) Depth of holes: 2 - 4 cm (5) To put 2 - 3 grains in a hole and cover with soil. (6) To cover with straw.
8. Fertilization	<ul style="list-style-type: none"> (1) Not needed for fertile soil. (2) Urea (N22.5) 50 kg/ha, TSP (P.33.8 - 40.5) 75 - 90 kg/ha for the soil in which N.P. content is low. (3) Basic manure and additional manure should be 1/2 in the case of phosphate fertilizer (TSP), total basic manure and introgen fertilizer (Urea). (4) Additional fertilization around 25 days after sprouting, and the second around 40 days (before the flowering season)

Table 3.15 Guidelines on Soybean Cultivation (Cont'd)

9. Irrigation and drainage	(1) Once or twice/week when the soil is too dry in order to stimulate germination (2) To pay attention not to cover the soil with water in the germination period of soybeans grown as a secondary crop for dry fields. Otherwise, it will spoil the germination.
10. Weeding	(1) First time: 2 - 4 weeks after seeding. (2) Second time: Before the flowering season.
11. Prevention of plant pests	Major disease and insects (1) Lalat Kacang (2) Wereng Kedelai (3) Kadik Coklat (4) Ulat penggerak polong (5) Karat (6) Virus. To spray chemicals once in every 1 - 2 weeks according to occurrence of disease and harmful insects.
12. Harvest	Matured conditions (1) Falling of leaves (2) Stems are tinged with yellow. (3) Water content 25% (4) 90% of pods should be matured (1) To reap with sickles on fine days. (2) To dry them on the floor for 3 - 4 days. (3) To thresh and coordinate. (4) To further dry under sunshines until moisture content becomes 12% and then store in containers or sell them.

Source: Agricultural Information Bureau, Agricultural Ministry, Indonesia, 1983.

As for the varieties as of 1987, the number of improved varieties has reached 22, and they are classified into early, medium and late maturing varieties as follows. Generally speaking, early and medium maturing varieties are suitable to be planted in rainy season and late ones in dry season. As for seeding patterns, drill seeding has been generally recommended. The seeding amount has not been indicated, so, the data given by the experts of Taiwan in East Java Province are shown in Table 3.16, in connection with the seeding amount which has been recommended at present. The seeding amount differs according to the size of grains or planting density, but, 50 kg/ha has been a general standard.

Table 3.16 Seeding Amount & Size of Seeds

Size	1000 grain weight (g)	Planting density (cm)	Seeding amount (kg/ha)	Number of grains (1000xgrains/ha)
Small grains	50-100	30-40x10	50-60	500-600
Large grains	100	40-45x10-15	40-45	300-500

Source: Agricultural Technical Mission Republic of China, Surabaya, 1985

Though it is prescribed in the column of fertilization that it is unnecessary to apply fertilizer to fertile soils of the aforementioned soybean cultivation guide each province has recommended to apply fertilization in most of the regions. Here is shown the fertilization standards which were prepared by a project team of Taiwan in the following Table 3.17 for reference.

As for the other items, these standards have been applied to them and utilized for guidance and extension by each province.

Table 3.17 Standard of Application of Fertilization

Classification	Amount of Fertilizer (kg/ha) (Component)			Conversion amount of Fertilizer		Line	
	N	P ₂ O ₃	K ₂ O	Urea	TSP		Kcl
Basic manure	10-25	80-150	70-120	22.2-55.5	177.6-333	116.2-199.2	PH. 5.3 or less
Additional manure	0-25	0	0	0-55.5	0	0	500-1000 kg/ha
Total	10-50	80-150	70-120	22.2-111	177.6-333	116.2-199.2	

Source: Agricultural Technical Mission, Taiwan, Surabaya, 1985

(2) Technical level of the farmers for soybean cultivation.

The guidelines which were decided by each province, as has been already described, have been extended to farmers of the regions through extension services of each province. The Table 3.18 is the summary of the study results on the actual cultivating techniques of the farmers. (30 farm households sampled, -- that is, 10 in East Java and 5 in each of the other provinces.)

Table 3.18 Soybean Cultivating Techniques of the Farmers in a Region

(Studied: July - August, 1987)

Operation	Name of Province				
	Jambi	S, Sumatra	E. Jawa	Bali	N. Sulawesi
1. Cropping condition					
1) Cropped area (ha)					
Paddy fields	△ 2-2.5	□ 0.5-1.0	○ 0.35-5.0		
Garden fields	□ 0.25-0.5	△ 1.5-2.0			
2) Cropping frequency					
1 cropping/year	△		□	□	
2 cropping/year	□	△	□	△	□
3 cropping/year		□			
2. Plowing & ground making					
Method					
a. Human power	○	△	○	○	△
b. Cattle power (cow)			□		□
c. Motive power (tiller, tractor)	△ (Tractor)		△ (Tiller)		
3. Fertilization					
1) Method					
a. On the whole area			△	□	
b. Between rows	○	○	□	△	□
c. No fertilization				□	□
2) Amount (kg/ha)					
a. Urea (N)	50 (22.5)	50-200 (22.5-90)	50-210 (22.5-94.5)	0-35(15.8)	25-50 (11.3-22.5)
b. ZA (N)			50-75 (22.5-33.8)		
c. TSP (P ₂ O ₅)	100-200 (45-90)	100-200 (45-90)	50-150 (22.6-67.5)	57-100 (25.7-45)	50-100 (22.5-45)
d. KCl ₂ ³ (K ₂ O)	60-200 (36-120)	0-50 (30)	50-75 (30-45)	30-50 (18-30)	25-50 (15-30)
e. Lime	0-2,000	0-1,500			
3) Frequency of additional fertilization/proportion (%)	0-1 (10)	0-1 (30-50)	1-3 (20-60)	0-1 (30)	0-1 (100)

Operation	Name of Province				
	Jambi	S, Sumatra	E. Jawa	Bali	N. Sulawesi
4. Seeding method					
1) Plowing					
a. Broadcast seeding (kg/ha)			△ 50		
b. Row seeding (kg/ha)			□ 40		
c. Drill seeding	○ 40-50		□ 35-40		□ 50-60
2) Without plowing					
a. Broadcast seeding (kg/ha)				□ 20-70	
b. Drill seeding (kg/ha)		○ 20-35	△ 35-40	□ 50	□ 40-50
3) Planting density (Row width x seed space/grains)	20x25/2-3	25x40/2-3	30x15/2-4	20x25/2-3	25x40/3-4
5. Chemical spray (Frequency)	3-6	3-6	3-8	2-4	3-5
6. Weeding (Frequency)	2-3	2-3	1-3	1-2	2-
7. Reaping, Drying					
a. With sickles	○	○	○	○	□
b. With handy sickles					△
c. Number of days for drying	3-4	2-7	3-7	3-7	2-4
8. Threshing, Cleaning					
a. Beating	○			△	□
b. Beating with clubs		○	○	□	△
Yield/unit (kg/ha)	900-1,000	1,000-1,500	1,000-2,000	800-1,850	1,000-2,000

Notes: ○ - Many □ - Medium △ - Few

1) Cultivation methods

a. Jambi

The farmers in transmigration areas adopt the after-tilling drill seeding method for upland fields (they sow after plowing and hoeing the ground.), while they adopt the after-tilling hole seeding method for paddy fields in the native village (they take the method of seeding after plowing, ground-making with tractors and making ridges). The both villages have a large scale of land and it is possible for them to expand its scale since they are surrounded by unreclaimed land. Even though it has passed ten years since they settled in the transmigration areas, the up-land fields of about 1.5 ha are infertile with low yield of soybean. On the other hand, the native village is located in the alluvial fertile paddy zone and the people are well-off as they keep gardens for rubber trees and coffee in combination. Some have also introduced a tractor for common use.

The following are their practices.

Preparation for seeding:

Tractors are utilized for plowing and ground-making in the native villages. Villagers of the transmigration region lay the fields fallow during dry season since it is impossible to crop during the season.

Pest control:

Since disease and insect occur frequently in these zones, the frequency of chemical spray and weeding is high.

Yield:

Low in the transmigration region and high in the native village.

b. South Sumatra

Studies were carried out on two native villages. Priority is given on the keeping of rubber forests by slash-and-burn method in the upland area of village A, and soybean is grown under rubber trees. The cropping pattern there is croppings of soybean in a year and it is repeated as long as possible (about five years). They adopt the drill seeding method without tilling.

Farmers of village B grow soybean as a secondary crop of rice and they adopt the hole seeding method without tilling. It is said that they have grown soybean since before World War II.

Fertilization:

Farmers in the paddy field areas seem to apply more fertilizer than the standard. They apply fertilizer into seeding holes between rice rows.

Pest control:

There is a tendency that diseases and insects easily occur and so pest control frequency is high. Since weeds grow, weeding frequency is naturally high.

Yield:

Average. Since they are grown repeatedly under rubber trees, the yield gradually declines as the trees grow high to provide shade from the sun.

c.. East Java

Studies were conducted on the secondary-crop-of-rice zone. The running scale of the farmers is generally small. The cropping patterns are different according to the priority they put. There are also differences in

the seeding methods, whether they take the seeding method without plowing or with plowing. Thus, there are various patterns for cropping in this zone.

Yield:

Generally high. It is oriented to intensive cultivation.

Preparation for seeding:

There are various methods for plowing and ground-making, such as human power, cattle power and machines (tillers).

Fertilization:

There are differences according to cropping patterns. They generally give fertilizer before plowing and seeding.

Pest control:

Disease and insect easily occur and so the pest control frequency is also high. Weeds also grow easily, and so the weeding frequency is naturally high.

d. Bali

They are divided into two types; i.e. 2 crops area of broadcast seeding without plowing and 2 crops area of drill-seeding without plowing. There can be seen a tendency to demand a side job and reduce labour for soybean production in the both areas.

Fertilization:

Many farmers do not apply fertilizer.

Pest control:

The occurrence of diseases and insects is less frequent there, and so frequency of pest control is low. Weeding frequency is also low possibly owing to broadcast seeding.

Yield:

Yield is high though labour is saved in cultivation, possibly owing to fertility of the soil.

e. North Sulawesi

Studies were conducted on transmigrant villages. As it is nearly 30 years since they settled, and the scale of possessed land is generally large (more than 2.0 ha), they have a stable base for life. As for cropping patterns, the transmigrators from Bali place the priority on soybean of 2 croppings by taking the drill seeding method with plowing, while those from Java island place the priority on paddy and grow soybean once.

Fertilization:

Since the soil is still fertile in transmigration area, many farmers do not apply fertilizer there.

Yield:

Generally high as a tendency, regardless of non-fertilization.

As are judged from the study results on the plowing and seeding methods which were described above, the people in East Java have adopted the cropping patterns which match natural conditions of location or running of gardens, and they are considered to be oriented to intensive culture, judging from the improved methods and a large quantity of fertilizer as well as chemicals. On the other hand, the people in Bali tend to save labour

for the growing since the arable land is limited.

2) Required labour according to operations

Table 3.19 Required Labour According to Operations

Unit: Man·day/Ha

Operation	Province				
	Jambi	S.Sumatra	B. Java	Bali	N. Sulawesi
1. Plowing, land preparation	3-60	30-60	7-50	2-8	2-9
2. Fertilization	3-8	3-6	0-14	0-8	1-4
3. Seeding	12-20	7-21	3-40	2-25	5-25
4. Control of disease & insects	6-20	6-25	10-18	3-9	3-10
5. Weeding	35-80	21-60	15-84	0-26	30-48
6. reaping, drying	16-35	11-26	21-42	17-23	10-23
7. Threshing, cleaning	12-36	8-31	10-56	12-46	10-24
8. Total labour required	106-219	123-173	139-215	44-108	73-115
Percentage(%)	76-102	80-88	(100)	32-50	53

(Investigated: July - August, 1987)

The Table 3.19 shows the investigation results of the required labour broken down by each operation.

Comparing the required labour/ha, according to each province, it is 139 - 215 persons/ha in East Java, representing the higher figure

than that in other provinces. The lowest figure is 44 - 108/ha of Bali. This may be attributed to the broadcast seeding method without plowing. The figures of other provinces exceed that of Bali, but they are below that of East Java.

To compare manpower required for each operation, plowing and land preparation largely differ depending on the methods. More manpower is required in the case of human power, which works as a factor to limit the cropping scale of soybean as a secondary crop of rice. Weeding operation generally relies on human power, though it may differ depending on the conditions of location where weeds grow. Pest control operation is influenced by the occurrence degree of diseases and insects, and the figure of required labour for this operation is the highest in East Java, followed by Jambi and then by South Sumatra. The proportion of this operation is anticipated to rise in the future as intensive cultivation is promoted.

3) Comparison of required labour broken down by operations

Table 3.20 Comparison of Required Labour for Soybean
Production broken down by Operation
(Studied: July - August, 1987)

Province/Village	Jambi	S. Sumatra	E. Java	Bali	
Operation	Sumber Madju	Sinar Bulan	Karya Tani	Sumber Malmur	Kailo Paksa
1. Operation	Plowing (Tractor) Drill seeding	Plowing of garden fields (Human power), Hole seeding	Plowing (Human Power), Hole seeding	Plowing, (cattle) Broadcast seeding non- fertilization	Non-plowing, Broadcast seeding, non- fertilization
2. Cropped area (Ha)					
1) Paddy fields	2.0		1.0	0.5	0.6
2) Up-land		0.2			
3. Plowing, Ground-making					
1) Method	Tractor	Human power(77)	Human power(77)	Cattle	
2) Required labour (man·day/Ha)	3	42	50	7	8
4. Fertilization	Between rows	Between rows	Between rows	Non- fertilization	Non- fertilization
1) Method (Kg/Ha)					
2) Amount					
Urea (N)	200	50	50(2A75)		
TSP (P)	200	100	75		
Kcl (K)		50			
Kapur (ca)		1,500			
3) Required labour (man·day/Ha)	5	7	2	-	-
5. Seeding					
1) Method	(25cm x 25cm) Drill seeding	(40cm x 20cm) Drill seeding	(30cm x 30cm) Drill seeding	Broadcast seeding	Broadcast seeding
	40Kg/ha(2-3)	25 Kg/Ha(2-3)	40 Kg/Ha (2-3)	50 Kg/Ha	60 Kg/Ha
2) Required labour (man·day/Ha)	20	10	40	7	6