BASIC DESIGN STUDY REPORT ON THE PROJECT FOR THE MULTIPLICATION AND DISTRIBUTION OF HIGH QUALITY SEED POTATO IN THE REPUBLIC OF INDONESIA

MARCH 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a Basic Design Study on the Project for the Multiplication and Distribution of High Quality Seed Potato and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a survey team headed by Dr. Hidehiro Horio, Deputy Director, Yatsugatake Station of National Center for Seeds and Seedling, Ministry of Agriculture, Forestry and Fisheries from August 22 to September 11, 1989.

The team exchanged views with the officials concerned of the Government of Indonesia and conducted a field survey in the Project site. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss the draft report and the present report was prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

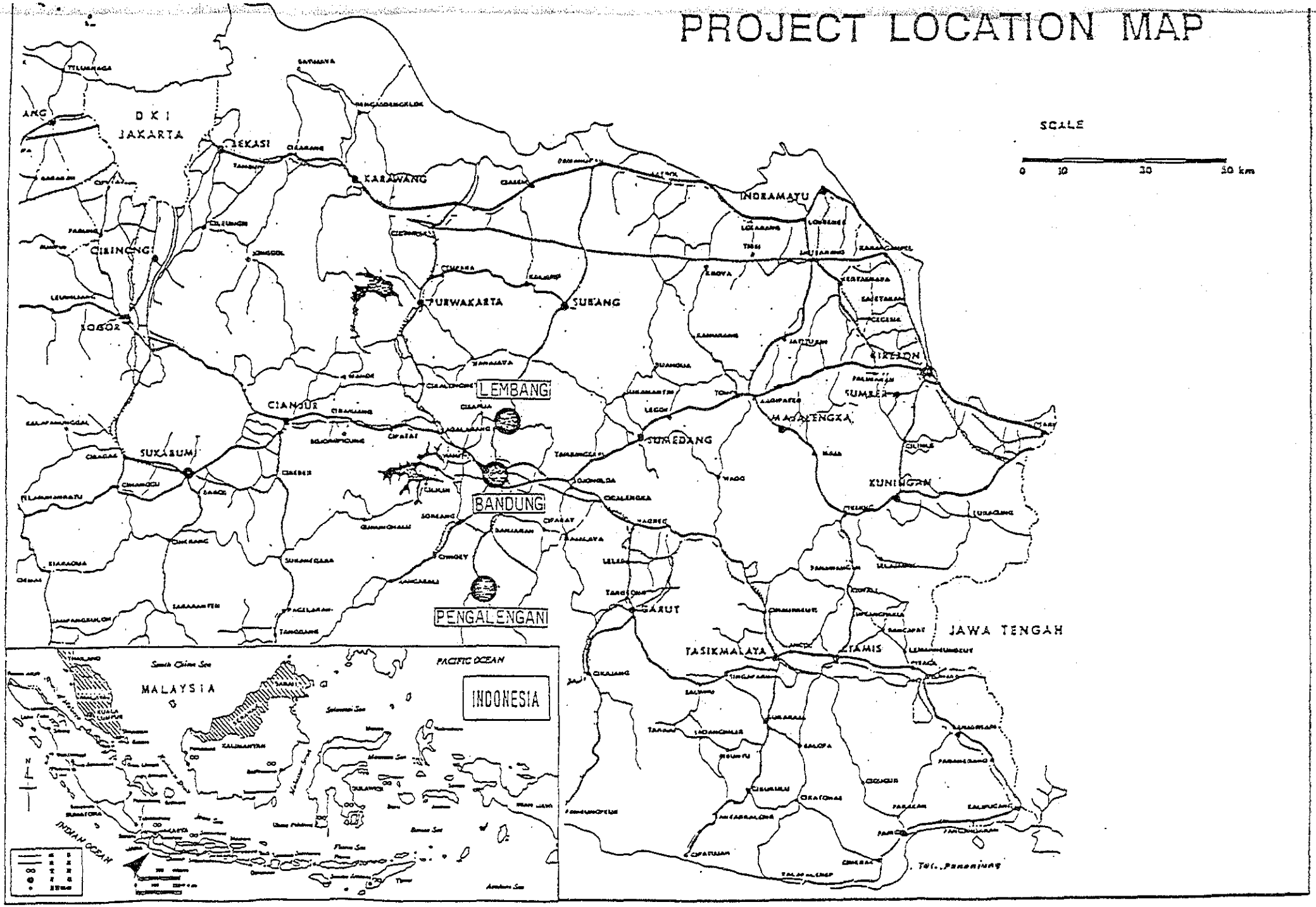
I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

March, 1990

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

PROJECT LOCATION MAP



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SUMMARY

S U M M A R Y

Agriculture is the most important industry in Republic of Indonesia (hereinafter referred to as "Indonesia") and nearly half of the working population is involved in agriculture.

Since becoming self-sufficient in its rice production (1984), the Indonesian Government has been planning to increase the production of other staple food crops such as soybeans and potatoes, and has requested the Government of Japan to prepare a development study on the multiplication and distribution of high quality crop seeds. In response to the request, the Japan International Cooperation Agency (JICA) dispatched a master plan study team to Indonesia, and in December 1987, the Field Study Report of "The Master Plan study on Multiplication and Distribution of Improved Soybean Seed and Seed Potato" was prepared.

This Project for the Multiplication and Distribution of High Quality Seed Potato was chosen by the Government of Indonesia from the master plan, and the Grant Aid Cooperation of Japan was requested for the implementation of this Project. In response to this request, JICA dispatched a Basic Design Study Team to Indonesia for 21 days (August 22 to September 11, 1989). The Study Team held a series of discussions with the agencies concerned, and, at the same time, conducted field surveys at Lembang Horticulture Research Institute, the Seed Control and Certification Service Center, the Foundation Seed Farm, and the Stock Seed Farm.

Although Indonesia has succeeded in becoming self-sufficient in rice production, the production is reaching its limit. To meet the diversification in food crops and population increase, potato cultivation is expected to be the newest source of carbohydrate supply and is considered as a first-grade crop in the high cool areas. Unit production volume is presently low (10 tons/ha), since the farms are using poor quality seed potatoes.

The objectives of the Project are as follows:

- To distribute pathogen-free, high quality seed potatoes at a reasonable price to farmers in the major potato producing area of West Java and thereby increasing the potato productivity.
- To provide the facilities and equipments necessary for increasing the production of pathogen-free, high quality seed potatoes.

Implementation of the Program will be headed by Director of Food Crop Agriculture, Directorate of Horticulture, the Directorate General of Food Crop Agriculture, the Ministry of Agriculture, with a committee composed of the Agency for Agricultural Research and Development, the Government of West Java and others.

The activities and necessary facilities for each Project agency is outlined below:

Agency	Activity	Necessary Facilities and Equipment
Lembang Horticulture Research Institute (LEHRI)	To supply pathogen-free, high quality basic seeds (G0) for foundation Seed Farm. To conduct tests on new varieties	Laboratory Screen Houses Laboratory Equipment
Foundation Seed Farm (BBI Unit)	To produce foundation seeds (G1, G2) from basic seeds (G0) supplied by LEHRI and supply to Stock Seed Farm. To conduct training of staff and seed potato producing farm personnel.	Screen House Laboratory Instructor House Irrigation System Laboratory & Training Equipment
Stock Seed Farm	To produce stock seeds (G3) from foundation seeds (G2) supplied by the Foundation Seed Farm and supply to seed grower.	Irrigation System Storage House Grading Room
Seed Control and Certification Service Center (BPSB)	To issue certificates for high quality seed potatoes after farm and laboratory inspection. To conduct fixation and evaluation of varieties.	Laboratory Screen House Laboratory Equipment
Seed Grower	To produce extension seeds (G4) from stock seeds (G3) supplied by Stock Seed Farm and deliver to potato growing farms	

The objective of the first stage is to produce 1,500 tons of extension seed (G4) per year. The objective of the final stage is to produce 4,500 tons of G4 per year.

The estimated Project construction cost to be borne by Indonesia is 314 million Rupiah.

As a result of implementation of the Project, the potato yield in West Java will increase from 10 tons/ha to 20 tons/ha. This effective result can be achieved and thereby will improve the living conditions of the inhabitants. Therefore, implementation of the Project with the Grant Aid Cooperation is considered to be appropriate. Indonesia has adequate budget and the personnel for the operations and management of the Project and there would be no problems for the Project implementation.

Project implementation will be smoother and more effective, if the following improvements and modifications are made:

- Improve the personnel education and operation system;
- Implement training programs for Project personnel and farmers;
- Arrangement of the environment for the equipment;
- Establishment of the maintenance system of equipment;
- Provide technical cooperation

ABBREVIATIONS

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	Seed Control and Certification Services (SCCS)
BS	Basic 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
EC	European 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
OECF	The Overseas Economic Cooperation Fund
PIU	Project Implementation Unit
PMDC	Potato Multiplication and Distribution Center

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	Stock Seed

Money Exchange Rate

US$1 = ¥137.74 (September, 1989)

Rp.1 = ¥0.0781 (September, 1989)

CHAPTER 1 : INTRODUCTION

CHAPTER 1 INTRODUCTION

As the international price of petroleum and natural gas has been low in the past few years, the Republic of Indonesia (hereinafter referred to as "Indonesia") is placing great importance on agriculture being its major industry.

The Government of Indonesia has taken active measures to increase the rice production by expanding the rice grown areas and, through the implementation of the Bimbingan Masal-Intensification Program (BIMAS, INMAS, etc.), they have succeeded in becoming self-sufficient in rice production in 1984. Hence, from now onwards the agricultural policy will focus on the promotion of a staple crop other than rice.

The objective of the 'Plan for the Promotion of Staple Food Crop Production in Indonesia' is to stabilize and expand the production of staple crops other than rice, such as soybean and potato, based on the crop diversification policy of the Five Year Development Plan IV (REPELITA IV 1984/1985 - 1988/1989).

With the development of the economy, the eating habits of the people have improved in recent years and the consumption of staple crops, other than rice, especially potatoes has increased. Therefore, increasing the potato production is an important part of the agricultural development plan. The harvest area for potatoes in Indonesia is around 32,000 ha, of which approximately 12,000 ha is in West Java. The annual potato yield is about 300,000 tons (40% from West Java); Apart from some exports to Singapore and Malaysia, most of the potatoes are consumed domestically--mostly in large cities, such as Jakarta.

Generally, potatoes are cultivated in cool areas at altitudes from 1,000 to 2,000m. However, these areas have reached the limit and now the measures are being taken to expand the cultivation to the mid-altitudes ranging from 400 to 1,000m. The development of potato production in these areas is expected. In Indonesia, the average yield of potato is about 10 tons/ha which is an extremely low figure compared to the average of 28.3 tons/ha in Japan. One of the reasons for this is the lack of a systematic

multiplication and distribution system of seed potato. Although Indonesia is importing high quality seed potatoes from countries, such as West Germany and Holand, the majority of farms are only using the home grown low quality seed potatoes.

Due to these circumstances, Indonesia has requested the Government of Japan to conduct a development study on the establishment of a multiplication and distribution system of high quality seed potato and soybean seed. Accepting this request, the Japan International Cooperation Agency (JICA) dispatched a master plan study team and, in December of 1987, prepared a field survey report on the Project for the Multiplication and Distribution of Improved Soybean Seed and Seed Potato. The Project for the Multiplication and Distribution High Quality Seed Potato was chosen from the above-mentioned master plan study by the Government of Indonesia and grant aid cooperation on facilities and equipments for the implementation of project was requested from the Government of Japan.

In response to the request, the Government of Japan decided to conduct a basic design study, and the Japan International Cooperation Agency (JICA) dispatched a study team headed by Dr. Hidehiro Horio, Deputy Director, Yatsugatake Station of National Center for Seeds and Seedlings, Ministry of Agriculture, Forestry and Fisheries to Indonesia for 21 days from August 22 to September 11, 1989.

The study team held a series of discussions with the Ministry of Agriculture, BAPPENAS (National Planning Agency), SETKAB (Technical Coordinating Committee) and the Government of the West Java Province. Also, the study team conducted a survey at the Lembang Horticulture Research Institute (Lembang), Seed Control and Certification Service (Bandung), the Foundation Seed Farm, and the Stock Seed Farm (Pengalengan).

As a result the basic data such as the scope of cooperation, requested facilities, equipment and measures to be taken by Indonesia, were compiled in the Minutes of Discussions and signed by the study team leader and by the Director General of Food Crop Agriculture, Ministry of Agriculture on August 31, 1989.

Upon returning to Japan, the study team analyzed and examined the results of the field survey, determined the selection of facilities, equipment and materials, and devised the operation and maintenance plan. Based on the above, the Draft Final Report on the basic design study of the Project was prepared.

The JICA dispatched a study team headed Dr. Hidehiro Horio to Indonesia for 8 days from November 26 to December 3, 1989 again to explain the contents of the Draft Final Report.

The basic items confirmed through the discussioning by both the Indonesian officials concerned and the study team are compiled in the Minutes of Discussion dated December 1, 1989.

This report is a compilation of the facilities, equipment, and material considered reasonable for the contents of the Grant Aid Cooperation program of the Government of Japan; the basic design; the project implementation plan; the operation and maintenance plan; the project evaluation; and recommendations, with regard to the implementation of the Project for the Multiplication and Distribution of High Quality Seed Potato.

A list of study team members, the field survey schedule, a list of interviews and the Minutes of Discussions are shown in the annex.

CHAPTER 2 : PROJECT BACKGROUND

CHAPTER 2 PROJECT BACKGROUND

2.1 General Conditions

2.1.1 Indonesian Agriculture

The Gross Domestic Product of Indonesia in 1987 was 114 trillion 518.5 billion Rupiah and its break down was as follows:

Agriculture, Forestry, and Fisheries	25.5%
Mining	13.1%
Manufacturing	13.9%
Commerce	16.8%
Civil Service	7.8%
Others	22.9%

Although the contribution of Agriculture, Forestry and Fisheries in National GDP has decreased (30.6% in 1980), it still represents a great portion of the national economy and employs nearly half of the total working population. According to the industrial trend, one of the characteristics for the changes in the GDP is the stagnation of the mining industry and commerce due to the low international cost of petroleum.

Indonesia's agriculture, forestry and fisheries industry has developed satisfactorily, with the GDP for 1987 being 29 trillion 208.2 billion Rupiah of which food crops, non-food crops, plantations, livestock, forestry, and fisheries represented 60.4%, 14.2%, 2.9%, 10.3%, 4.5% and 7.7% respectively. Agriculture centers around the production of food crops, especially rice. Indonesia had been a great importer of rice for many years,but in 1984 they succeeded in becoming self-sufficient in rice production. Diversification of food crops is progressing.

The composition of staple food crops is as follows:

Rice	38.9%
Corn	5.7%

Cassava	6.6%
Sweet Potato	1.3%
Peanuts	3.4%
Soybean	0.7%
Vegetables and Others	10.6%
Fruits	25.1%

The ratio of rice compared to other crops is extremely high.

There has been no increase in the cultivation area for rice and about 9.9 million hectares are cultivated with rice. But due to the increase in intensive cultivation areas the total yield of rice is increasing slightly. However, the conversion from non-intensive to intensive cultivation is reaching its limit and therefore, the present situation will continue in the future.

The ratio of staple crops, such as corn, cassava, and sweet potato are also high and there have been no great changes in the cultivation trend. As for the soybeans and potatoes, a slight increase in yield is foreseen.

2.1.2 Agriculture in West Java Province

West Java Province is a leading agricultural area in Indonesia. Having 20% of the country's rice cultivation area, it has a typical agricultural system based on rice. However, the rice yield has only increased very slightly since 1985 and there has been no progress in the production.

As for the other staple food crops, their yield ratio in West Java is as follows (1986 figures):

Corn	3.9%
Cassava	12.7%
Sweet Potato	22.3%
Peanuts	14.9%
Soybean	6.8%
Potato	42.1%

The ratio of potatoes is especially high. The total cultivation area for potatoes is around 32,000 ha (1987) of which 12,000 ha (38%) is in West Java.

Table 2-1-1 Target and Result of Rice Production in REPELITA IV

		Unit	1984	1985	1986	1987	1988
Result	Intensive Cultivation	1000ha	7.747	8.073	8.402	8.865	9.240
	I N S U S	1000ha	4.402	5.022	5.832	6.521	7.211
	I N M U M	1000ha	3.345	3.051	2.570	2.344	2.029
	Non-intensive Cultivation	1000ha	1.432	1.287	1.146	772	489
	Total area harvested	1000ha	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	1000ton	24.701	25.781	26.867	27.736	28.624
Target	Intensive Cultivation	1000ha	8.632	8.821	9.130		
	I N S U S	1000ha	4.399	4.659	4.922		
	I N M U M	1000ha	4.332	4.162	4.209		
	Non-intensive Cultivation	1000ha	1.132	1.081	741		
	Total area harvested	1000ha	9.764	9.902	9.988	9.923	3.251
	Yield per hectare	ton/ha	2.67	2.68	2.71		
	Total production	1000ton	25.933	26.542	26.707		

Source : Kebijaksanaan dan Langkah-Langkah Operasional Rembangunan Pertanian Tanaman Pangan REPELITA IV
Evaluasi PELITA IV Tahun Ketiga (1986/1987)
Statistik Indonesia 1988

Table 2-1-2 Target and Result of Other Crops Production in REPELITA IV

Unit : 1000ton

	Crops \ Year	1984	1985	1986	1987	1988	Annual growth rate
Result	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
Target	Corn	5,288	4,329	5,920	5,154	5,479	
	Cassava	14,167	14,056	13,312	14,356	9,817	
	Sweet potato	2,157	2,161	2,091	2,012	1,319	
	Groundnut	535	528	592	533	443	
	Soybean	769	870	1,221	1,161	903	
	Green pea	187	200	209			
	Potato	326	318	446			

Source : Kebijaksanaan dan Langkah-Langkah Operasional Rembangunan Pertanian Tanaman Pangan REPELITA IV
Evaluasi PELITA IV Tahun Ketiga (1986/1987)
Statistik Indonesia 1988

Table 2-1-3 Agricultural production in West Jawa Province

Unit : 1,000tons

Crop \ Year	1984	1985	1986	1987	1988[1]
Rice	17,026	18,046	18,026	18,523	15,768
Corn	201	147	232	163	240
Cassava	2,082	1,943	1,833	1,777	1,193
Sweet Potato	396	410	468	402	325
Groundnut	80	76	96	67	83
Soybean	52	41	84	52	64
Potato	158	176	188		

Source : Statistik Indonesia 1988

Note [1]Figure shows total up to August

2.2 Production and Distribution of Potatoes

2.2.1 Production of Potatoes

Potatoes are grown on 32,000 ha (1987) of land in 19 provinces of Indonesia. The major potato producing areas are the western, eastern and central provinces of Java where over 70% of the country's total output is produced.

The major problem concerning with the cultivation of potatoes in Indonesia is the hot climate. Potatoes are being cultivated in the highlands (1,000 to 2,000 m in altitude) where the climate is suitable for growth.

In 1986 the cultivation area and production of potatoes nearly doubled the 1971 figure, but the yield per unit area remains low (7 - 12t/ha). Potato output in Indonesia is shown in Table 2-2-1.

Table 2-2-1 Potato Output In Indonesia (1981~1987)

Year	harvesting Area (ha)	Output (ton)	Yield (t/ha)
1981	26,660	195,400	7.3
1982	21,000	164,800	7.8
1983	30,300	250,000	8.3
1984	31,600	325,600	10.3
1985	30,600	317,700	10.4
1986	37,166	446,625	10.4
1987	32,019	386,961	11.9

Fig.2-2-1 MAJOR POTATO PRODUCING AREAS IN WEST JAVA PROVINCE

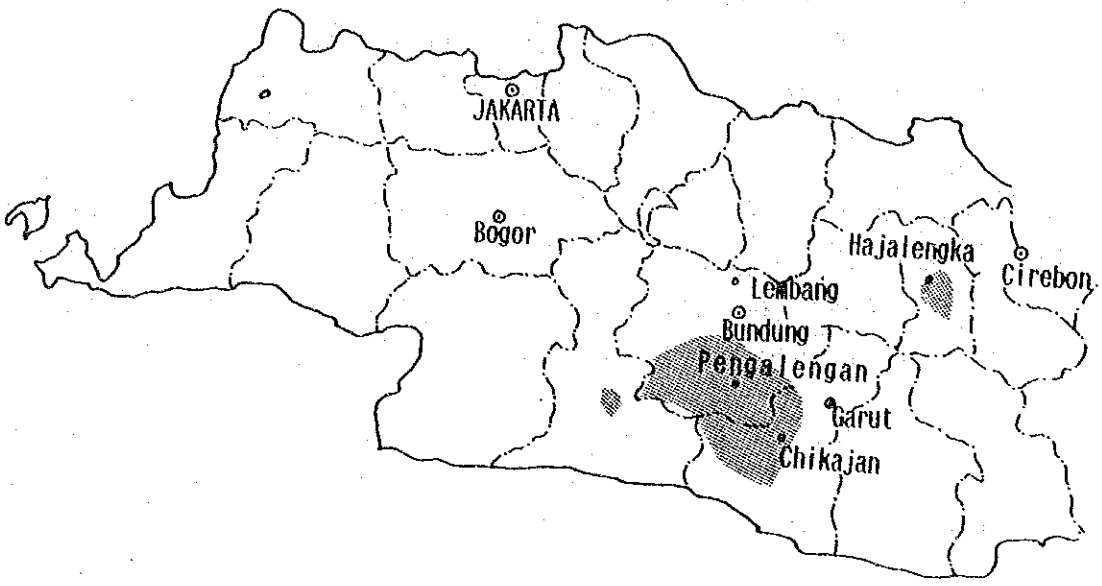


Fig.2-2-2 CROPPING PATTERN IN WEST JAVA

Cropping pattern \ Month	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
I	Potato				Potato				Potato			
II	Cabbage, Tomato				Potato				Cabbage, Tomato			
III	Cabbage				Haize				Potato			

Potato production in West Java is shown in Table 2-2-2. The Pengalengan project area is located in the district of Bandung which is a main potato cultivation area in West Java.

Table 2-2-2 Output of Potatoes in West Java (by district) in 1986

District	Yield Area (ha)	Output (ton)	Unit Area Yield(ton/ha)
Pandeglang	9	14	1.56
Lebak	—	—	—
Bogor	288	2,157	7.49
Sukabumi	111	2,229	20.08
Cianjur	654	10,007	15.30
Bandung	4,943	83,906	16.98
Garut	4,671	70,851	15.17
Tasikmalaya	10	28	2.80
Ciamis	—	—	—
Kaningan	141	1,206	8.55
Cirebon	—	—	—
Majalengka	1,376	17,200	12.50
Sumedang	87	354	4.07
Indramayu	—	—	—
Subang	48	412	8.58
Purwakarta	—	—	—
Karawang	—	—	—
Bekasi	42	118	2.81
Tangerang	—	—	—
Serang	—	—	—
Total	12,380	118,482	9.57

Source; Produkisi Tanaman Sayuran di Jawa, 1986.

Potato production in the project area is outlined below:

1) Potato Cultivation

The Pengalengan project area in the district of Bandung is a major potato producing area in West Java and cropping is conducted twice yearly.

The seed potatoes used by farms are mostly those which are selected from ordinary cultivated potatoes and thus the renewal rate of seed potatoes is extremely low. Ordinary farms are using fifth to sixth generation seed potatoes which are produced by themselves. In some cases, tenth generation, or more, seed potatoes are being used. 30 to 60 gram potatoes are used as seed potatoes and the planting density is generally 80cm interval between ridges and 35cm between roots.

According to the sampling survey made at P.D. MAMIN by the study team, the ridges were arranged at 80cm interval, the roots were planted sparsely at 42 - 45cm interval, and the number of roots planted were 29,000/ha. The roots consisted of 70% ordinary roots, 20% late budding roots, and 10% defective roots.

2) Cropping Pattern

The general cropping pattern in Pengalengan is as follows:

Fig. 2-2-3 Potato Cropping Pattern in Pengalengan

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cropping Pattern	Cabbage			Potato			Fallowing			Potato		
							or Maize					

In West Java, cropping is conducted three times a year with crop rotation of potatoes and other vegetables. However, there are many cases where potato planting is repeated three times a year.

Cropping is conducted four times a year in Pengalengan (see above Fig. 2-2-3). Potatoes are usually planted twice in a year. They are grown during the periods of April and October. As the July period is the dry season, it is generally fallowing time and maize may be planted during that time depending upon the amount of precipitation or the condition of irrigation facilities. After harvesting the October period potatoes, cabbage cultivation commences in January.

Crop-dusting is conducted infrequently during the April period and hence the potato yield is relatively small, but the unit price is high.

The October period is the wet season and crop-dusting is conducted frequently. During this period the yield is great, but the unit price is low.

3) Grade

The grade of potato in Pengalengan is the Granola of West German origin.

4) Diseases and Vermin

Potato was originated in a cool climate. In tropical areas, diseases and vermin peculiar to the potato propagate profusely and thereby pose stronger restricting factors for potato growth than at locations having higher temperatures.

Although potatoes are grown in the cooler plateau areas of Indonesia they have a low yield due to disease and vermin infestation.

(1) Diseases

Potato diseases can be roughly classified into three groups: diseases caused by filamentous fungi, diseases caused by bacteria and diseases caused by viruses.

As the potato multiplies by vegetative reproduction, once it is infected with a disease, the disease will be passed on from generation to generation. This phenomena is a difficult problem for potato culture and therefore, the prevention of disease is of utmost importance.

Many potato diseases are transmitted through the medium of soil. Diseases of this type are the main cause of poor potato shape and skin. As the chemical application for controlling the diseases is a difficult measure, it is essential that the repeated cultivation should be avoided to prevent disease accumulation in the soil. For this reason it is important to establish a crop system, which is the only means for preventing potato diseases.

The spreading of diseases during the seed potato storage period should not be overlooked. If it is quite necessary to maintain a good environment for seed potato storage; any damaged, deformed or otherwise inferior seed potatoes must be culled out.

- Epidemics:

  Diseases caused by filamentous fungi: Approximately one month after budding, brownish spots will appear on the lower leaves of any potato plant which is infected with its type of disease. It is left untreated, the disease will spread rapidly creating a whitish fungi on the underside of the leaves. These diseases causes a high withering rate and a low yield potato crop.

  These types of diseases occur periodically in Indonesia. During the periods of heavy rainfall, the disease related damage increases and therefore the application of chemicals absolutely necessary at these times. Approximately 70% of the total cost of chemical application is spent on controlling these diseases.

  These diseases easily spread to plants that have become soft due to excessive use of fertilizers and therefore fertilization, must be carried out with extreme care.

- Wilt:

Wilt is caused by bacteria. It is reported that 10 to 30 percent of all potato crops are damaged by wilt (higher damage rates are experienced in lower elevation areas). Repeated cultivation increases the disease related damage.

The principle countermeasures against wilt are to rogue out and plant that seems to be infected and to conduct crop rotation with noninfectional plants such as rice. Also, the application of high quality compost is an effective measure. As the partial measures, such as application of soil germicide, deep plowing (overturning and plowing), and the transferring of soil from one place to another place also have positive effects.

- Virosis:

In general, virosis is a latent disease that reduces potato yield and quality. The following viruses exist in Indonesia:

Potato leaf roll	Potato A-mosaic
Potato Y-Mosaic	Potato M-mosaic
Potato X-mosaic	Tomato black-ring
Potato S-mosaic	

Of these, the potato leaf roll, and the potato Y and S mosaic diseases are virosis. BPSB is capable of inspecting potatoes for these three diseases and for the potato X-mosaic disease.

It is known that virosis infect potatoes in the following ways:

1 through the medium of plant-lice;
2 by finding its way into plant juices, including the juices of tubers;
3 directly from the soil;
4 from a plant making direct contact with a contaminated plant;
5 contamination from smoke and from contact with farmers.

In Indonesia potatoes are grown in green crop fields along with tomatoes--both are members of the eggplant family--thus the environment is virosis infectious.

Virosis prevention measures are as follows:

1 Use of pathogen free seed potatoes;

2 Employing segregated cultivation;

3 The extermination of plant-lice;

4 Crop rotation;

5 Roguing the fields of infected plants.

As of this time, virosis prevention has not been practiced in Indonesia.

(2) Vermin

· Potato Moth:

Potato moths are prevalent the year round. They eat the stems, leaves, and tubers of the potatoes growing in the fields, and also the potato seeds which are in storage. Moths have a tendency to be more reproductive during the dry seasons. It is reported that the potato yield reduction rate caused by damage inflicted by moths is from 20 to 45 percent.

Prevention of moths can be accomplished by chemical sprinkling and by planting the potatoes deep in the soil.

An effective means of protecting the harvested potatoes from moth damage is to store them in indoors and covered with powdered chemical. Also, insect nets should be installed in potato storehouses.

· Speckled Nightwalker:

Speckled nightwalkers eat potato stems, leaves and tubers. The nightwalkers cause most of the damage during the potatoes' sprouting season. By neglecting to take care of

the plants, the nightwalker can cause considerable damage--nightwalkers have eaten all the leaves in some potato fields, leaving the fields completely bald.

Chemical spraying is a preventative measure against the speckled nightwalker.

- Plant-lice:

Plant-lice reproduce the year round in Indonesia; their number increases especially during the dry seasons. Plant-lice such plant juices and act as intermediaries between plants and viruses.

Chemical spraying is a preventative measure against plant-lice.

- Mole-cricket:

It is believed that the mole-cricket is the cause of blight, but the actual damage done to potatoes by this insect is not known.

- Root-lump Wireworm:

It is reported that root-lump wireworms causes 15 to 45 percent of the potato yield reduction rate and is responsible for 50 to 80 percent of the potatoes having inferior quality. Wireworms together with wilting increases potato crop damage by many times over.

To prevent the intrusion and contamination of potato fields by worms, the fields should be treated with DD or chloropicric chemical.

5) Potato Production Cost

Potato production cost in West Java Province is approximately Rp. 2.5 million/ha, a figure that is lower than that for Central Java but is more than twice that for East Java, Jambi, and South sulawesi. The reason for the high cost is mainly attributed to high costs for agricultural chemicals and fertilizers which accounts for about 45% of the production cost.

Potato production cost in the West Java Province is shown in Table 2-2-3; and for the other provinces is shown in Table 2-2-4.

Table 2-2-3 Potato Production Cost in West Java Province

(unit : Rp 1,000/ha)

Production Cost		2,524	(100%)
	Seed potato	600	(24%)
	Fertilizers	753	(30%)
	Agricultural chemicals	795	(31%)
	Labor	334	(13%)
	Others	42	(2%)
Yield per Unit Area :		14.3 ton/ha	
Production cost per kg		Rp./kg 176.5	

Source : Potato Production in Indonesia, 1986

Table 2-2-4 Potato Production Cost in Various Indonesian Provinces

(unit : Rp.1,000/ha)

Province	Seed Potato	Fertilizers & Agricultural Chemicals	Others	Total
West Java	600 (23.8)	1,548 (61.4)	375.7(14.8)	2,523.7 (100)
Central Java	1,950 (66.5)	755.3(25.8)	227.9(7.7)	2,933.2 (100)
East Java	600 (51.7)	369.7(31.9)	190.9(16.4)	1,160.6 (100)
Jambe	480 (38.1)	212.3(16.8)	567.9(45.1)	1,260.2 (100)
South Sulawesi	343.3(38.6)	227.3(25.5)	319.8(35.9)	890.4

Source : Potato Production in Indonesia, 1986

2.2.2 Potato Distribution and Consumption

1) Import and Export of Food Potatoes

A small amount of the potatoes produced in the northern part of Sumatera is exported to Singapore and Malaysia (see Table 2-2-5). Low transportation cost because of the geographical location of Sumatera, makes export possible. Potatoes produced in other areas of Indonesia are consumed domestically.

The eating habits of Indonesians are changing; the number of fast food stores and western style restaurants are increasing rapidly. Domestic potato production is unable to meet the demand of those restaurants and they must rely on potato imports. As potato importation is regulated, many restaurants deliver seed potatoes to farmers and entrust potato culture to them.

Table 2-2-5 Imports and Exports of Food Potatoes

(unit : ton)

	Exports	Imports
1985	58,703	602,998
1986	52,803	65,684
1987	58,825	2,086
1988	57,045	5,806

Note : 1988 figures include the amounts through the end of November

Source : Directorate of Horticulture, Ministry of Agriculture

2) Potato Prices

In 1986, the consumer price of potatoes was approximately twice as much as for rice (Rp. 375/kg). Since that time, the price of rice has increased and, in September 1989, potato prices were comparable (price comparison at supermarkets in Bandung).

Changes in the consumer price of potatoes is shown in Table 2-2-6. Wholesale prices of potatoes in the West Java Province are shown in Table 2-2-7.

Table 2-2-6 Changes in the Consumer Prices of Potatoes

(Rp./kg)

Year	Jakarta	Bandung
1981	418.8	343.8
1982	469.0	396.7
1983	471.6	405.6
1984	456.5	345.8
1985	405.1	374.3
1986	459.5	332.4
1987	490.0	480.0
1988	550.0	520.0
1989 (9月)	680.0	650.0

Source : Dinas Pertanian Pangan, Pemerintah Propinsi Daera Tingkakt I Jawa Barat

Table 2-2-7 Farm and Wholesale Prices of Potatoes in the West Java Province

(Rp./kg)

	1986		1987		1988	
	Farm Price	Wholesale Price	Farm Price	Wholesale Price	Farm Price	Wholesale Price
Jan.	170	212	159	381	228	300
Feb.	199	234	181	443	231	291
Mar.	241	279	199	374	276	308
Apr.	232	254	251	364	351	385
May.	270	316	236	377	379	423
Jun.	328	359	278	390	451	532
Jul.	300	344	275	368	533	567
Aug.	290	330	282	402	395	452
Sep.	272	313	273	375	287	335
Oct.	202	256	312	500	266	304
Nov.	203	249	386	508	272	309
Dec.	185	221	355	445	237	292

Source : Dinas Pertanian Pangan, Pemerintah Propinsi Daera Tingkakt I Jawa Barat

3) Future Potato Consumption

Domestically produced potatoes are consumed mostly in large cities, such as Jakarta, Surabaya, Medan, Bandung, and Yogyakarta. Except for South Sulawesi, potato consumption in the major potato producing provinces is greater than the national average of 2.2 kg/person/year (see Table 2-2-8). Changes in the per capita potato consumption are shown in Table 2-2-9. The potato harvesting area and production areas and potato consumption amounts are shown in Fig. 2-2-4.

The possible rice production area in Java is limited and there is little hope for increasing the rice production, Hence, it is considered that the source of carbohydrates will switch from rice to potatoes since potato and rice prices are just about equal.

As shown in Table 2-2-9, the potato consumption rate has been increasing and, as a result, it is believed that potato prices will be stable in the future.

Table 2-2-8 Potato Consumption in Various Indonesian Provinces (1987)

1.	D.A. Acch	2.66 (kg)
* 2.	North Sumatera	3.29
* 3.	West Sumatera	6.35
4.	Riau	2.39
* 5.	Janbi	3.75
6.	South Sumatera	2.35
* 7.	Bengkulu	3.82
8.	Lampung	1.72
9.	D.K.I Jakarta	3.75
*10.	West Java	3.98
*11.	Central Java	2.30
12.	D.I. Yogyakarta	1.99
*13.	East Java	2.99
14.	Bali	1.82
15.	East Nusa Tenggara	1.31
16.	East Timor	1.19
17.	West Kalimantan	0.68
18.	Central Kalimantan	0.56
19.	South Kalimantan	0.82
20.	East Kalimantan	1.09
21.	North Sulawesi	1.04
22.	Central Sulawesi	0.82
*23.	South Sulawesi	1.03
24.	Maluku	1.52
25.	Irian Jaya	2.08
Average in Indonesia		2.20

* Major producing province

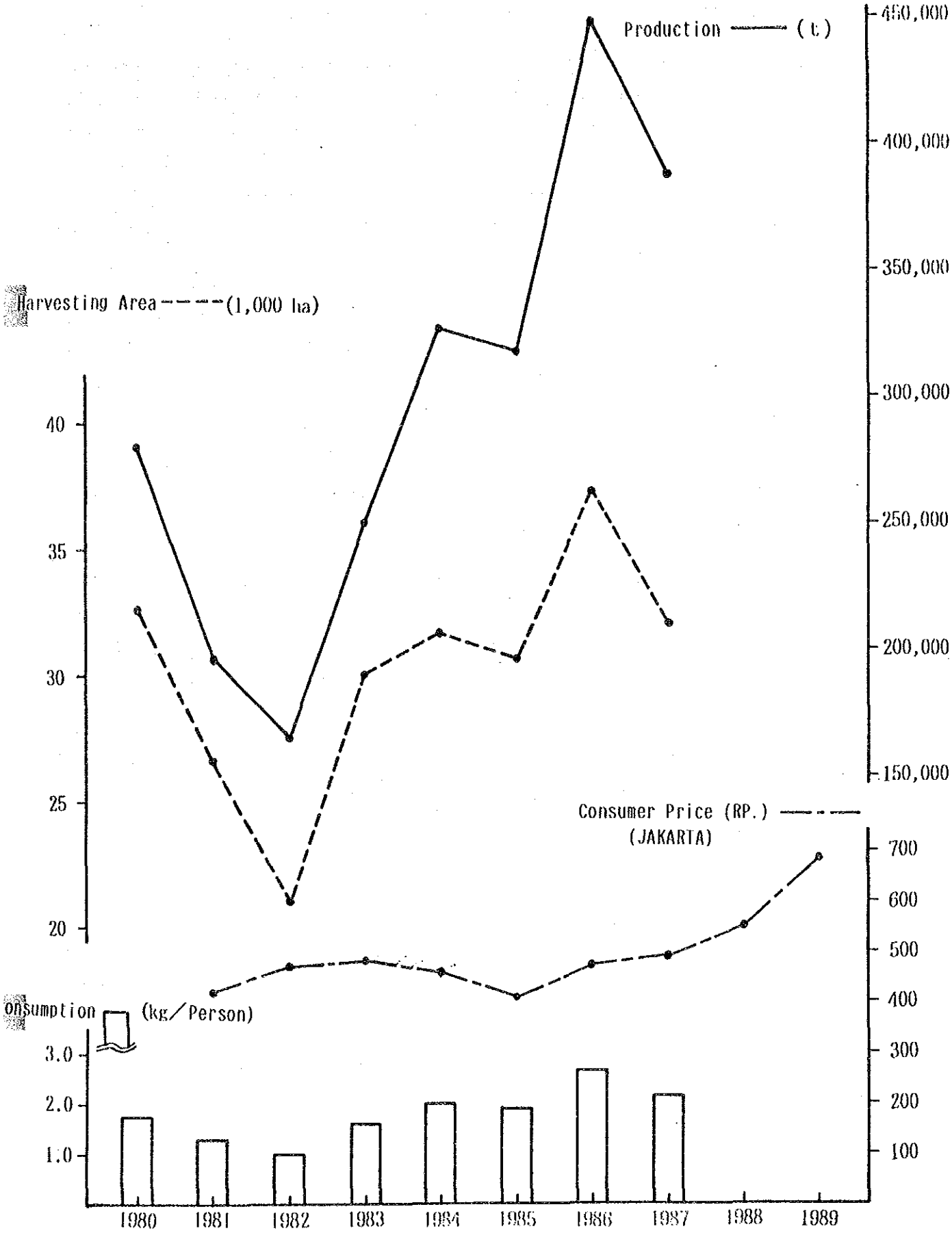
Source: Directorate of Horticulture, Ministry of Agriculture

Table 2-2-9 Annual Potato Production and Per Capita Consumption

Year	Per Capita Consumption	Annual Production
1978	1.5 (kg)	229,500 (t)
1980	1.7	230,100
1981	1.3	195,400
1982	1.0	164,800
1983	1.6	250,000
1984	2.0	325,000
1985	1.9	317,700
1986	2.6	446,295
1987	2.2	386,961

Source: Statistik Pertanian Tanaman Pangan, Directorat Pertaian Tanaman Pangan

Fig.2-2-4 CHANGES OF PRODUCTION AND CONSUMPTION OF POTATO



2.3 Seed Potatoes

From the field survey it was found that the average farmer has been using home grown seed potatoes and in some cases tenth generation seed potatoes were being used. About ten farmers in Pengalengan were using imported seed potatoes and, according to the hearing survey, they harvest more than 20 tons/ha of potatoes. Imported seed potatoes cost Rp. 2,500/kg, a price the average farmer finds difficult to afford.

The farmers mainly use small sized potatoes (30 to 60 grams each) for seeds. They are not cut for planting. From 1.2 to 1.5 tons of seed potatoes are planted per hectare.

Some of the farmers who have sufficient funds plant large, uncut seed potatoes. They use about 2.0 tons of seed potatoes per hectare. It is said that the production per unit area is higher than that of the former method.

Imported seed potatoes are of good quality and produce high yields. Only those farmers having sufficient funds purchase the imported seed potatoes. The average farmer uses seed potatoes passed down several generations from the original imported seed potatoes.

Most of the potatoes produced by the average farmer is consumed by the farmer himself; the renewal rate of the seed potatoes is low, which makes it difficult to maintain the high seed potato quality. This is one reason for the difficulty to accomplish the increase of potato production per unit area.

2.3.1 Seed Potato Production Situations

Indonesia's annual seed potato production is 5.0 tons. Amount required in excess of 5.0 tons must be imported.

Traders importing seed potatoes distribute them to nurseries who, in turn, sell them to farmers who have adequate funds.

The amount of imported seed potatoes and the countries from which they come from are listed in Table 2-3-1. Table 2-3-2 shows Indonesia's seed potato production in recent years.

Table 2-3-1 Amount of Imported Seed Potatoes

(unit : kg)

Year	France	West Germany	Netherlands	Others	Total
1982	—	486.000	142.269	92.125	720.394
1983	—	653.994	314.490	331.211	1.299.695
1984	—	286.260	34.630	39.480	360.370
1985	—	243.125	15.040	160	258.325
1986	960	88.450	132.000	2.113	223.523
1987	100.000	100.000	82.040	135.140	417.180
1988	37.000	280.000	122.360	5.870	445.230

Source : Directorate of Horticulture, Ministry of Agriculture

Table 2-3-2 Domestic Seed Potato Production (Breeder Seed)

Year	Amount (kg)
1986	7.879
1987	4.708
1988	5.805

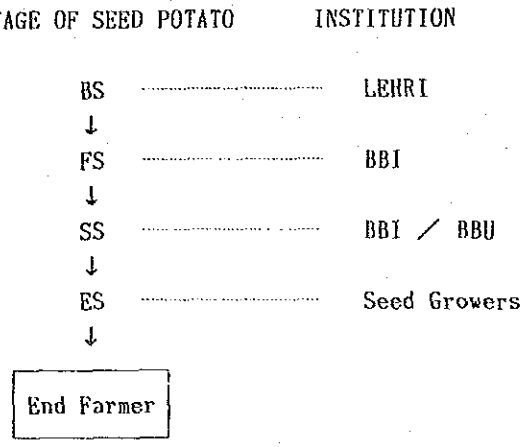
Source : Directorate of Horticulture, Ministry of Agriculture

2.3.2 Seed Potato multiplication and Distribution System

The seed potato multiplication and distribution system in Indonesia is the same as for the other crops. Since the system was established only a few years ago, it is still under the control of the Government. Due to the lack of experience, facilities, and equipment, the system is not functioning fully.

The Government's basic multiplication and distribution system is as shown in Fig. 2-3-1.

Fig. 2-3-1 Seed Potato Multiplication and Distribution system

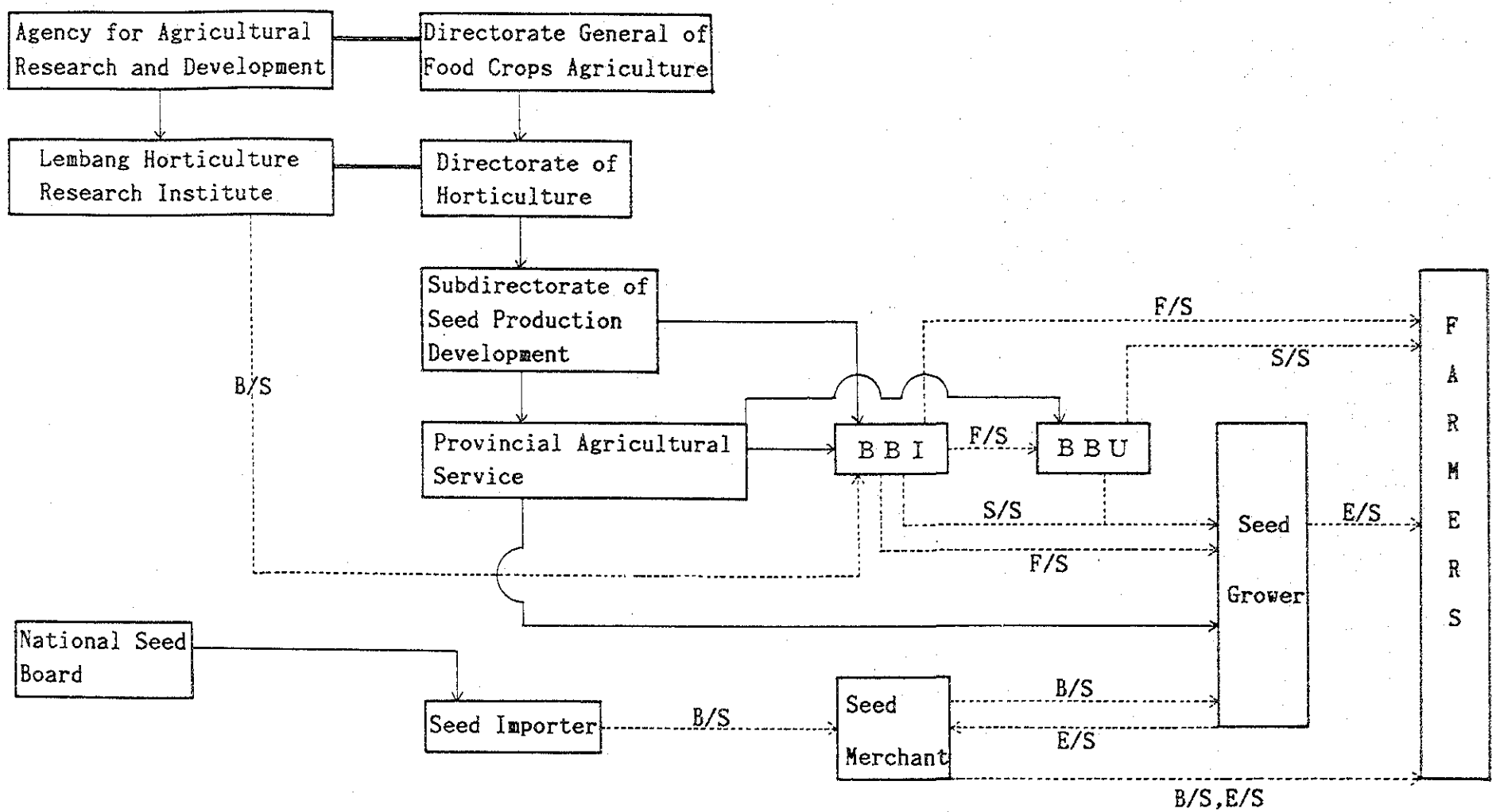


2.3.3 Seed Potato Distribution Systems

There are two seed potato distribution systems in Indonesia (see Fig. 2-3-2): one is the distribution of domestic seed potatoes produced by the organization headed by LEHRI; the other is the distribution of imported seed potatoes from foreign countries.

When there is insufficient production of domestic seed potatoes, the imported seed potato takes on a very important role. The distribution of imported seed potatoes is initiated by traders selling them to nursery companies who, in turn, circulate them to those farmers having sufficient funds. These farmers grow potatoes, using the seed potatoes up to the 2nd or 3rd generations. The harvested potatoes are classified into domestic consumption size and seed potato size (30 to 60 g/each). Potatoes classified as seed potatoes are either consumed for private use or are sold for seed.

Fig. 2-3-2 ORGANIZATION OF MULTIPLICATION AND DISTRIBUTION OF SEED POTATO



The seed potatoes used in the West Java Province are produced in Pengalengan and Lembang. These potatoes are distributed to various potato growing areas by Bangdung based seed brokers.

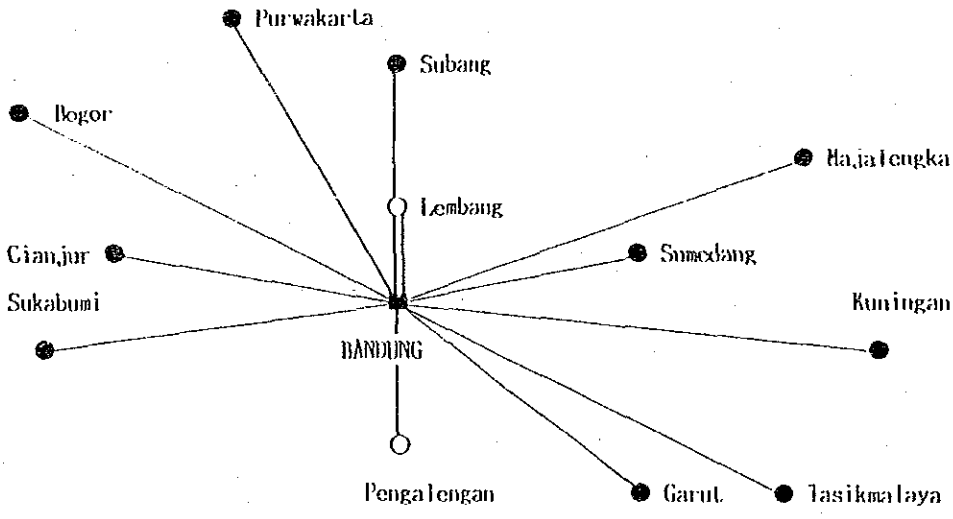
Fig. 2-3-3 shows the distribution of seed potato in the West Java Province. Table 2-3-3 shows the market prices of seed potatoes in that province.

Table 2-3-3 Market Price of Seed Potato in the West Java Province

Grade	Price (Per kg)
Imported	Rp. 2,500
Domesticaly Produced (with certificate)	Rp. 1,200
Domestically Produced (without certificate)	Rp. 650 to 1,000
*Domestically Produced (large pieces, without certificate)	Rp. 1,250

* In Pengalengan only

Fig.2-3-3 ORGANIZATION OF DISTRIBUTION OF SEED POTATO IN WEST JAVA



Map of the Distribution of Seed Potato in West-Java Province

Note: ● Main Area of Seed Potato Production
○ Main Area of Potato Production

2.3.4 Seed Potato Producing Techniques

1) Basic Seed (BS) Multiplication Techniques

The multiplication of basic seed potatoes is carried out by the stem-top culture for producing pathogen free planting materials. Then, using the materials, good quality stock seed is produced by application of the rapid multiplication method.

The multiplication method is a new technology system. With financing from USAID and technical assistance by CIP, the multiplication of basic seed potatoes has improved to some level in Indonesia.

(1) Tissue Culture

For plant tissue culture, laboratory facilities such as clean rooms, culture rooms, and screen houses for preventing plant-lice are provided at LEHRI where skilled specialists are engaged in the multiplication of basic seed potatoes.

Bud tips cut from selected tubers are cultured under germ free conditions. After culturing them for approximately for two months, first planting materials can be harvested. After that about 30 planting materials can be harvested in every six weeks.

(2) Screen House

The cut stems obtained from the sterile cultured small planting materials are used as mother plants for multiplication in a plant-aphid proof screen house. The mother plants are planted at an interval of 5 x 5cm in a mixture of steam disinfected sand and compost (1:1). The stem cuttings obtained from the mother plants are transplanted to a screen house where the tuberlets are grown. 3 to 5kg/m^2 tuberlets may be harvested in 80 days.

(3) Isolated Multiplication Farm

The tuberlets grown in the screen house are germinated by diffused light storage for 2.5 to 3 months. They are then planted in an isolation farm. The produced seed potatoes are again multiplied and after that they are distributed as basic seeds.

2) Extension Seed

Basic seeds are those which are produced at farms equipped with a system for producing seed potato in isolated multiplication farms. However, as there are problems such as lacking of capacities for multiplying facilities and low efficiency of making final BS in LEHRI for the production of high quality seed potato, seed potato with grades lower than FS are extremely lacking.

2.3.5 Quarantine and Inspection System

1) Import Quarantine

All agricultural products which includes seeds and potatoes that are imported or exported and those coming from or going to the islands are inspected by the Agricultural Quarantine Office.

All seed potatoes are unloaded in Jakarta. Other local offices are responsible for the inspection of produce, including edible potatoes, coming from or going to the islands. Imported edible potatoes in the form of processed goods are not inspected.

2) Domestic Quarantine and Inspection

The BPSB is responsible for the inspection of domestic seed potatoes. The inspections are conducted at seed farms and laboratories.

The lembang Horticulture Research Institute conducts its own inspection of basic seed.

Before issuing a certificate for the seed potatoes, the BPSB conducts at least four seed farm tests (prior to planting, and 30, 45, and 60 to 70 days after planting) and one laboratory test.

2.3.6 Present Condition of Seed Potato Multiplication and Distribution Facilities

The facilities for the multiplication and distribution of seed potato in Indonesia are still inadequate. Most of the seed potatoes are third or fourth generation that are harvested at ordinary farms. Seed potatoes that are adequate in size (30 - 60 grams/each) are hand-picked. Dedicate seed potato farms do not exist.

Even at the BBI/BBU, 60 to 80 percent of harvested potatoes are used as seed potatoes. The bruised or extremely small or large sized potatoes are used as food.

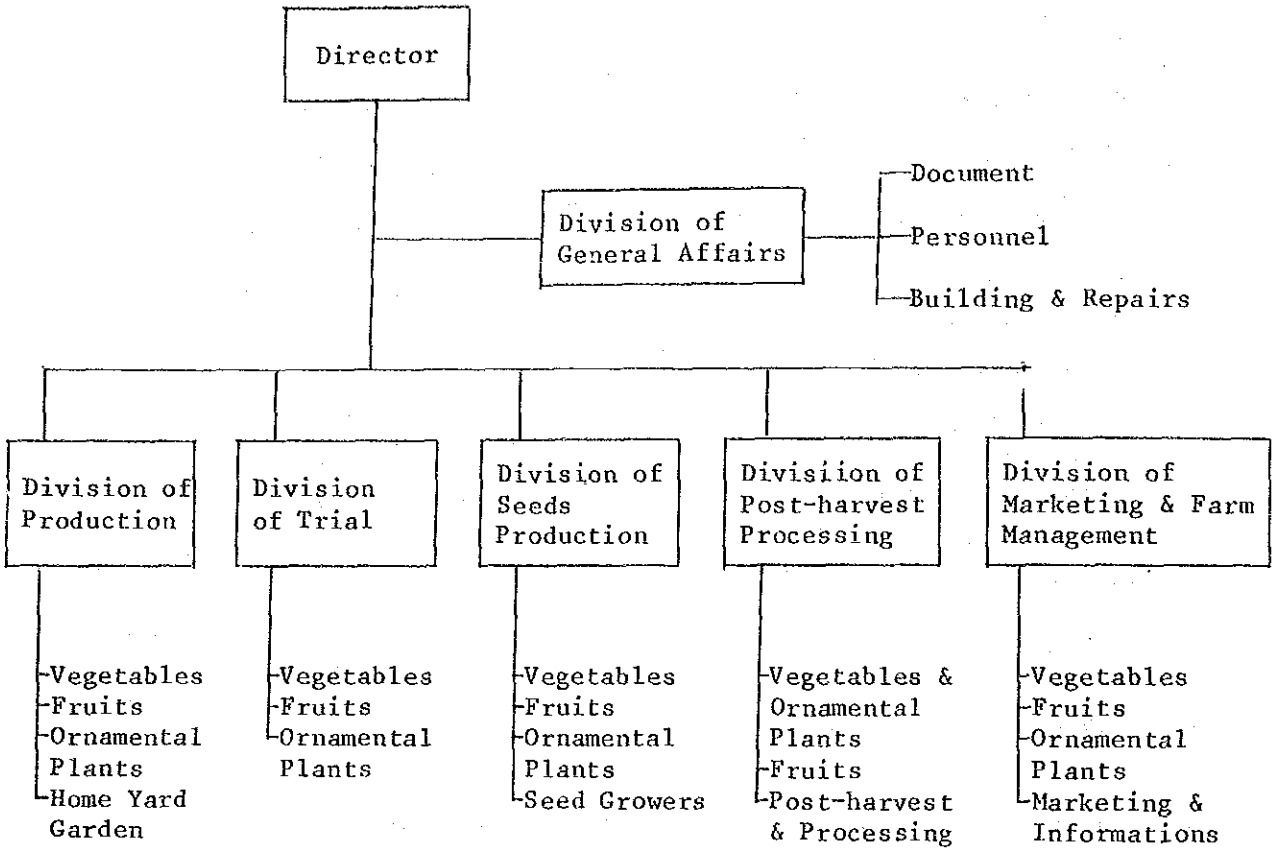
2.4 Present Condition of Project Related Agencies

2.4.1 Directorate of Horticulture, Directorate General of Food Crop Agriculture, Ministry of Agriculture

The Directorate of Horticulture is a department of the Directorate General for Food Crop Agriculture of the Ministry of Agriculture. It was previously under the Directorate for the Production of Food Crops and, in 1983, was elevated to the Directorate of Horticulture. It is in charge of the administrative affairs of the central government in matters pertaining to vegetables, fruit trees and ornamental plants. The production and distribution plan for seed potatoes and the appropriate budgetary measures are also worked out by this directorate.

The organization chart of the Directorate of Horticulture is shown below. The Seed Production Division of the Directorate of Horticulture is in charge of this Project and is responsible for the general coordination of related organizations.

Fig. 2-4-1 Organization Chart of the Directorate of Horticulture



2.4.2 Lembang Horticulture Research Institute (LEHRI)

The Lembang Horticulture Research Institute (LEHRI) is located in a mountainous region at 7km north of the Lembang city area. The institute is situated at an altitude of 1,250m. The average temperature of the area is about 16°C and has a yearly precipitation of 2,600mm. Hence, the area is relatively cool with a high precipitation.

The institute's history can be traced back to the Bogor Research Institute in 1940. The present organization was established in 1981.

The Lembang Research Institute is placing special emphasis on the research of the following seven vegetables: potato, tomato, cabbage, beans, pepper, onion, and garlic.

Regarding the multiplication and distribution of seed potato, this institute is responsible for the production of basic seed (BS) grade potatoes and its distribution to BBI and BBU.

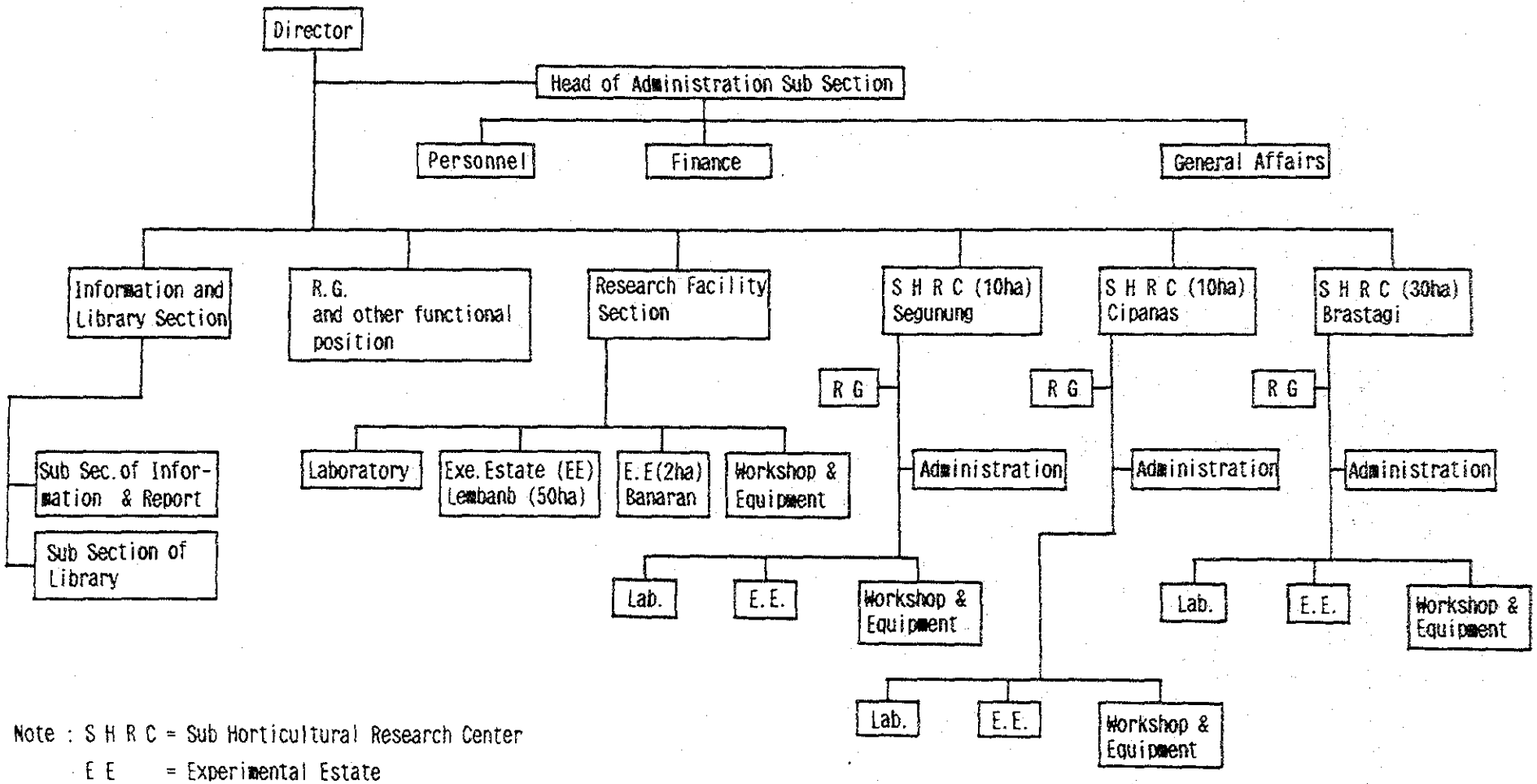
The institute, using the tissue culture technique, produces the tuberlets which become the source of BS. The tuberlets are used in experiments for the multiplication of BS grade potatoes. Apart from their experimental use, BS grade potatoes are not produced for the multiplication and distribution of seed potatoes; however, the system is technically capable of producing BS grade potatoes for the multiplication and distribution purpose.

1) Organization and Operation

The institute comes under the control of the Agency for Agricultural Research and Development (AARD) of the Ministry of Agriculture, and is managed by a yearly budget of about Rp.200,000,000 (excluding personnel expenses).

The organization chart is shown in Fig. 2-4-2. The research staff at the three centers and the Lembang Research Institute number 380. About 200 staff members are stationed at Lembang; forty are researchers and fifty are assistants. There are ten researchers and fifteen assistants involved in potato research at a 3ha test farm.

Fig. 2-4-2 Organization chart of LEHRI (Lembang Horticulture Research Institute)



Note : S H R C = Sub Horticultural Research Center
E E = Experimental Estate
R G = Researchers Group

2) Research Activity

The main themes or research at the present potato section are as follows:

- Research concerning pathogen free stock seed
- Grade test according to use
- Establishment of cultivation technique in the mid to high elevation land areas
- Fixation of new varieties
- Cultivation test
- Breeding program
- Others

3) Present Condition of Facilities and Equipment

The site location of the present facilities is shown in Fig. 2-4-3. Most of the existing equipments was obtained through USAID and are currently used for research of plant diseases and harmful insects.

4) Future Objectives

The Potato Section has a screen house and some research equipments obtained through USAID but they are inadequate. If the Potato Section was to become fully equipped, the speedy multiplication process using seed potato tissue would be possible.

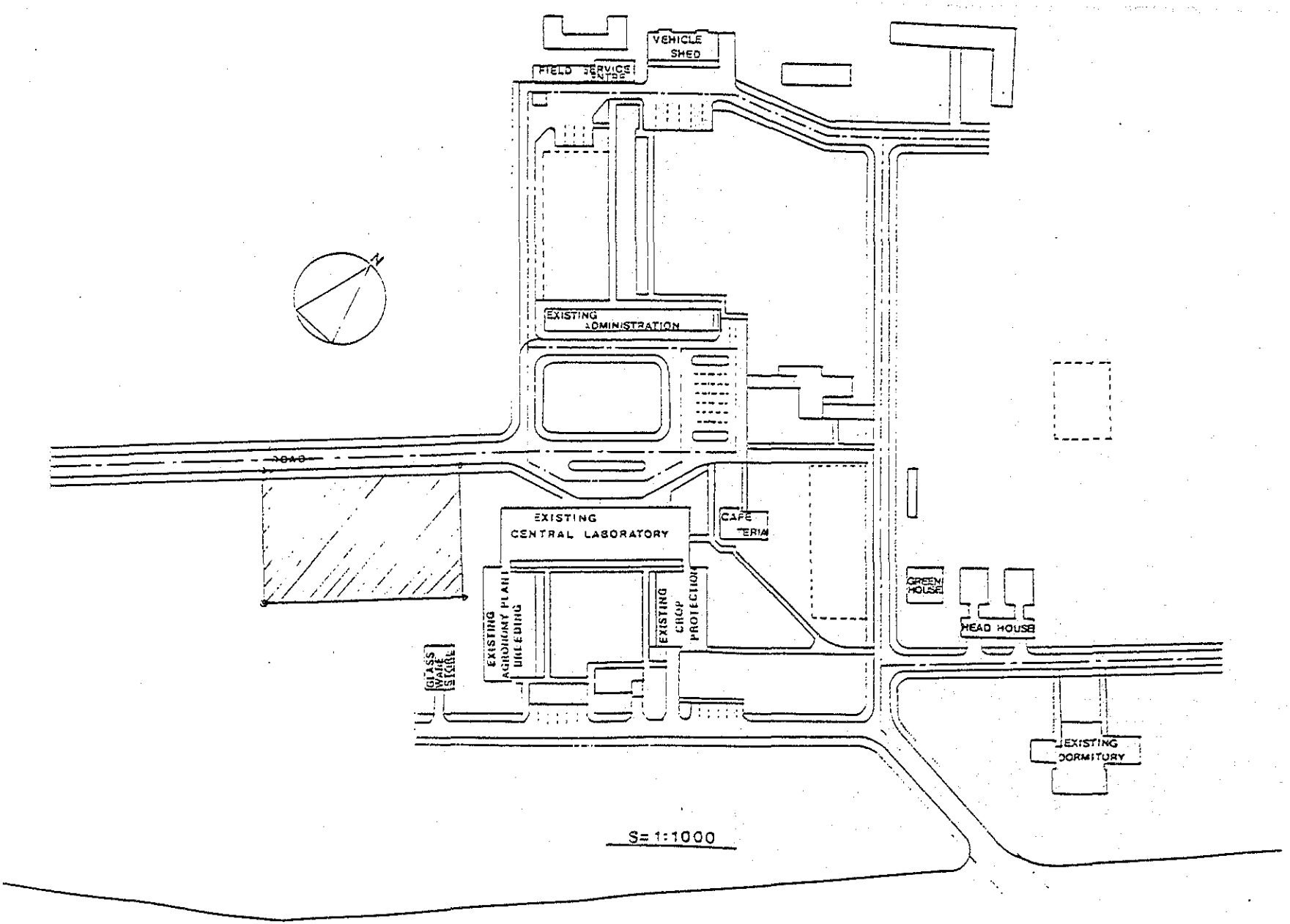


Fig. 2-4-3 LAYOUT OF LEHRI

Table 2-4-1 LEHRI'S Present Facilities and Equipment

Name of equipment	Quantity
- p H meter	1
- Refrigerator	1
- Autoclave	1
- Oven	1
- Heating and drying apparatus	1
- Hot plate and magnetic stirrer	2
- Analitical balance	1
- Stereo master microscope	2
- Aquadislata apparatus	1
- Flasks and glass ware	
- Clean bench	1
- Shaker	1
- Small shaker	2
- Shelves with artificial lamps	4
- Thermohygrograf	1
- Lamps timer	1
- Elisa reader	1
- Refrigerator	1
- Shaker	1
- Balance	1
- Apparatus for elisa test	
- Incubator	1

2.4.3 Foundation Seed Farm (BBI Unit) and Stock Seed Farm

The Foundation Seed Farm and the Stock Farm located in Pengalengan, 50km south of Bandung (2 hours by car) are both new farms but, so far, only their sites have been acquired.

Pengalengan is at altitude of approximately 1,500m and has an average temperature of 15°C and a yearly precipitation of 2,200mm. Pengalengan is suitable for the cultivation of highland vegetables and is one of the major potato growing areas.

1) Foundation Seed Farm

The site of the Foundation Seed Farm is located at the foot of the mountain at 5km south from the center of Pengalengan. The farm consists of 5ha of land. Maize and tomatoes are presently being grown here. (Refer to Fig. 2-4-4)

The BBI supervising the Foundation Seed Farm comes under the control of the Directorate of Horticulture of the Ministry of Agriculture. The BBI was established in Pasirbanteng in West Java. Its activities began in 1982. Presently the BBI has 28.8ha of land and 35 employees are involved in food crop seed distribution.

The site of the Foundation Seed Farm is undulated and requires improvements. There will be no problems concerning the water source for irrigation. This farm will become a model seed potato multiplication farm and will have training facilities. Now, there is only one person in charge of the farm. For the actual Project, additional personnel experienced in the field of potato cultivation will be dispatched from the BBI and its subordinate agency, the BBU.

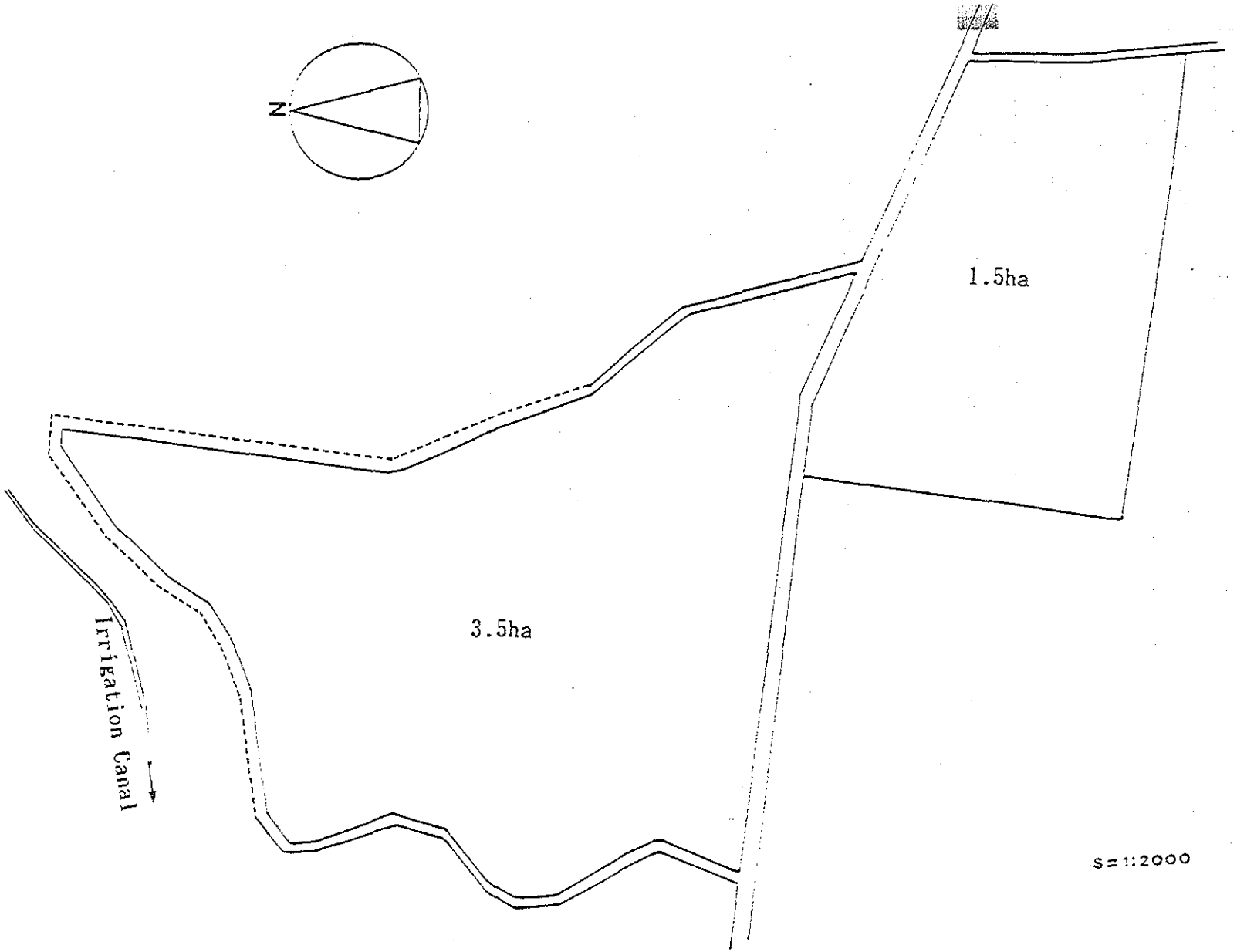


Fig. 2-4-4 LAYOUT OF BBI UNIT

2) Stock Seed Farm

The selected site for the Stock Seed Farm is located in a hilly section 2km south of the Foundation Seed Farm. The site is presently used to cultivate potatoes, maize and cabbages under a lease contract with the local farmers.

About 120ha of land is in the possession of Perusahaan Daerah Makanan dan Minuman (Provincial Enterprise for Food and Drinks) and 25ha of this land is prepared for the Project's stock seed farm. (see Fig. 2-4-5).

Perusahaan Daerah Makanan dan Minuman which runs the stock seed farm is a public corporation established in 1962 by a 100% investment from the West Java Province Government and is capitalized at Rp.800,000,000. The corporation has 300 employees and operates an ice plant, a stock farm and a milk factory.

Perusahaan Daerah Makanan dan Minuman is participating in the Project for the following reasons: The West Java Province Government may easily control the price of seed potato that are supplied by the corporation and thereby supply them to farms at a low price; the corporation possesses land suitable for the stock seed farm.

2.4.4 Seed Control and Certification Service (BPSB)

The Seed Control and Certification Service was established in 1980 for the purpose of seed inspection and the issuing of certificates. There are 13 head office and 14 branch offices located throughout the country.

The Seed Control and Certification Service of the Project is located in the south of Bandung, 2km from the center of the city. It is also responsible for the Jakarta branch office. Bandung is located at an latitude of 700m. The average temperature in Bandung is 22°C; yearly precipitation in the area is about 2,000mm.

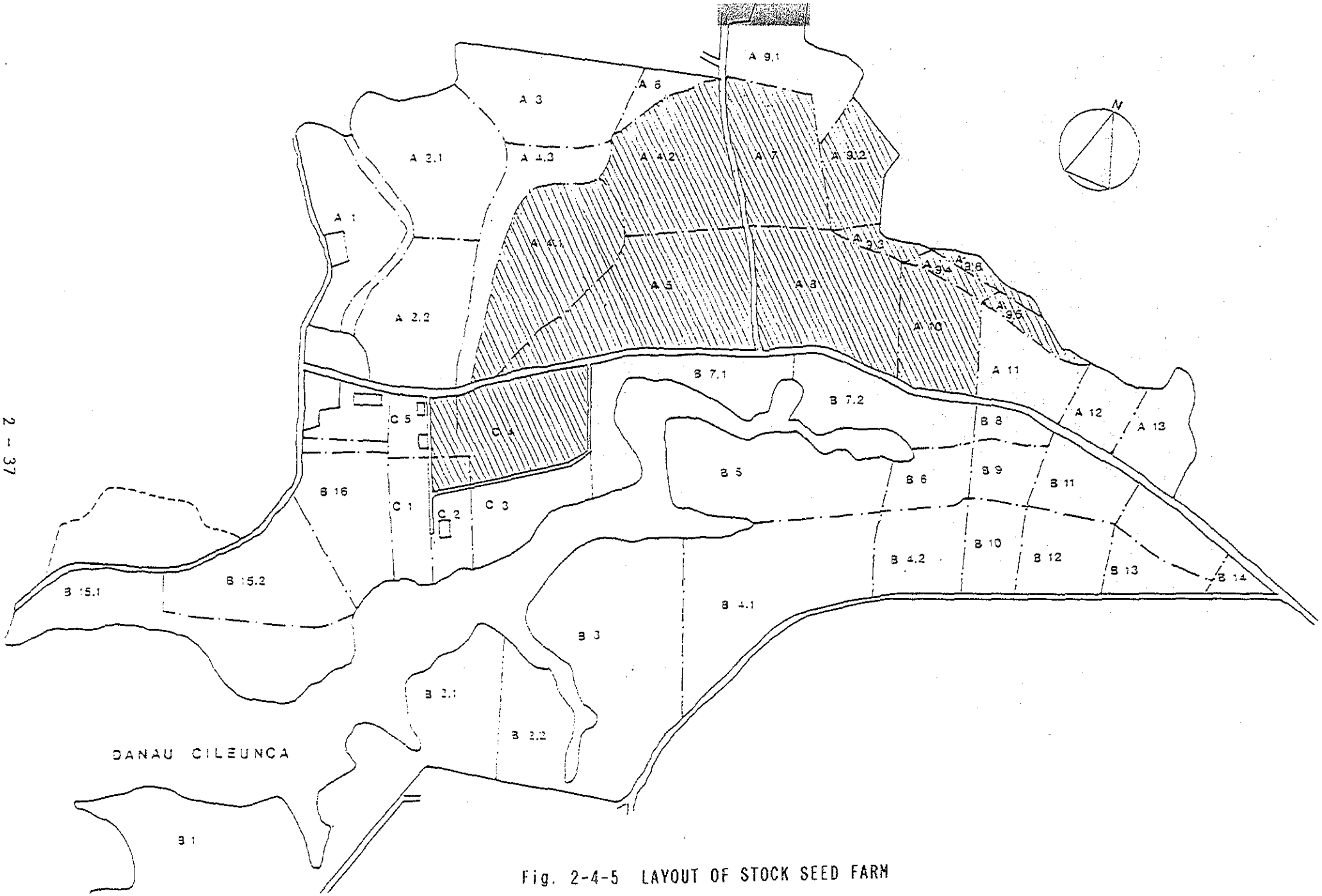


Fig. 2-4-5 LAYOUT OF STOCK SEED FARM

1) Organization and Operation

The Seed Control and Certification Service comes under the control of the Directorate General of Food Crop Agriculture, of the Ministry of Agriculture. It has 170 staff (1989/1990) which includes to office personnel at the Jakarta branch office. Eighteen staff members are involved with potatoes. Twelve seed inspectors are stationed at various districts.

The Service' yearly budget is Rp.136,790,000 and the seed inspection costs of all the districts amounts to Rp.30,600,000 (this does not include personnel expenses). The organization structure of the Seed Control and Certification Service is shown in Fig. 2-4-6; the total number of staff personnel are shown in Table 2-4-2.

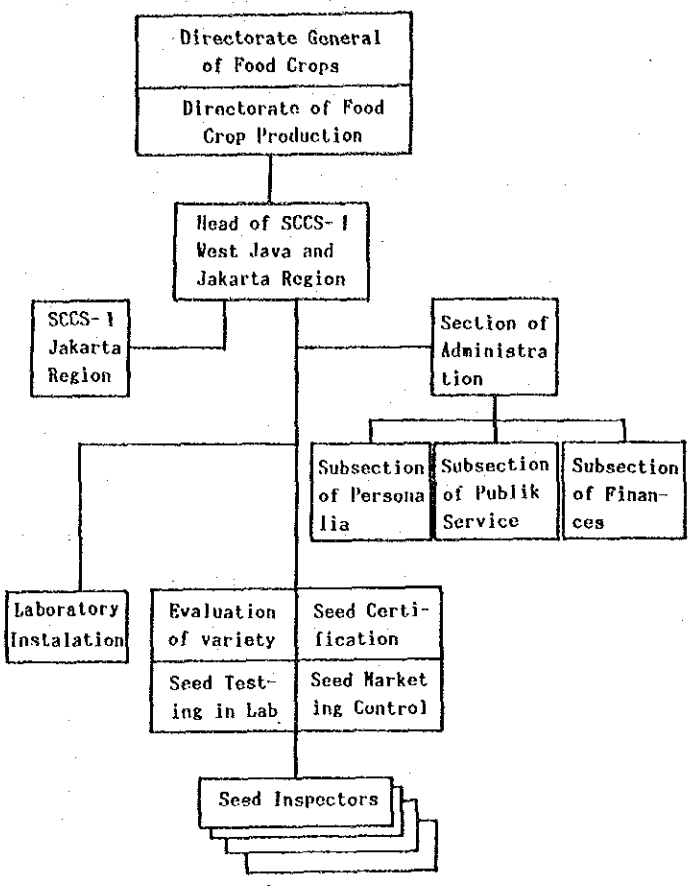
2) Present Activities

The Seed Control and Certification Service is presently conducting inspection and laboratory tests of rice and the issuing of certificates. The number of certificates to be issued in 1989/1990 is estimated to be 725 of which 10% are related to potato.

The fees for farm inspection are Rp.1,500/ha/test. Laboratory rice testing fees are Rp.2/kg (certification fee), and Rp.15,000/sample for potatoes.

Fig. 2-4-6 The Organization Structure of the SCCS

The Organization structure of the SCCS are:



The region of SCCS-I included West Java and Jakarta.

Table 2-4-2 Total Number of Staffs in the SCCS

No.Status	85/86	86/87	87/88	88/89	89/90
1. West Java					
- Technical staff	49	50	50	50	84
- Administration staff	41	41	41	43	41
2. Jakarta					
- Technical staff	9	15	29	32	33
- Administration staff	10	11	11	14	16
Total	109	117	131	139	174

3) Present Condition of Facilities and Equipment

As the Seed Control and Certification Service is now involved with rice, there are practically no seed potato facilities. Since the equipments are inadequate, it will be difficult to start the operations concerning potatoes using current facilities and equipments. Fig. 2-4-7 shows the site location for the Seed Control and Certification Service. Table 2-4-3 shows the current status of potato nurturing equipment.

4) Future Objectives

In order to proceed with the Project, it will be necessary to strengthen the potato related section of the Seed Control and Certification Center. The present problem lies with the lack of farm inspection vehicles and laboratory analysis equipment. If outbreaks of diseases or insect invasions are reported, appropriate action cannot be carried out smoothly. Damage may be minimized if these points are enforced.

2.5 Outline of Related Project

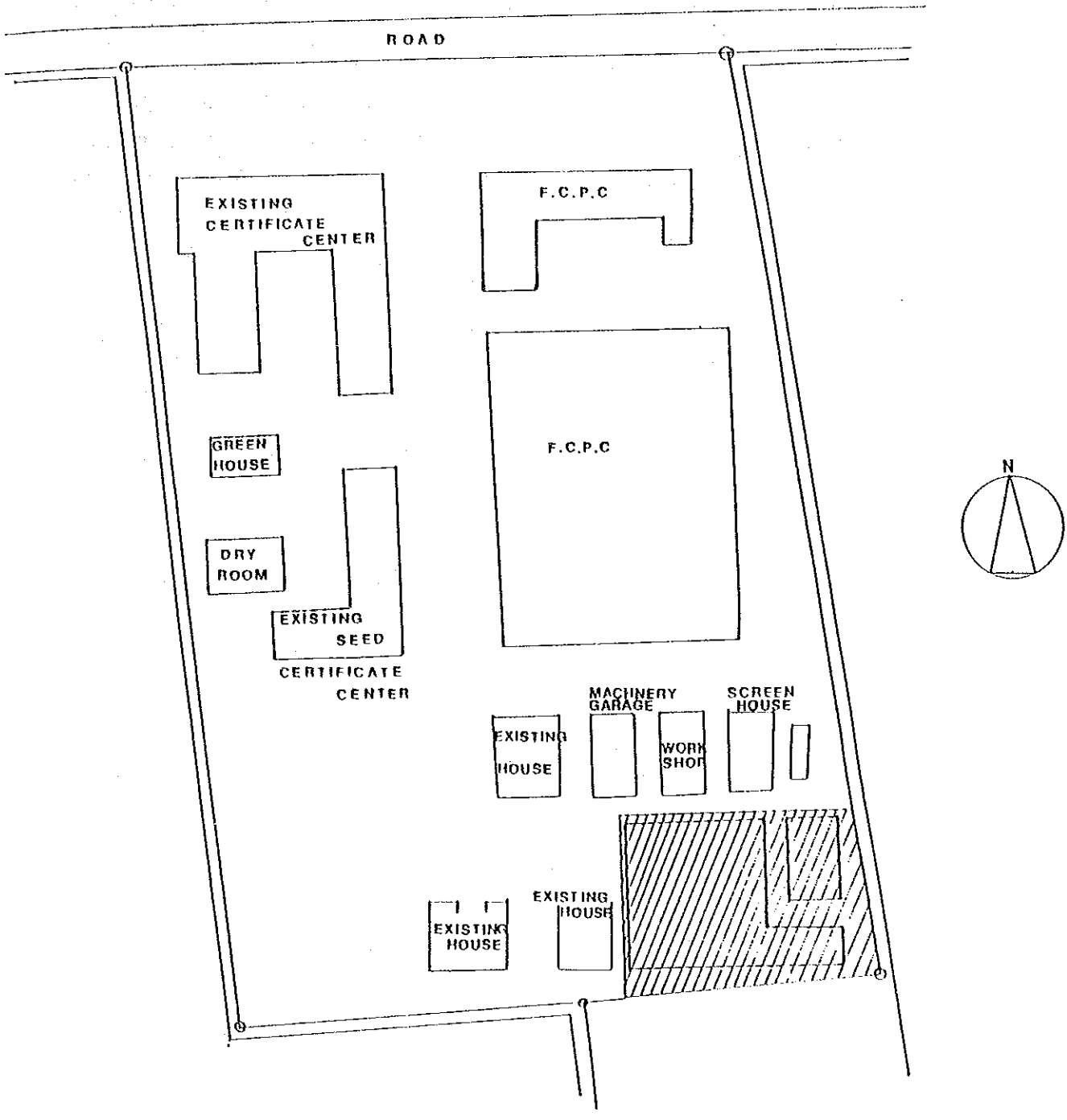
Through the Seed I Project (1971 - 78) financed by the International Bank for Reconstruction and Development, the seed policy of Indonesia is being vastly improved. A National Seed Board was established as part of the Project's activities.

The National Seed Board is an advisory organ of the Ministry of Agriculture's seed policy. Its head office is at the Directorate General for Food Crop Agriculture, Ministry of Agriculture. With regard to the production of seeds, the Board's approval must be obtained for the introduction and extension of the varieties.

The Board has three subcommittees for Guidance, Control and Certification of Seeds in connection with the evaluation, extension, and production and marketing of seeds.

The Government of Indonesia has been involved in the Regional Development Project of the International Potato Center since 1982 and has conducted research and training aimed at increasing the

Fig. 2-4-7 LAYOUT OF BPSB



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potato production. Presently, Indonesia is placing priority on the production of seed potato in the three provinces of West, Central and East Java through the rapid multiplication method. These provinces are responsible for more than 70% of the total potato production in Indonesia.

Under this Project, the facilities and equipment necessary for the rapid multiplication of seed potato will be provided by grant aid to West Java which has the largest cultivation area and the highest production among the three provinces.

2.6 Background and Contents of the Request

After succeeding in becoming self-sufficient with regard to rice, the Government of Indonesia, in 1985, requested Japan's cooperation in increasing the production of crops other than rice. In 1986 the two countries agreed that an umbrella-type cooperation would be offered for the improvement of rice, soybean, and potato production. After the R/D of this Project was concluded, Japan was requested to provide a master plan for the Project.

The Project for the Multiplication and Distribution of High Quality Seed Potato was chosen by the Government of Indonesia from the master plan survey and grant aid cooperation was requested from Japan.

The facilities, equipments and sites requested by the Government of Indonesia are as follows:

Facilities - Equipments	Installation Location
1. Facilities and equipment necessary for the cultivation of basic seed	LEHRI (Lembang)
2. Facilities and equipment necessary for the cultivation of foundation seed	Foundation Seed Farm (Pengalengan BBI Unit))
3. Facilities and equipment necessary for the cultivation of stock seed	Stock Seed Farm (Pengalengan)
4. Facilities and equipment necessary for the examination of high quality seed potato	BPSB (Bandung City)
5. Facilities and equipment for training purposes	Foundation Seed Farm (Pengalengan BBI Unit)
6. Facilities and equipment for quality control, etc.	Foundation Seed Farm (Pengalengan BBI Unit)

CHAPTER 3 : PROJECT DESCRIPTION

CHAPTER 3 PROJECT DESCRIPTION

3.1 Objectives

The Government of Indonesia has decided to actively the encourage potato production in order to meet the increasing demand for potatoes. The aim of the Government is not only to increase the production but also to develop the processing industry by using the potatoes grown within the country for French fried potatoes and potato chips and, in the future, to increase the exports of surplus goods to the neighboring countries. So far, French fries and potato chips are being imported.

Poor cultivation techniques and low quality seed potatoes cause the low yield of potatoes at cultivating farms. Imported, high quality seed potatoes are also available. But due to the distribution problems after the importation, ordinary farms are unable to obtain them. To increase the potato production, the immediate objective will be to provide a stable supply of disease-free, high quality seed potatoes. Additional objectives include the potato varieties suitable for each district, the improvement of cultivation and planting management techniques, and the improvement of seed potato storage methods.

The objective of approximately 12,000ha Project area in West Java will be the multiplication of disease-free, high quality seed potato and to distribute them to ordinary farms and thereby replacing the expensive imported seed potatoes will domestic ones.

To achieve these objectives, the level of research must be raided and, with regard to Project related facilities, the functions of the Lembang Horticulture Research Institute, the Seed Control and Certification Service in Bandung, and the Foundation Seed Farm and Stock Seed Farm in Pengalengan should be strengthened.

The construction of facilities and the supply of equipments which are necessary for seed potato production are to be provided through the Grant Aid Cooperation Program.

3.2 Examination of the Request

3.2.1 Examination of the Appropriateness and Necessity of the Project

1) Objectives and Effects

The objectives of this Project are to produce disease-free, high quality seed potato through the rapid multiplication method, to distribute them to farms at reasonable prices, and to improve the potato productivity.

After implementation of this Project, the farmers will be able to use domestically produced disease-free, high quality seed potatoes at low prices instead of the high priced imported ones. This will lead to the increased production of potatoes, an improvement in farming economy, and a decrease in the amount of money being spent on foreign produce. Furthermore, the problems concerned with the production and distribution of seed potatoes will be solved, and the West Java Province's seed potato multiplication and distribution system will be established and will act as a model for other provinces to follow.

2) Reality of Objectives

The initial target seed potato yield of this Project is set at 1,500 tons/year; however, after the improvement of multiplication technique and the improvement of marking system of seed potato, the yield to expected to increase gradually up to 4,500 tons/year which is the final target of the Project.

Hence, it is necessary to expand the present area of the stock seed farm from 25 ha for producing 4,500 tons/year of seed potato.

3.2.2 Evaluation of Project Implementation and Operation

The Government of Indonesia has no plans to increase the number of personnel at Project related organizations. They intend to make the use of present personnel and to strengthen the Potato Section.

Project survey results indicate that if the present budget and number of personnel are maintained, no particular problems should be confronted in the Potato Section.

Maintenance and management expenses should be covered by the sale of stems by the Lembang Horticulture Research Institute, the sale of seed potatoes by the Foundation and Stock Seed Farms, and the inspection fees by the Seed Control and Certification Service.

1) Lembang Horticulture Research Institute

   Nine staff members at the Lembang Horticulture Research Institute are involved in potato cultivation. The organization structure is shown in Figure 3-2-1.

   A budget of Rp.15,000,000/year (excluding personnel expenses) is secured by the Agency for Agricultural Research and Development (AARD) of the Ministry of Agriculture.

2) Fourteen personnel involved in potato cultivation will be transferred from BBI and BBU units in West Java to the Foundation Seed Farm. The organization chart is shown in Fig. 3-2-2.

   Regarding the budget, West Java Province will be responsible for personnel expenses and the Directorate General for Food Crops of the Ministry of Agriculture will be responsible for operational costs.

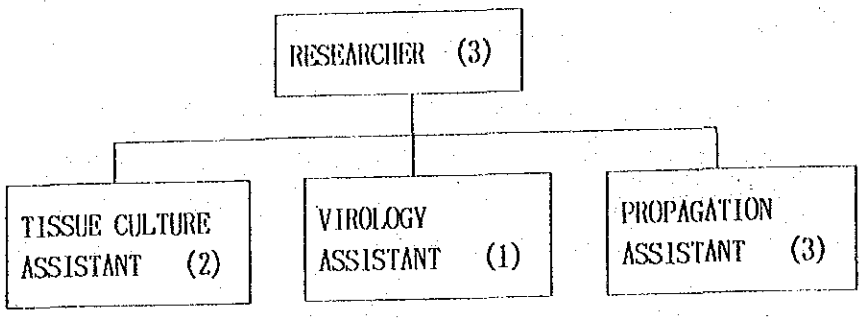
3) Stock Seed Farm

   The Stock Seed Farm will have a staff of twelve people who will be dispatched from the public corporation of Perusahaan Daerah Makanan dan Minuman (refer to Fig. 3-2-3). Budgetary measures will be taken by Perusahaan Daerah Makanan dan Minuman; 55% of the profits will be paid to the West Java Province Government.

4) Seed Control and Certification Service (BPSB)

   A staff of eighteen people will be involved in potato cultivation at the Seed Control and Certification Service. The staff will be divided into field inspectors and laboratory inspections (refer to Fig. 3-2-4). Budgetary measures will be taken by the Services' controlling agency, the Directorate General for Food Agriculture of the Ministry of Agriculture.

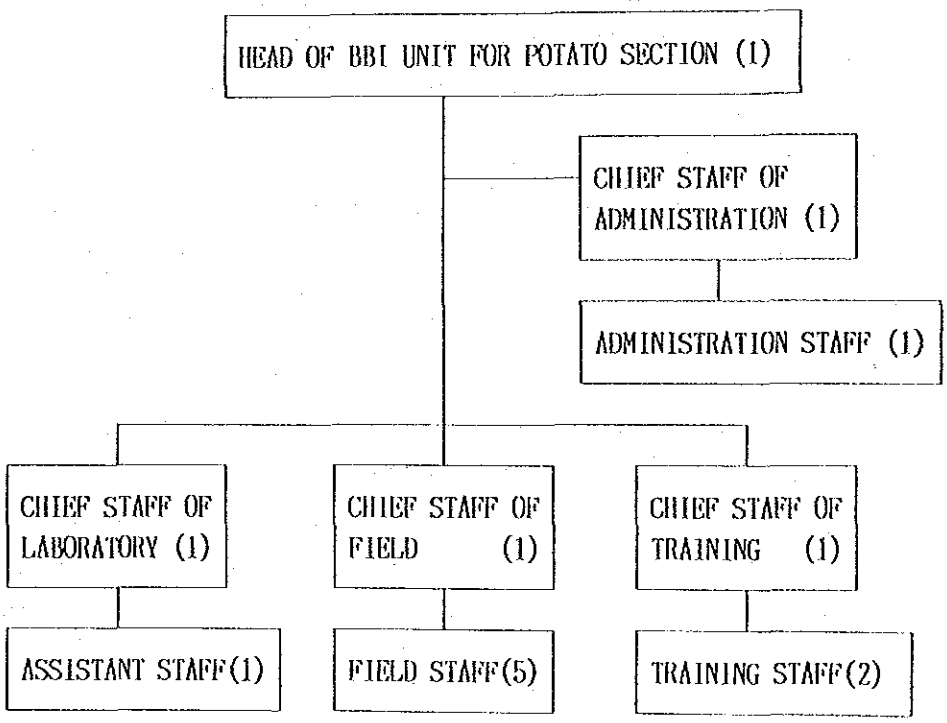
Fig. 3-2-1 Organization of LEHRI for Potato Section



TOTAL NUMBER OF STAFF (9)

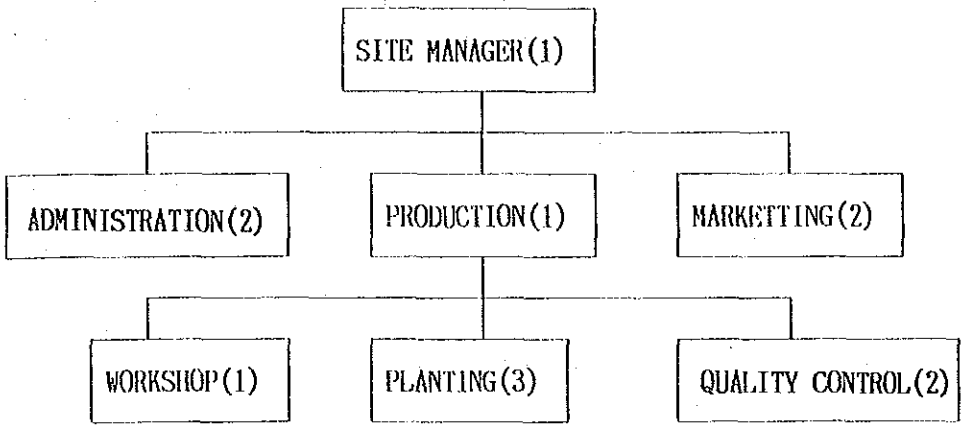
NOTE.( );NUMBER OF STAFF

Fig.3-2-2 Organization of BBI Unit



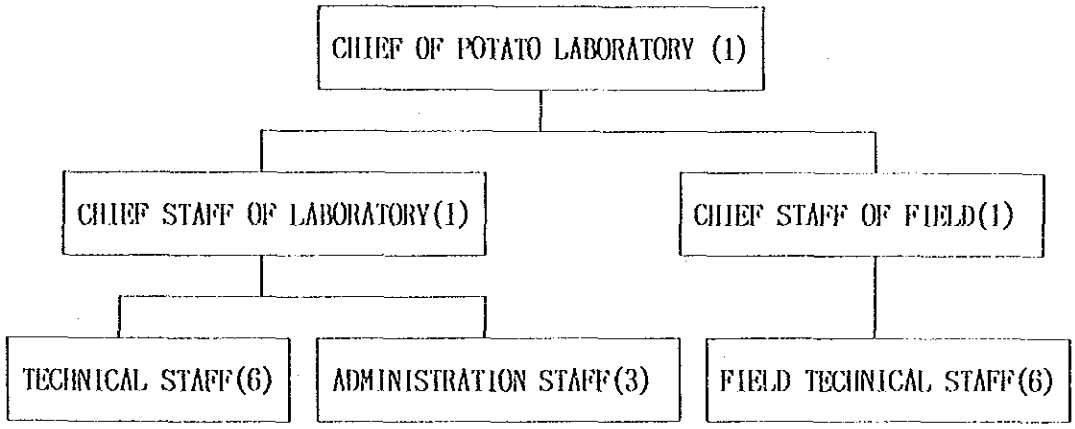
TOTAL NUMBER OF STAFF (14)

Fig. 3-2-3 Organization of Stock Seed Farm



TOTAL NUMBER OF STAFF (12)

Fig. 3-2-4 Organization of BPSB for Potato Section



TOTAL NUMBER OF STAFF (18)

3.2.3 Relation to Similar or Other Aided Projects

Projects concerning potatoes that are aided by other agencies are mentioned below. As research and experimentation are their main objectives, they will not overlap with this Project but their results should be reflected in this Project.

1) USAID

(1) Aiding country: U.S.A.

(2) Period of Cooperation: 1985 - 1989

(3) Site of Research/Experiment:

Lembang Horticulture Research Center
(West Java Province)

(4) Main Theme of Research:

Potato tissue culture, multiplication method, etc.

2) Project on the Research and Development of Lowland Vegetables

(1) Aiding Country: Netherlands

(2) Period of Cooperation: 5 years (1987 - 1992)

(3) Site of Research/Experiment:

Subang, Sukamandy (West Java Province)

Brebos (Central Java Province)

(4) Main Theme of Research: Development of varieties:

Introduction selection and cultivation vegetables suitable to lowlands.

- Collection of local varieties.
- Cultivation technique:
  Cultivation techniques for lowland vegetables, irrigation techniques.
- Diseases and harmful insects:
  Research on diseases and harmful insects, prevention and extermination techniques.
- Agricultural economy:
  Farm management

3) South East Asia Program for Potato Research and Development (SAPPRAD)

This organ was established by five South East Asian countries (Indonesia, the Philippines, Thailand, Sri Lanka, and Papua New Guinea) for the purpose of conducting joint potato research and development. The objectives are to solve the problems common to South East Asian countries, to strengthen the research capacities, and to transfer and promote the research results to farms.

Project funds have been provided by the participating countries, the ADAB (Australian Development Assistance Bureau) and the CIP (International Potato Center). The management of this Project is conducted by CIP under mutual consent of the joint research and development countries. To avoid any overlapping with regards to potato research and development, the projects were assigned as follows:

(1) Cultivation of potato varieties for lowlands : The Philippines

(2) Cultivation techniques for potatoes in tropical areas : Indonesia

(3) Utilization of seedlings : Sri Lanka

(4) Storage and utilization : Thailand

(5) Practical seed production techniques : Papua New Guinea

SAPPARD is presently supervising the following tests:

(1) Heat resistance tests on the nutritive system, and resistance tests to the wilt disease.

(2) Tests on hybrid seedlings (20 - 30 tons/ha) supplied by CPI (Philippines, Sri Lanka).

(3) Diffused light storage tests on saplings grown from seedlings, and tubers obtained from seed tubers.

(4) Seed potato production using rapid multiplication and seedlings.

Indonesia will conduct tests on the technical improvement currently being conducted for the purpose of decreasing production costs and increasing yield and profit.

CIP provides the seeds and seedlings for the research and development use.

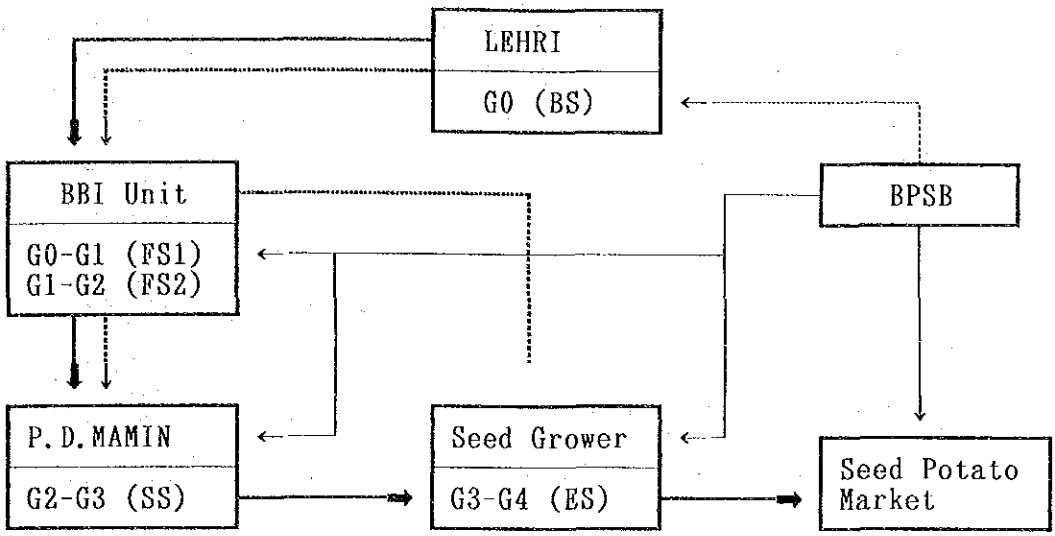
3.2.4 Examination of the Project's Organization Factors

This is a cooperative Project of the central government (Ministry of Agriculture) and the West Java Province Government. The central Government will be responsible for the tissue culture at the Lembang Horticulture Research Institute, and the multiplication and inspection of seeds at the Foundation Seed Farm. The provincial government will be responsible for the management of the Foundation Seed Farm and the Stock Seed Farm and activities involved in disseminating information pertaining to seed and techniques to seed farms and general farms.

The Directorate General of Food Crop Agriculture of the Ministry of Agriculture will carry out the operation by coordinating the Lembang Horticulture Research Institute, the Foundation Seed Farm and the Seed Control and Certification Service Center.

The function chart of these organizations is shown in Fig. 3-2-5. The role and activity of each organization with regard to this Project are mentioned below. Seed potato farms are not included in the grant aid program of this Project.

Fig. 3-2-5 Function Chart



Note : Flow of Seed Potato
Inspection & Certification (Labeling)
Technical Guidance
Identification & Evaluation

1) Activity of LEHRI

- To introduce and select new varieties
- To produce pathogen free planting materials to BBI Unit
- To dispatch lecturer for training in BBI Unit
- To monitor and evaluate the planting material which is sent to BBI Unit

2) Activity of BBI Unit

- To produce GI and G2
- To conduct training for BBI staff, BPSB staff, Perusahaan Daerah Makanan dan Minuman staff, seed grower, etc.
- To give technical guidance to Perusahaam Daerah Makanan dan Minuman and seed grower
- To distribute G2 to Stock Seed Farm

3) Activity of Stock Seed Farm (Perusahaan Daerah Makanan dan Minuman)

- To produce G3 from G2
- To distribute G3 to seed grower (contract farmer)
- If necessary, to providde the agricultural input (fertilizer, pest-cide, tool, sprayer, etc.)
- If necessary, to buy the seed potato from contract farmer

4) Activity of Seed Grower

- To produce G4 from G3 under technical guidance of BBI Unit and BPSB
- To sale the seed to farmer throw market

5) Activity of BPSB

- Seed inspection
- Seed certification
- Identification and evaluation of varieties

3.2.5 Examination of the Requested Facilities and Equipment

1) Lembang Horticulture Research Institute

The facilities and equipment requested can be divided into cultural and research facilities, screen house, and related equipment. The list of facilities is shown in Table 3-2-1. The requested items are mostly the facilities and equipment necessary for tissue cultivation; however, some office equipment are also included. As the present office equipment are thought to be adequate, it was omitted. As for the use of LPG in the laboratory, this will be changed, for safety reasons, to electric grills.

Additional items considered necessary but were not requested by Indonesia are listed together with the requested items in the Annex.

2) Foundation Seed Farm

The list of items requested by the Foundation Seed Farm can be classified as follows:

(1) Facilities and Equipment Necessary for Foundation Culturing:

The net house requested by Indonesia has poor durability and will last only for 1 or 2 years; thus, it was changed to a stainless steel screen house.

- Screen house
- Farm machinery house
- Storage for seed potatoes
- Compost shed
- Storage for fertilizers and agricultural chemicals
- Irrigation system
- Equipment for farm management
- Related equipment

(2) Facilities and Equipment Necessary for Training:

There are no lodging facilities near the farm; therefore a lodging facility for trainees and lecturers should be constructed within the farm.

- Training facilities
- Lodging facility
- Training equipment

(3) Facilities and Equipments Necessary for Quality Control:

- Grading facility
- Laboratory
- Related equipment

(4) Others:

The staff for the farm will be transferred from BBI/BBU in West Java; therefore housing for the instructor and personnel will be required. A guest house was requested by Indonesia, but the lodging facility for trainees and lecturers will serve the purpose.

(5) Additional Facilities and Equipment

Upon considering the requested items, they were thought to be inadequate for maintaining the functions of the Foundation Seed Farm; therefore, additional items, mostly laboratory equipment were added. The items believed to be necessary for the Project are listed in the List of Facilities and Equipment in the Annex.

3) Stock Seed Farm

The list of facilities and equipment requested by Indonesia are shown in Table 3-2-5 and 3-2-6. The items are mostly concerned with the facilities and equipment necessary for the reading of stock seed (G3) and can be classified as follows:

- Grading facility
- Farm machinery house
- Storage for seed potatoes
- Compost shed
- Storage for fertilizers and agricultural chemicals
- Irrigation system
- Water supply facility
- Farm management equipment

Regarding the storage for fertilizers and chemicals, the present facility will be used.

4) Seed Control and Certification Service

The items requested for the Seed Control and Certification Service are the facilities and equipment necessary for the inspection, fixation and evaluation of seed potato, and may be classified as follows:

- Research facility
- Screen house
- Vehicles for farm inspection
- Research equipment

Indonesia's request included a storeroom for test pieces. This item was excluded but will be substituted by other equipment.

Upon considering the facility and the requested items, additional equipment necessary for Project use were chosen and are shown in a table in the Annex.

3.2.6 Examination of the Necessity for Technical Cooperation

Once the Project is efficiently and effectively implemented and the activity base is established, greater results may be expected if the technical cooperation from Japanese specialists is provided for improving the level of research, and production techniques for seed potatoes and appropriate promotional activities.

3.2.7 Basic Policy for Project Implementation

After confirming that the effects of the Project and Indonesia's implementation capabilities fulfilled the requirement of the Grant Aid Cooperation Program, it was deemed appropriate for the Japanese Government to offer cooperation.

The Project outline and the basic design were prepared in accordance with the grant aid program.

The reasons for modifying some of the Indonesia's requests are given in the section "Contents of the Project and Requested Facilities and Equipment."

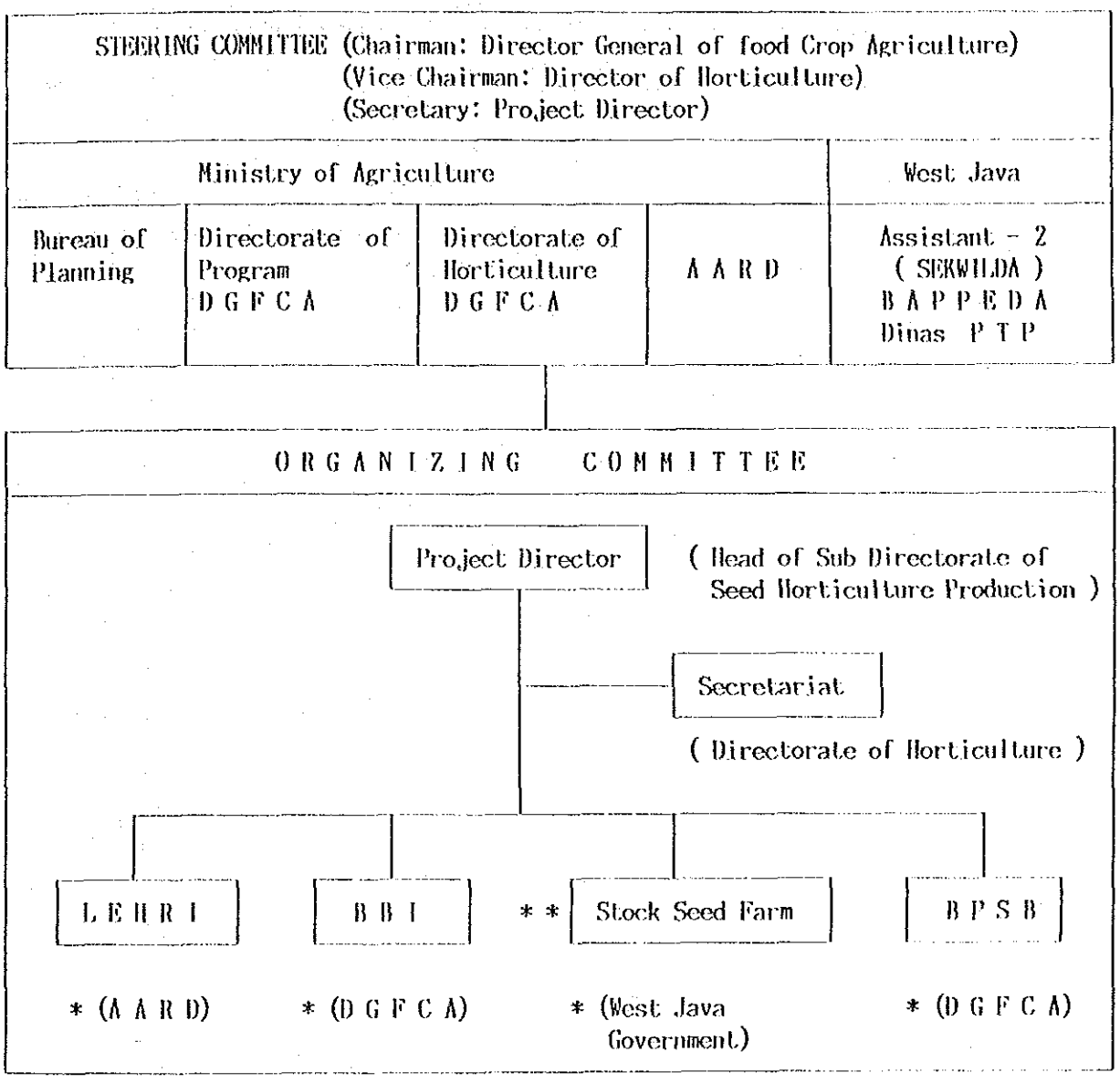
3.3 Outline of the Project

3.3.1 Project Implementation Agency and Operation System

The Directorate of Horticulture, The Directorate General of Food Crop Agriculture of the Ministry of Agriculture is the agency responsible for the Project. The Lembang Horticulture Research Institute (LEHRI), the Foundation Seed Farm (BBI Unit), the Stock Seed Farm, and the Seed Control and Certification Service come under the agency's control.

The Steering Committee and the Organizing Committee will be in charge of this Project (see Fig. 3-3-1 Organization Chart of the Project).

Fig. 3-3-1 Organization Chart of the Project



* Source for administration and budget

* * Stock Seed Farm ;

1) Steering Committee

The Steering Committee is composed of the Ministry of Agriculture's Bureau of Planning, the Directorate of Program, the Directorate of Horticulture of the Directorate General for Food Crop Agriculture, the Agency for Agricultural Training and Promotion, and the Government of West Java.

According to an official announcement by the Ministry, the Director General of Good Crop Agriculture will be the Chairman, the Director of Horticulture will be the Vice Chairman, and the Project Director will be the Secretary.

2) Organizing Committee

The Organizing Committee will be responsible for managing the Lembang Horticulture Research Institute, the Foundation Seed Farm, the Stock Seed Farm, and the Seed Control and Certification Service. The Committee will also be responsible for managing the Project.

The Head of the Seed Production Section of the Directorate of Horticulture, Directorate General of Food Crop Agriculture will be appointed as the Project Director.

3.3.2 Project Planning

The main objectives of the Project include the multiplication and distribution of pathogen-free, high quality seed potato through the application of the rapid multiplication method, and by the activities of the organization mentioned in Section 3.2.4. Other Project activities include the selection of suitable varieties, cultivation technique training, and promotional activities.

1) Production of Seed Potato

The role of each organization in the production of seed potato is as follows:

- Pathogen-free, high quality basic seed (GO) is supplied to the Lembang Horticulture Research Institution.

- The Foundation Seed Farm conducts the multiplication of G1 and G2 seed and supplies G2 to the Stock Seed Farm
- The Stock Seed Farm supplies G3 to seed potato farms.
- Quality testing is conducted by the Seed Control and Certification Service and certificates are issued for seeds that are pathogen-free and high quality.

The basic plan for the production of seed potato which is necessary for the determining the scale of Project facilities is shown in Table 3-3-1.

Table 3-3-1 Basic Plan for Seed Potato Multiplication

Organization	Gene-ration	Capacity Required for year (for season)	Target Yield unit/ year (unit/season)	Seed Required unit/ year (unit/season)	Remarks
LEHRE	G0 (BS)	14 bed	14,900 cut +Small Tuber		Screen House, Efficiency 70% 1,620cut/bed for 3 months 14× 1,620× 0.7
BBI unit	G1 (FS1)	* 1,588m²	202,278 pcs	from LEHRI 14,900 cut BBI 44,650 cut	Screen House, Efficiency 85% 50cut/m²×4pcs× 1,191m² ×0.85
BBI unit (Foundation Seed Farm)	G2 (FS2)	3.54ha (1.18ha)	1,028,520 pcs (342,840 pcs)	202,278 pcs (67,426 pcs) +Small Tuber	Efficiency 85% 57,140pcs/ha×6pcs×1.18ha × 3×0.85
Stock Seed Farm	G3 (SS)	18 ha (6 ha)	230.0 t (76.7 t)	1,028,520 pcs (342,840 pcs)	Efficiency 85% 15t/ha× 6ha× 3×0.85
Seed Grower (Extension Seed Farm)	G4 (ES)	153 ha (51 ha)	1,530 t (510 t)	229.5 t (76.5 t)	Efficiency 2/3 15t/ha× 153ha×2/3

* Screen House for G0 → G1 : 1,191m²
Screen House for G0 → G0 : 397m²
Total : 1,588m²
Bed size : B 900× L 1,800× H 200

2) Research Plan

Research activities will center around the Lembang Horticulture Research Institute. Major research subjects will be:

- Selection of new varieties suitable to different area conditions.
- Establishment of rapid seed multiplication methods.
- Measures for the prevention of plant diseases and insect damage.
- Improvement of cultivation techniques.

3) Training Plan

(1) Objectives

Training facilities to be built within the Foundation Seed Farm complex will be used for the following training:

- Seed potato multiplication techniques;
- Inspection methods;
- Cultivation techniques (including crop rotation).

The training facilities will also be used for the purpose of disseminating the use of high quality seed potatoes.

(2) Operation System

A chief and two assistants will be dispatched to the Foundation Seed Farm for training purposes. The training budget will be provided by the Directorate for Food Crop Agriculture, the Ministry of Agriculture; aid from FAO and CIP may also be used.

(3) Trainees

Each training session will be limited to 20 trainees for a period of less than one month. The following personnel will receive training:

- BBI staff (all personnel concerned with potato cultivation)
- Technical promotional staff from the West Java Province

·BPSP staff

· Technical promotional staff from major potato producing areas other than West Java.

Presently there are no organizations in Indonesia conducting potato cultivation training; thus, this training program will contribute greatly to the education of the country's potato growers.

(4) Lecturers

Lecturers from the following institutions will be invited to participate in the training program:

· Lembang Horticulture Research Institute

· Bogor Agricultural University and

· Other Agricultural Universities

· Specialists for FAO, JICA, etc.

· Others

(5) Types of Training

Training will include the principle techniques of seed potato production, storage, marketing, agricultural machinery, etc. Fifteen training sessions are planned during a year (see Fig. 3-3-2).

3.3.3 Locations and Conditions of Project Sites

There are three Project sites. They are located in Bandung, the provincial capital of West Java, and in Lembang and Pengalengan in the Bangdung district. The locations are shown in Fig. 3-3-3. Site conditions are as follows:

1) Lembang Horticulture Research Institute

The Lembang Horticulture Research Institute is located 7km north of Bandung city at an altitude of 1,250m.

Fig. 3-3-2 Seed Potato Production Training Schedule

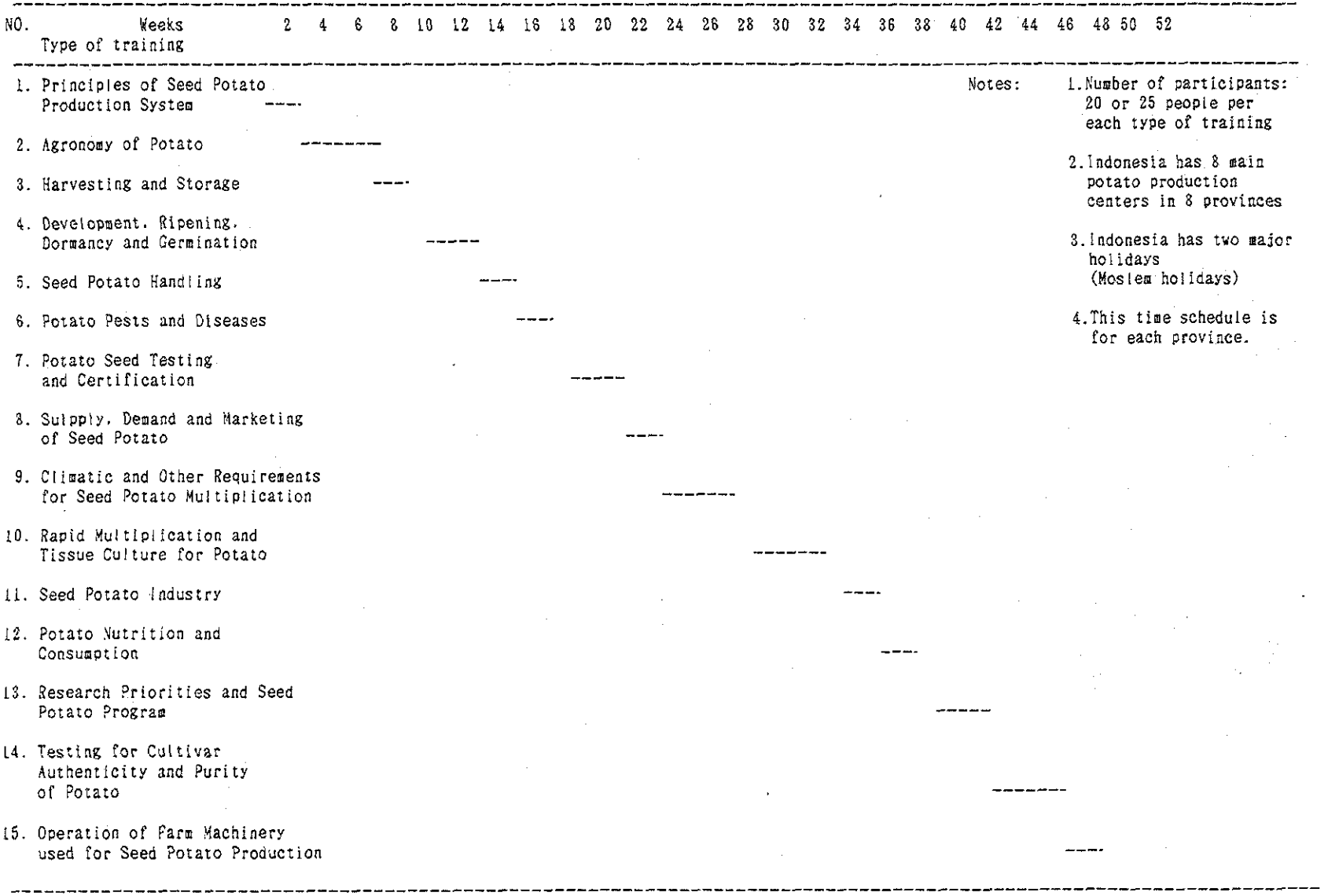
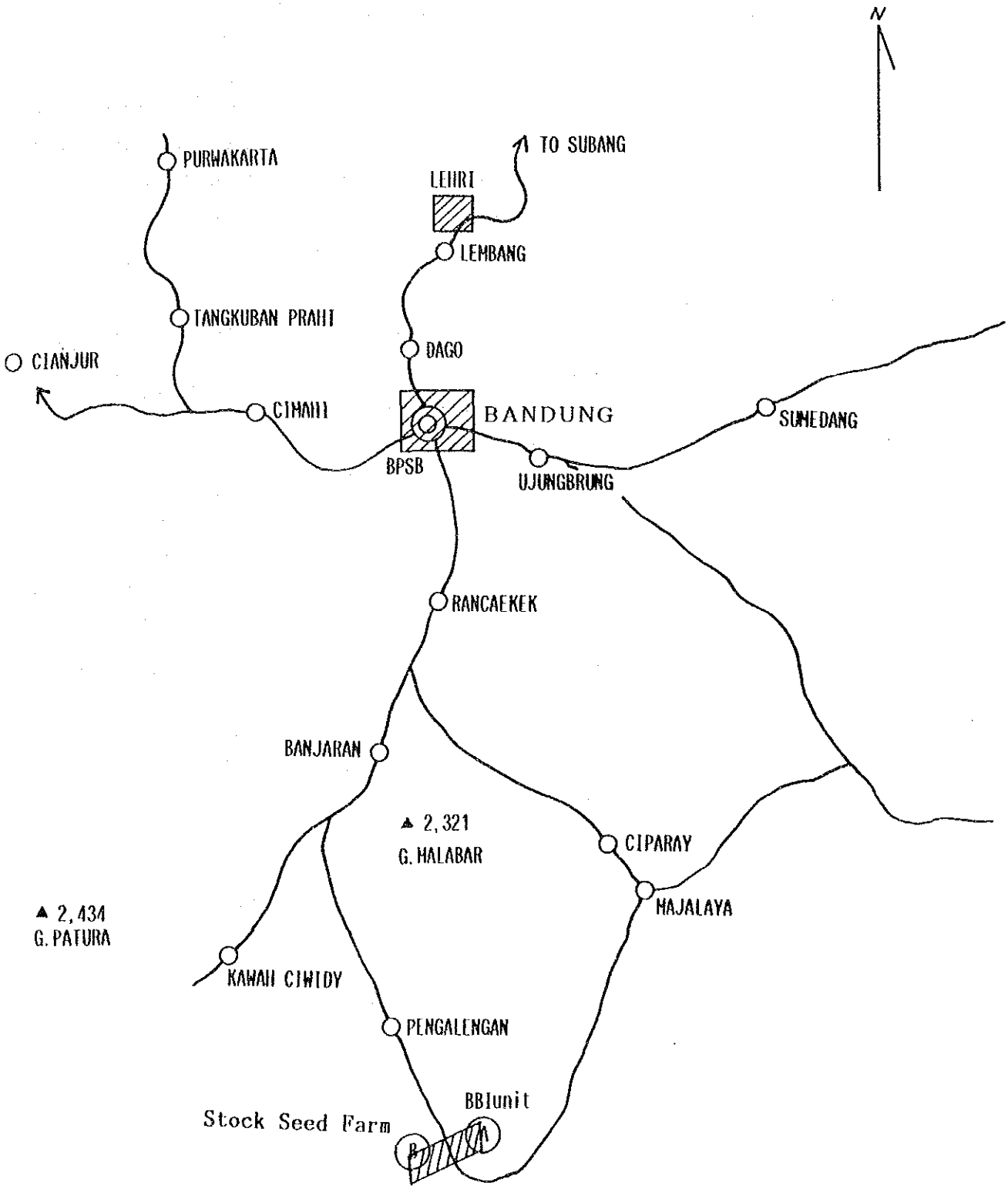


Fig. 3-3-3 Project Location Map



Groundwater is the water supply source. It is pumped up into an elevated tank and then supplied to various areas. Available electricity is 220V. Although telephones are installed, it is difficult to place calls to outside areas.

Water and electricity supplies pose no problems for Project implementation. But, since it is difficult to make telephone connections, radios will be used for communications with other organizations.

2) Foundation Seed Farm and Stock Seed Farm

The Foundation and Stock Seed Farms are located at 50km south of Bandung city in a hilly region at an altitude of 1,500m. The infrastructure conditions of the farms are as follows:

(1) Foundation Seed Farm

The water pipes are buried beneath the road in the vicinity of the Project site; no problems can be foreseen with the water supply system. Electricity must be obtained from a power source located at 1km from the site. There are no telephone lines; radios must be used for communication purposes.

Water for the Project's planned irrigation system may be supplied for a nearby waterway.

(2) Stock Seed Farm

Electricity is being supplied to the area. Water may be obtained from an existing well at the site. Radios must be used for communications.

Irrigation water may be supplied from a river on the west side of the farm.

(3) Seed Control and Certification Service Center

The Seed Control and Certification Service Center is located in the suburbs at 2km south of the center of Bandung city at an altitude of 700m.

The site is surrounded by swampy land where fish breeding ponds and paddy fields are located. Some of the paddy fields were filled with 80cm of earth to accommodate the construction of the present Center.

Ground water will be used as the Project's water source. The capacity of the elevated tank currently being used is too small causing water shortages from time to time and hence a new tank must be installed. The electricity supply is adequate. Telephones are installed but radios will be necessary for communications with the Foundation and Stock Seed Farms.

3.3.4 Outline of the Project Facilities and Equipment

Upon examining the items requested by Indonesia, the facilities to be built at the Lembang Horticulture Research Institute, the Foundation, Stock and Seed Farms, and the Seed Control and Certification Service Center are listed in Table 3-3-2. Equipment to be provided are listed in Table 3-3-3.

3.3.5 Operation and Maintenance Plan

1) Operation and Maintenance System

The departments mentioned below will be responsible for the operation and maintenance of the various Project facilities and associated equipments. There will, however, be other departments which actively cooperate with these departments. Operation and maintenance costs are shown in Table 3-3-4.

- Lembang Horticulture Research Institute: Department of Management, Maintenance and Repair Section
- Foundation Seed Farm: General Affairs Department
- Stock Seed Farm: General Affairs Department
- Seed Control and Certification Service: General Affairs Department, Facilities Section

Table 3-3-2 List of Facilities to be Built

Organization	Facility	Area (m^2)	Remarks
LEHRI	Laboratory for Tissue Culture	247.5	Facility for bio-multiplication
	Screen House	97.5	Facility of GO growth
	Soil Storage	16.0	Soil storage for screen house
BBI Unit	Office Building	148.0	Office and laboratory
	Farm Machinery House	90.0	With workshop
	Storage Room	70.0	With grading space
	Storage for Fertilizers & Chemicals	40.0	Separated by a partition
	Lectures' House	456.8	3 bedroom house, 2 bedrooms Tenement house (4 families)
	Experts and Guest House	176.0	For 4 people
	Training Facility	208.0	For a maximum of 20 people
	Trainees' Lodging	412.0	For a maximum of 20 people
	Compost Shed	32.5	Roofed shed and mist irrigation
	Screen House	3,042.0	
	Soil Storage	90.0	
	Irrigation System	-	For an area of 3.5 ha
Stock Seed Farm	Grading House	95.0	
	Farm Machinery House	88.0	With workshop
	Storage Room	152.7	
	Compost Shed	50.0	
	Irrigation System		18 ha
	Water Supply Facility		Elevated tank ($5m^3$ x 2.5m), Pump
BPSB	Laboratory Building	320.0	
	Screen House	48.6	Ventilation
	Water Supply Facility		Elevated tank ($5m^3$ x 3.5m), Pump

Table 3-3-3 List of Equipments to be Supplied

Organization	Objective	Major Equipment	Quantity
LEHRI	1. For tissue culturing and multiplication in the preparation room	Center Table, destillation apparatus, low speed centrifuge, etc.	28 types
	2. For stem cultivation (pathogen-free) in the clean room	Clean beach, micri-scope UV lamps, etc.	75 types
	3. For stem cultivation in the culture room	Incubator, shelving with lights, etc.	6 types
	4. To conduct pathogen tests on seedling obtained from tissue culturing in the inspection room	Elisa reader, high speed chromatography	14 types
	5. To operate the farm screen house	Hand tractor, chemical sprayer, soil sterilizer	6 types
	6. To deliver seedlings	Cold storage car	1
	7. To communicate with other organizations	Radio equipment	1
		LEHRI-Total	63 types
BBI Unit	1. For pathogen tests and research	Elisa reader, micro-scope, center table etc.	12 types
	2. For operations and management of the farm and screen house	Trctor, soil sterilizer, chemical sprayer, etc.	4 types
	3. Training purposes	Video, overhead projector, etc.	7 types
	4. For transportation and farmsupervision	Jeep, truck, and motorcycle	3 types
	5. To communicate with other organizations	Radio equipment	1
		BBI Unit-Total	27 types
Stock Seed	1. To operate and manage farms	Tractor, chemical sprayer, etc.	3 types
	2. To communicate with other organizations	Radio equipment	1
		Stock Seed Farm-Total	4 types

(cont'd)

Organization	Objective	Major Equipment	Quantity
BPSB	1. For the inspection and identification of pests, and the fixation and evaluation of the varieties of seeds.	Elisa reader, microscope, center table, etc.	30 types
	2. Vehicles necessary for farm inspection	Jeep, motorcycle	2 types
	3. To communicate with other organizations	Radio equipment	1
		BPSP-Total	33 types
		GRAND TOTAL	127 types

2) Operation and Maintenance Plan

The departments in charge will prepare a list of all facilities and equipment fixtures. They will maintain the custody of all equipment specifications, manuals, parts lists, repair manuals, and they will distribute copies to those sections responsible for Project equipment operations.

Any noticeable wear to the facilities, materials or equipments is to be reported to the Operation and Maintenance Section who, after considering the necessity for repair or replacement, will include the appropriate costs in the budget/operational plan--costs directly related to the research section are to be included in the budget for research activities.

3) Operation and Maintenance Costs

The yearly operational expenses for the Project are roughly estimated as follows:

(1) Electricity Rates

a) Lembang Horticulture Research Institute

The electricity use contract with PLN is KVA unit; the rates will be the same as for office use:

Unit Electricity Rates:

Basic rate : Rp. 3,680/KVA

Surcharge rate : Rp. 97.75/kw.hr (including common fee of Rp. 1.75/kw)

Electricity Fee:

Office building	:	60KVA x 0.7 x 8 hrs x 25 days	= 1,050kw.hr/month
Basic rate	:	60KVA x Rp.3,680/KVA x 12 months	= Rp.2,649,600
Surcharge rate	:	1,050kw.hr x Rp.97.75/kw.hr x 12 months	= Rp.1,231,650
		TOTAL FEE:	Rp.3,881,250

b) Foundation Seed Farm

The electricity use contract with PLN is based on 40KVA units; the rates will be the same as for office use:

Unit electricity rates:

Basic rate : Rp.3,680/KVA

Surcharge rate : Rp.97.75/kw.hr (including common fee of Rp. 1.75/kw)

Electricity Fee:

Office building	:	4.1KVA x 0.7 x 8 hrs x 25 days =	574kw.hr/month
Training building	:	2.0KVA x 0.5 x 8 hrs x 20 days =	160kw.hr/month
Lodging house	:	9.1KVA x 0.5 x 12 hrs x 20 days =	1,092kw.hr/month
Lodging house for lectures	:	4.5KVA x 0.5 x 12 hrs x 20 days =	540kw.hr/month
Staffing house	:	7.9KVA x 0.5 x 12 hrs x 30 days =	1,422kw.hr/month
Director house	:	2.4KVA x 0.5 x 12 hrs x 30 days =	432kw.hr/month
		TOTAL	4,220kw.hr/month

Basic rate	:	40KVA x Rp.3,680/KVA x 12 months	= Rp.1,766,400
Surcharge rate	:	4,220kw.hr x Rp. 97.75 x 12 months	= Rp. 412,505
		TOTAL FEE:	Rp.2,178,905

c) Stock Seed Farm

The electricity use contract with PLN is based on KVA units: the rates will be the same as for office use:

Unit electricity rates:

Basic rate : Rp.3,680/KVA

Surcharge rate : Rp.97.75/kw.hr (including common fee of Rp.1.75/kw)

Electricity Fee:

Office building	:	1.9KVA x 0.7 x 8 hrs x 25 days = 266 kw.hr/month	
Basic rate	:	2KVA x Rp.3,680/KVA x 12 months	= Rp. 88,320
Surcharge rate	:	266kw.hr x Rp.97.75/kw.hr x 12 months	= Rp.312,018
		TOTAL FEE	Rp.400,338

d) Seed Control and Certification Service Center

The electricity use contract with PLN is based on KVA units: the rates will be the same as for office use:

Unit electricity rates:

Basic rate : Rp.3,680/KVA

Surcharge rate : Rp.97.75/kw.hr (including common fee of Rp.1.75/kw)

Electricity Fee:

Office building	:	6.5KVA x 0.7 x 8 hrs x 25 days = 1,300 kw.hr/month	
Basic rate	:	7KVA x Rp.3,680/KVA x 12 months	= Rp. 309,120
Surcharge rate	:	1,300kw.hr x Rp.97.75/kw.hr x 12 months	= Rp.1,524,900
		TOTAL FEE	Rp.1,834,020

(2) Communication Costs

As radios will be used for communications, telephone rates were not compiled. The yearly cost for radio operations and maintenance are estimated to be Rp.100,000.

(3) Fuel Costs for Machinery

a) Lembang Horticulture Research Institute

Most of the cost will be for the fuel to operate the transportation vehicles, soil sterilizers and emergency generators:

Light Oil: 19,200 liters/year x Rp.200 = Rp.3,840,000

b) Foundation Seed Farm

Fuel for tractors, vehicles, irrigation pumps and soil sterilizers:

Light Oil: 36,000 liters/year x Rp.200 = Rp.7,200,000
Gasoline: 3,000 liters/year x Rp.400 = Rp.1,200,000

c) Stock Seed Farm

Fuel for tractors and irrigation pumps:

Light Oil: 25,800 liters/year x Rp.200 = Rp.5,160,000

d) Seed Control and Certification Service

Fuel for farm inspection vehicles and emergency generators:

Light Oil: 63,360 liters/year x Rp.200 = Rp.12,672,000
Gasoline: 9,000 liters/year x Rp.400 = Rp. 3,600,000

(4) Equipment Operation and Maintenance Costs

The annual operation and maintenance costs for tractors, vehicles, and irrigation equipment were estimated as 5% of their initial cost. The annual operation and maintenance costs for the research equipment are mainly for chemicals and other consumable items such as paper products. Hence, the annual costs were estimated as 0.5% of the equipment's initial costs.

a) Lembang Horticulture Research Institute:

Vehicles	: ¥ 9,000 x 5%	=	¥ 450	(Rp. 5,562)
Research Equipments	: ¥90,000 x 0.5%	=	¥ 450	(Rp. 5,562)
TOTAL	:	=	¥ 900	(Rp.11,124)

b) Foundation Seed Farm:

Vehicles	: ¥18,269 x 5%	=	¥ 913	(Rp.11,285)
Research Equipments	: ¥41,800 x 0.5%	=	¥ 209	(Rp. 2,583)
TOTAL	:		¥1,122	(Rp.13,869)

c) Stock Seed Farm:

Vehicles	: ¥54,000 x 5%	=	¥2,700	(Rp.33,374)

d) Seed Control and Certification Service Center:

Vehicles	: ¥ 9,800 x 5%	=	¥ 490	(Rp. 6,056)
Research Equipments	: ¥31,000 x 0.5%	=	¥ 155	(Rp. 1,915)
TOTAL	:		¥ 645	(Rp. 7,971)

(5) Training Cost

Training cost as estimated by Directorate of Horticulture was 36 million Rupiah per one course for 25 participants based on the actual budget of the seed production training course of FAO. In this project, the cost was estimated as 126 million rupiah for one year (15 courses per one year).

The breakdown is shown below:

(Unit: Rp.1,000)

(1) Lodging and meal 20 participants x Rp.10 x 14 days	=	Rp. 2,800
(2) Internal transport 20 participants x Rp.15	=	Rp. 300
(3) Transport of lectures 4 lectures x Rp.100	=	Rp. 400
(4) Remuneration for lecturers 4 lectures x Rp.100	=	Rp. 400
(5) Office supplies lumpsum	=	Rp. 1,000
(6) Books lumpsum	=	Rp. 3,000

(Unit: Rp.1,000)

(7) Miscellaneous (secretary etc.) lumpsum	=	Rp. 500
TOTAL	=	Rp. 8,400 (for one course)
Grand Total Rp.8,400 x 15 courses/year	=	Rp.126,000 (for one year)

Table 3-3-4 Operation and Maintenance Costs

(Rp.1,000)

	LEHRI	BBI Unit	S.S. Farm	BPSR
Electricity Rates	3,881	2,178	400	1,834
Communication Costs	100	100	100	100
Fuel Costs	3,840	8,400	5,160	16,272
Equipment Operation and Maintenance Costs	11,124	13,869	33,374	7,971
Training Expenses	-	126,000	-	-
SUBTOTAL	18,945	150,547	39,034	26,177
T O T A L				234,703

3.4 Technical Cooperation

Preceding the Grant Aid Cooperation Program, it is planned to dispatch the Japanese experts to the Lembang Horticulture Research Institute in 1990. Grant Aid Cooperation and technical cooperation must be closely linked for the effective operation of the Project, for the increase of seed potato production skills, and for the establishment of a distribution route. This cooperation must continue until the Project is fully operational.

The areas and organizations requiring technical cooperation are described below:

1) Lembang Horticulture Research Institute

- Seed fixation and evaluation techniques for the introduction and selection of new varieties suitable to the conditions of the potato growing areas and the needs of consumers.

- Techniques necessary to culture pathogen-free stem tips of newly introduced varieties, for mass-multiplying and inuring stems under pathogen-free conditions, and to constantly supply basic seeds (G0) by multiplying the stems in transferred soils.

- Inspection techniques for identifying diseases affected seedlings obtained from tissue cultivation.

2) Foundation Seed Farm

- Techniques to produce G1 from pathogen-free seedling supplied by Lembang Horticulture Research Institute by applying the stem-cutting multiplication method in the screen house, and to produce G2 from G1 by multiplication.

- Techniques that are generally necessary for cultivating seed potato in order to train Stock Seed Farm staffs and seed potato farmers.

3) Stock Seed Farm

- Techniques related to the removal of diseased plants and pest control.

- Cultivation techniques suitable to the local areas and the different seasons (plowing method, crop rotation, storage, use of middle-sized potatoes).

4) Seed Control and Certification Service Center

- Techniques for pest investigation and identification.

- Techniques for fixing and evaluating varieties.

CHAPTER 4 : BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 Design Policies

The Basic design for the Project was prepared according to the policies established by examining the results of the field surveys and the discussions held with the concerned Indonesian agencies related with the Project. The major design policies are as follows:

1) The Project facilities should suit to the natural conditions in Indonesia.

   The Project site is located on a plateau that is more than 700m high. Facility buildings should be designed after taking into account the climatic and local building construction conditions.

2) The type and sizes of the Project facilities should be adequate for the purposes of the Project.

   The types and sizes of Project facilities should be decided based on the analysis of the contents of the Government of Indonesia's request, and by considering the Project's future development plan.

3) Project facilities and equipment should be such types that permit easy operation, management and maintenance.

   Project facilities and equipment should be arranged properly so that it will be easily accessible by the employees and thereby the facilities will be more functional and economical.

   The facilities should be designed by taking into account their durability and simplicity to manage and maintain. Project equipment should be the types that can be easily operated and maintained.

4) Project facilities should be designed so that they can be built by using the Indonesian construction methods and materials.

An effort should be made to minimize the facility construction costs by adopting Indonesian construction methods and materials. This will make the facility management and maintenance simple and will shorten the construction period.

4.2 Examination of Basic Design Conditions

4.2.1 Design Conditions of the Project Facilities

1) Natural Conditions

(1) Annual precipitation in Lembang, Pengalengan and Bandung is more than 2,000mm. Average annual temperatures for those areas are approximately 16°C, 15°C, and 22°C respectively.

The following measures should be taken against intensive rainfalls during the rainy seasons:

a) The slopes of facility buildings should be steep for fast draining of rainwater.

b) Building roof edges should be jut out long enough to prevent the entry of sunlight and rain.

c) The floor levels of buildings should be at least 200mm higher than the ground level to prevent temporary flooding during rainy seasons.

d) Existing power and water supply lines in the LEHRI should be used for the Project.

(2) Foundation Seed Farm (BBI Unit)

The Project site is selected at the foot of a mountain 5km south of Pengalengan City. This site is about 200m away from a village and is divided in two parts by a road. There is 3.5 ha of land on one side of the road and 1.5 ha on the other side. The land of 3.5 ha in size is almost on the same level as the road, but is undulated. The 1.5 ha piece of land is approximately 2m higher than the road, but is slightly sloped towards the road.

The site should be used for the Project as follows:

a) Major Project facilities should be compactly arranged on the 1.5 ha land for better functioning of the facilities.

b) The topsoil of the 1.5 ha land should be removed and the land should be leveled off. The removed topsoil should be placed on the 3.5 ha land which will be used for the seed farm.

c) The 3.5 ha land should be partitioned for efficient seed farm use.

d) Buildings should be strong and easy to clean.

(3) Java Island is situated in an earthquake zone. Strong quakes have hit the island several times in the past. As a result of the past earthquake analysis, the following factors should be incorporated into the facility design:

Although the seismic coefficients adopted for structure design in Indonesia are approximately one-tenth of that used in Japan, the factor K = 0.05 should be used for flat buildings, and K = 0.1 should be used for elevated water tanks.

2) Project Site Environment

(1) The Lembang Horticulture Research Institute (LEHRI)

The Project site has been selected at a location to the south of the institute's Central Research Facility and is situated on a plateau. The site which is 60cm lower than the surrounding area faces a road in the LEHRI. Part of the site is presently used as farm land.

The site should be used for the Project as follows:

a) As there is no drainage problem in the site area, the land should be used as it is, regardless of its elevation.

b) To minimize the quantity of earth moving, only the surface soil should be removed and then the land should be levelled.

c) The seed farm should be facilitated with an irrigation system. Irrigation water should be taken from a stream that is approximately 20m below the elevation of the land.

d) Electricity should be obtained from a village that is located at about 1.0km away from the site.

e) Water should be obtained from a supply main (pipe diameter about 150mm) that exists underneath the road.

f) Since the Project's staff will be assigned from BBI's main office, a staff house should be built.

(3) Stock Seed Farm

The selected Project site is in the highland area at about 2.0km south of the BBI Unit. The facility complex and the seed farm will be arranged on each side of a road. The facility complex site is located on land where the two warehouses and one office building already exist. The site faces a road.

The seed farm is located on the west side of the road that passes a ridge top. The land is mildly sloped towards the west and there is a stream at the land's western border.

The site should be used for the Project as follows:

a) The existing office building is old and deteriorated; it is rarely used and should be removed. The two existing warehouses will be used for storing fertilizers and agricultural chemicals for Project use.

b) The existing well should be used for the Project. A new pumping facility and an elevated water tank should be installed.

c) Electricity should be taken from the existing supply line that runs along the roadside.

d) An irrigation system should be installed in the seed farm.

e) Insect control trees should be planted along the road and a new access road should be built on the seed farm side of the hedge.

(4) Seed Control and Certification Service Center (BPSP)

The selected Project site is within Seed Control and Certification Service Center's land. It is about 2km south of Bandung City and is surrounded by rice fields. The Center's land was developed by filling up the existing rice fields to an 80cm higher level and then building a brick wall around the filled area.

The site should be used for the Project as follows:

a) Since the site is a small plot, the Project facilities should be compactly built.

b) The site ground is soft; pile foundations should be used.

c) Electricity should be obtained from the Seed Control and Certification Service Center.

d) The existing well water supply system should be used for the Project. Deteriorated pumping units and the water tanks having insufficient capacity should be replaced.

3) Building Method and Materials

(1) Facility Buildings should be the types that can be built using general Indonesian building methods.

a) As a principle, columns and beams should be rigid frame structures. Walls should be reinforced concrete block structures. Roofs should be truss structures. Warehouses, mechanical shops, and fertilizer houses that may have long spans should be steel frame types. Small incidental buildings, such as pump houses, should be reinforced concrete block structures having wooden roof frames.

b) Since the facility buildings must be kept clean, floors should be either tile finish on concrete or mortar trowel finish on concrete base.

c) The exterior walls of buildings should be mortar spray finish or paint finish on cement mortar.

(2) As a general principle, Indonesian building materials should be used.

a) Materials allowing simple maintenance and easy spare parts supply should be adopted for use.

b) The Government of Indonesia regulates imports and domestic materials should be used as much as possible for the Project. Domestic materials for the Project use should be carefully selected by taking into account of the quality and durability of the materials.

4.2.2 Conditions for Selecting Project Equipment and Materials

The selection of equipment and materials for the Project use should be made to satisfy the Project facility requirements and be adequate for carrying out the Project's planned activities. If funding and procurement restrictions are imposed, the selection should be made within the limits of the restrictions to obtain the materials and equipment that will provide maximum efficiency for the Project's purposes.

4.3 Basic Design

4.3.1 Arrangement Plan

1) Lembang Horticulture Research Institute (LEHRI)

A laboratory for tissue culture, a screen house, and a soil store house is to be built in the LEHRI. Building arrangement was made based on the following basic principles:

(1) The laboratory and screen house should be independent buildings as their different functions require different structure types. The buildings should be located close to each other to minimize the walking distance between them.

(2) The laboratory building should not be located too close to roads in order to avoid vibrations caused by vehicular traffic.

(3) Visitors' cars should be parked in the existing parking lot. A new parking area for trucks should be built in the vicinity of the screen house.

(4) The laboratory building should have two entrances: one facing the approach from the road; the other from the existing central laboratory building.

Based on the above basic principles, the arrangement of the three Project buildings in LEHRI was made as shown in Basic Design Drawing-1.

2) Foundation Seed Farm (BBI Unit)

The facilities necessary for the foundation seed farm can be classified into those essential for foundation seed culturing and those needed for technical training.

The facility arrangement for the foundation seed farm was made based on the following basic principles:

(1) The facilities should be organically arranged on the 1.5 ha of land by taking their functions into account.

(2) The facilities should be compact to make effective use of the site area.

(3) To reduce the number of buildings required, as many facilities as possible should be housed in one building.

(4) Each building should be of flat type in view of the small bearing stress of the ground and ease of construction.

(5) Two access roads to the farm should be built: one from the existing main road; the other from the east side of the farm where the land is relatively flat.

(6) The compost shed should be located away from the other facilities.

The facility arrangement of the foundation seed farm is shown in Basic Design Drawing-5.

3) Stock Seed Farm

Existing fertilizer storage and agricultural chemical storage will be used for the Project. A grading house, machinery room, seed potato storage, and compost shed should be newly built. The arrangement of the facilities was made based on the following basic principles:

(1) Many facilities should be built in one building.

(2) The existing deteriorated office building should be removed. Other existing facilities should be used as it is.

(3) The felling of the existing trees on the site should be minimized.

(4) The compost shed should be located away from other facilities and the main road.

The facility arrangement of the stock farm is shown in Basic Design Drawing-20.

4) Seed Control and Certification Service Center (BPSB)

An inspection and certification building and a screen house are to be built for the Project.

The arrangement of the facilities was made based on the following basic principles:

(1) Entrance to the inspection and certification building should be made facing the side of the existing building.

(2) The soil storage should be located close to the screen house.

(3) The facility arrangement should be made so as not to interfere with existing underground utility lines.

The facility arrangement of the seed Control and certification service center is as shown in Basic Design Drawing-28.

4.3.2 Building Plan

Requirements for the Project buildings are as follows:

(1) Buildings for the Lembang Horticulture Research Institute

a) Laboratory Building for Tissue Culture

This building is for the culturing of GO from basic seed. The building will have a staff room, inspection room, laboratory, clean room, culture room, inuring preparation room, etc.

b) Screen House

The multiplication of the mother roots cultured in the inuring preparation room will be accomplished in the screen house.

The inner sides of the house will be screened. The roofing should be light-transmissible to allow natural lighting to enter the house.

As there are different steps involved in seed culturing, the screen house should be divided into two sections. A simple disinfection facility should be installed at the entrance of the screen house.

c) Soil Storage House

Soil to be used in the screen house's planting beds will be placed in the soil storage house.

(2) Buildings for the Foundation Seed Farm

a) Management Building

The management building will consist of a staff office room, laboratory, and a meeting room. The laboratory will also the utilized for staff training.

b) Farm Machinery House

The house will consist of a workshop and a machinery room.

c) Storage House

The storage house will consist of seed potato grading rooms and storage rooms.

d) Chemical Fertilizer Storage House

The house should have a chemical fertilizer storeroom and an agricultural chemical storeroom. The two rooms must be completely separated by a wall.

e) Guard House

To be used by the seed farm guards.

f) Lectures' House

Lodging for the staff training instructors and the technical extension workers.

g) Experts and Guest House

Housing for the experts and guests.

h) Training Building

This building will be used for training purposes to aid in the achievement of Project objectives. The building should be able to accommodate about twenty trainees. There should be a training room, instructors' office, rest room, and management office in the building.

i) Trainee House

Lodging for the trainees. The house will consist of bedrooms, a dining room, kitchen, communal shower room, etc.

j) Screen House

The multiplication of G1 seed from G0 will be conducted in the screen house.

k) Compost Shed

A roofed shed for compost.

l) Soil Storage House

Soil for the planting beds of the screen house will be stored in this house.

(3) Buildings for Stock Seed Farm

a) Grading House

Grading of seed potatoes will be conducted in this house. An office for the farm director and instructor, a staff room, and a grading room should be in this house.

b) Agricultural Machinery and Storage House

This house will have an agricultural machinery room, a workshop, and a seed potato storeroom.

c) Compost Shed

For the storage of seed farm use compost.

(4) Buildings for the Seed Control and Certification Center

a) Inspection and Certification Building

The inspection for potato diseases and certification of seed potatoes will be conducted in this building. The building will consist of an inspection room, staff room, incubation room, isolation room, meeting room, etc.

b) Screen House

The culturing of seed potatoes for inspection and certification will be conducted in this house.

c) Soil Storage House

Soil for screen house use will be stored in this house.

1) Floor Plan and Section Plan

(1) Lembang Horticulture Research Institute

a) Laboratory Building for Tissue Culture

The laboratory should be divided into three zones: an inspection and research zone; a cultural and inuring preparation zone; an affiliated facility zone.

The three zones should be arranged to best suit the facility functions. The cultural room and the inuring preparation room should be located next to the screen house. Rooms to be provided with air conditioning should have ceiling heights of 2.5m. The ceilings in other rooms should be from 2.7 to 3.0m high to allow natural ventilation.

The clean room, cultural room, and inuring preparation room should be dust-proof and insulated. There rooms should have assembled frame type interiors and air conditioning units should be installed.

b) Screen House

A hallway should be used to connect the laboratory building to the screen house. Sufficient work spaces should be provided inside the house. The house should be 3.6m high at the roof edge. Screened skylights should be installed on the roof. The sides of the house should be enclosed with aphid-roof stainless steel nets.

c) Soil Storage House

The storage house should be able to store three different types of soils (disinfected, non-disinfected, and reserved soils). There should be enough space in the house to store farming tools. The roof edge height should be 2.8m.

(2) Foundation Seed Farm

a) Office Building

An office, director's room, laboratory, and meeting room

are connected by a halfway. Since the laboratory will also be used for training purposes, it should be of an appropriaite size. The ceiling heights of all rooms should be from 2.8 to 3.5m. The office should be partitioned for the technical staff members.

b) Farm Machinery House

A workshop should be built between the farm machinery room and the garage. Under-beam height should be at least 3.2m.

c) Grading and Storage House

Both the grading room and storage room should be divided in two for G1 and G2 seeds. Room heights should be more than 3.3m to allow natural ventilation.

d) Fertilizer House

This house should have a fertilizer store room and an agricultural chemical store room. Each room should have its own door.

e) Guard House

The guard house ceiling should be 2.5m high.

f) Lectures' House

According to Indonesian standards, one family unit should have three bedrooms, a living room, and a kitchen and four family units should have at least two bedrooms, a living room, and a kitchen. There should be five family units in the staff house. The living room ceiling height should exceed 2.5m.

g) Lodging for Experts and Guests

Each guest room should be provided with a simple kitchen, a bath and toilet. The ceiling height of the room should be at least 2.5m. Meals for the instructors will be served at the dining room of the trainees' lodging facility.

h) Training Facility

Supplemental rooms should be arranged to satisfy the functional needs of the training room. Room heights should exceed 3m.

An utility room and lodging for trainees should be incorporated into the training building.

i) Trainees' Lodging

Each room should accommodate two trainees. The building itself will be U-shaped and the rooms will be lined up along the hallways in each leg of the "U". Each hallway will terminate in the kitchen and dining room at the base of the "U". The dining room will be the communications center for trainees; it should be large enough to accommodate the trainees and instructors during meal times. The dining room will also be used by farm staff members during daytimes. The rooms, including the dining room, should exceed 2.4m in height.

j) Screen House

The screen house should provide sufficient work space for the culturing of potatoes in the planting beds. Passage way should be wide enough to allow a hand tractor to be operated. The roof should be 3.8m height at its edges. 980 planting beds (each 1,800mm x 900mm) will be required per season.

k) Compost Shed

Since the farm use compost may be purchased from suppliers, the size of the compost shed should be sufficient to store about 10% (4.5 tons) of total farm use compost.

1) Soil Storage

The soil storage is to be divided into three sections. The section used for farm tool storage will be roofed. The other two sections will not be roofed. This facility should be able to store 140m^3 of soil.

(3) Stock Seed Farm

a) Grading House

A grading room, a farm director's and specialist's room, and a staff room should be arranged in one row. The grading room should be provided with a storage room having an independent door.

b) Agricultural Machinery and Storage House

An agricultural machinery room, workshop, and seed potato storeroom should be arranged in a row. The under-beam height should be 3.0m.

c) Compost Shed

Since the farm use compost may be purchased from suppliers, the shed should be capable of storing about 10% (22.5 tons) of the total farm use compost. The shed should be roofed, but the upper parts of walls should be left open.

(4) Seed Control Certification Service Center

a) Laboratory Building

After examining the Indonesian Government's request, it was deemed that the laboratory building should be divided into a research zone and an administration zone.

b) Screen House

The screen house should be of double wall type having nets and windows that can be opened and closed. Skylights provided with nets should be installed in the roof.

(5) Examination of Design Conditions

The size of each Project facility should be decided upon based on each room's staff plan.

Room sizes were decided upon based on the following standards derived after taking into account of Indonesia's request, drawings of similar facilities in Indonesia, general facility standards in Japan, the Japanese Ministry of Agriculture, Forestry, and Fishery's research laboratory's specifications, and the floor space calculation standards for the research buildings in Japan's Tsukuba Research Town:

Name of Room	Area (m^2/person)
· Office space	4.5 to 7.5 (general and special)
· Laboratory	20 to 22
· Laboratory (simple)	10 to 12
· Meeting room (general)	1.5 to 3.5
· Director's room	20 to 30
· Training room (class room)	1.2 to 3.5 (classroom and multipurpose room)
· Instructor's office	10 to 20
· Trainees' rest room	2.0 to 3.5
· Lodging for trainees	8.0 to 12.0
· Dining room	1.2 to 2.5
· Kitchen	80 to 85% of dining room space
· Lodging for Instructors	6.0 to 8.0

The sizes of special rooms were decided upon based on the arrangement of the equipments to be used.

The area of each Project facility was decided upon as follows:

a) Lembang Horticulture Research Institute

Table 4-3-1 Design Basis for Laboratory Building, Screen House, and Soil Storage Spaces

(unit: m^2)

Name of Room or Space	Space Use Condition and Basis of Area Calculation	Calculated Area	Decided Area
Staff Room	3 staff + 4 instructors 7 Persons x $5m^2$/person	35	34
Inspection Room	Space for equipment arrangement		14.5
Laboratory	3 researchers + 1 or 2 leaders 4 persons x $22m^2$/person	88	81
Clean Room	2 clean beaches 1 side table		13.5
Incubator Room	Incubator and passageways		12.9
Cultural Room	Plant culture rack space		9.9
Inuring Preparation Room	Plant culture rack space		9.9
Screen House	22 planting beds x $4m^2$/bed	88	97.5
Soil Storage	50% of one section's soil $9m^3 = 4.5m^3$		20

b) Foundation Seed Farm

Table 4-3-2 Design Basis for Office Building Space

(unit: m^2)

Name of Room or Space	Space Use Condition and Basis of Area Calculation	Calculated Area	Decided Area
Office	13 staff 13 persons x $5m^2$/person	65	60
Farm Director's Office		20	15
Laboratory	2 staff + training space 2 persons x $10m^2$/person + $20m^2$	40	39
Instructors'	2 instructors 2 persons x $10m^2$/person	20	20

Table 4-3-3 Design Basis for Training Building Space

(unit: m^2)

Name of Room or Space	Space Use Condition and Basis of Area Calculation	Calculated Area	Decided Area
Training Room	Max. 20 trainees + equipments 20 persons x $3.0m^2$/person	60	64
Instructors'	4 instructors 4 persons x $10.0m^2$/person	40	26
Trainees' Rest Room	20 persons x $2.0m^2$/person	40	36
Control Room			14
Utility Room	Celaning and ironing spaces		16.5

Table 4-3-4 Design Basis for Trainees' Lodging House Space

(unit: m^2)

Name of Room or Space	Space Use Condition and Basis of Area Calculation	Calculated Area	Decided Area
Lodging Rooms	2 persons per room, total 20 trainees 20 persons x $20m^2$/person	200	200
Dining Room	20 trainees + 15 staff + 4 instructors 39 persons x $2.0m^2$/person	78	60
Kitchen	50% of dining room	29	33

c) Stock Seed Farm

Table 4-3-5 Design Basis for Grading House Space

(unit: m^2)

Name of Room or Space	Space Use Condition and Basis of Area Calculation	Calculated Area	Decided Area
Office	7 staff 7 persons x 4.5m^2/person	31.5	29.1
Director's/ Instructor's Room		20	16.2

d) Seed Control and Certification Service Center

Table 4-3-6 Design Basis for Laboratory Building Space

(unit: m^2)

Name of Room or Space	Space Use Condition and Basis of Area Calculation	Calculated Area	Decided Area
Staff Room	11 researchers + 7 staff members 18 person x 4.5m^2/person	81	40
Director's/ Instructor's Room		30	25
Meeting Room	18 persons 18 persons x 2.0m^2/person	36	25
Instrument Room	Spaces for a centrifuge unit side table, etc.	20	
Incubation Room	Spaces for 2 incubators and other equipments		16
Balance Room	Spaces for side tables and other equipments		15.7
Isolation Room	Spaces for side tables and other equipments		17.5

Design basis for the screen house was decided upon as follows:

- Necessary Number of Planting Beds:
  Required planting bed area : 1,588m^2
  Area of one bed : 0.9m x 1.8m = 1.62m^2
  Necessary number of planting beds : 1,588/1.62 = 980

- Necessary Creen House Space:
  Required space for one bed: $3m^2$/each
  Necessary space: 980 beds x $3m^2$/bed = $2,940m^2$

- Twelve screen houses are to be built:
  $6.5m^2$ x 40m x 12 each =$3,120m^2$

2) Elevation Plan

The elevation plan for Porject buildings was established by adopting such locally available construction materials that allows for low facility operation and maintenance costs based on the viewpoint that the buildings would be sufficiently functional for Project purposes and would not detract from the appearance of the surrounding areas.

4.3.3 Structure Plan

1) Basic Conditions

(1) Project buildings should be similar to the types generally found in Indonesia and which are easy to contract.

(2) Bearing Capacity of Ground

According to the results of the geological surveys that were conducted at the sites of the Lembang Horticulture Research Institute, the Foundation Seed Farm, and the Stock Seed Farm, the geology consists of clay mixed with volcanic ash and sand.

According to past geological data obtained for the existing buildings nd the results of the drop-penetration tests conducted during the field survey period, the ground bearing capacity at the sites was estimated to be more than 6.0 tons/m^2. Thus, the bearing capacity for the Project building design was decided 6.0 tons/m^2.

The top layer of ground at the Seed Control and Certification Service Center is approximately 80cm thick filled soil. Beneath the top layer is a small gravel-mixed silt layer and high water content soft clayey silt exists below this silt

layer. The groundwater table is about 150cm below the ground surface.

According to 1986 soil boring data obtained at the site of the Center, the ground bearing capacity is expected to be 2 tons/m^2.

(3) Project Building Types

The Project buildings are of the following types:

1 Lembang Horticulture Research Institute

Building Name	Structure Type
a. Laboratory building	Reinforced concrete with steel frame roof, flat
b. Screen house	Light metal and steel frame, flat
c. Soil storage	Reinforced concrete block, flat

2 Foundation Seed Farm

Building Name	Structure Type
a. Office building	Reinforced concrete with steel frame roof, flat
b. Farm machinery house	Steel frame, flat
d. Fertilizer storage house	Steel frame, flat
e. Guard house	Reinforced concrete block, flat
f. Lectures' house	Reinforced concrete with wooden roof, flat
g. Experts and guests house	Reinforced concrete with wooden roof, flat
h. Training house	Reinforced concrete with steel frame roof, flat
i. Trainees' lodging house	Reinforced concrete with wooden roof, flat
j. Screen house	Light metal and steel frame, flat

k. Compost shed	Steel frame, flat
l. Soil storage	Brick without roof

3 Stock Seed Farm

Building Name	Structure Type
a. Grading house	Reinforced concrete with steel frame roof, flat
b. Farm machinery and storage house	Steel frame, flat
c. Compost shed	Steel frame, flat

4 Seed Control and Certification Service Center

Building Name	Structure Type
a. Laboratory building	Reinforced concrete with steel frame roof, flat
b. Screen house	Light metal and steel frame, flat
c. Soil Storage	Reinforced concrete block

2) Structure Design Plan

(1) Basis of Design

The following structure design standards are used in Indonesia:

- Indonesian Building Structure Standards (Peraturan Bangunan Nasional)
- Building Design Load Rules (Peraturan Pembebanan Indonesia Untuk Gedung)
- Reinforced Concrete Structure Rules (Peraturan Buton Bertulang Indonesia)
- American Building Standards
- British Building Standards
- Japan Industry Standards (JIS)
- Japan Agricultural Standards (JAS)

JIS and JAS were used for the Project facility design.

(2) Building Method

In general, the Project buildings should be reinforced concrete rigid-frame structures. The roofs should either be steel frame or wooden structures depending upon their span lengths. The Project's machinery and storage houses should be steel frame structures in view of the cost efficiency and short construction period. Small buildings not having an office space should be reinforced concrete block structures with wooden roofs.

(3) Foundations

All Project building foundations, except for the laboratory building at the Seed Control and Certification Service Center (SCCS), should be the spread type.

Since the ground bearing capacity at the SCCS site is weak, the foundation of the laboratory building should be of prestressed concrete pile type. According to past boring data, pile lengths should be from 12 to 13m. The screen house foundation should be a concrete slab type.

(4) Design Load

1 Dead Load (Fixed Load)

The unit weight of building materials should be as follows:

- Reinforced concrete : 2.4 tons/m^2
- Red brick : 1.9 tons/m^2
- Reinforced concrete blocks : 2.0 tons/m^2

2 Live Load

Live loads on the major rooms of Project buildings should be as shown in Table 4-3-7.

Table 4-3-7 List of Live Loads

(unit: kg/m^2)

Name of Room	For Floor	For Beams, Columns, and Foundations	During an Earthquake
Staff Room	300	180	80
Laboratory	300	180	80
Inspection Room	300	180	80
Clean Room	300	180	80
Inuring Preparation Room	300	180	80
Incubation Room	300	180	80
Office	300	180	80
Loading Room	180	130	80
Dining Room	180	130	80

3 Seismic Force

Indonesia is located in an earthquake zone; a large number of them have been recorded in the past but non of them were of great magnitude.

Earthquake coefficients currently being used in Indonesia are one-tenth of those used in Japan; thus, k = 0.05 for major Project buildings and k = 0.1 for elevated water tank design should be adopted.

4 Wind Force

According to the hearing investigation conducted during the field survey period, residents in the Project side areas have not experienced any strong winds.

By taking into account the past strong wind record in Indonesia, a wind volocity of 20m/sec and a wind force of 20 h kg/m^2 (h being the structure height in meters) should be adopted for Project facility design.

(5) Manor Building Materials

Based on the Japan Industrial Standards (JIS), the allowable stress for building materials should have the following values and the values listed in Tables 4-3-8 and 4-3-9:

Concrete: Fc = 210 kg/cm^2, Slump = 15 to 17cm