BASIC DESIGN STUDY REPORT
ON
THE CONSTRUCTION PROJECT OF FACILITIES
FOR
STRENGTHENING OF PIONEERING RESEARCH
FOR
PALAWIJA CROPS PRODUCTION
IN
THE REPUBLIC OF INDONESIA

MARCH 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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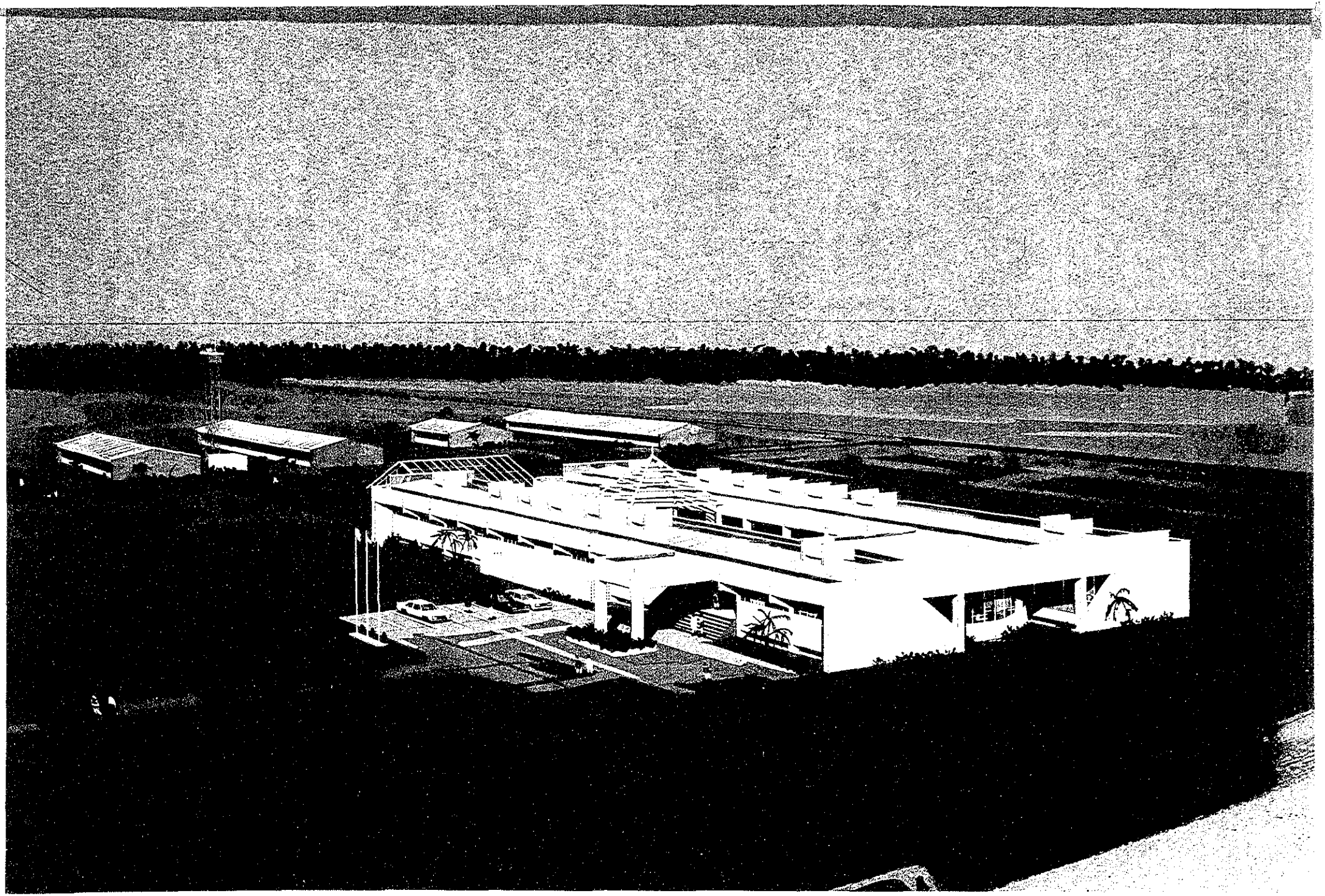
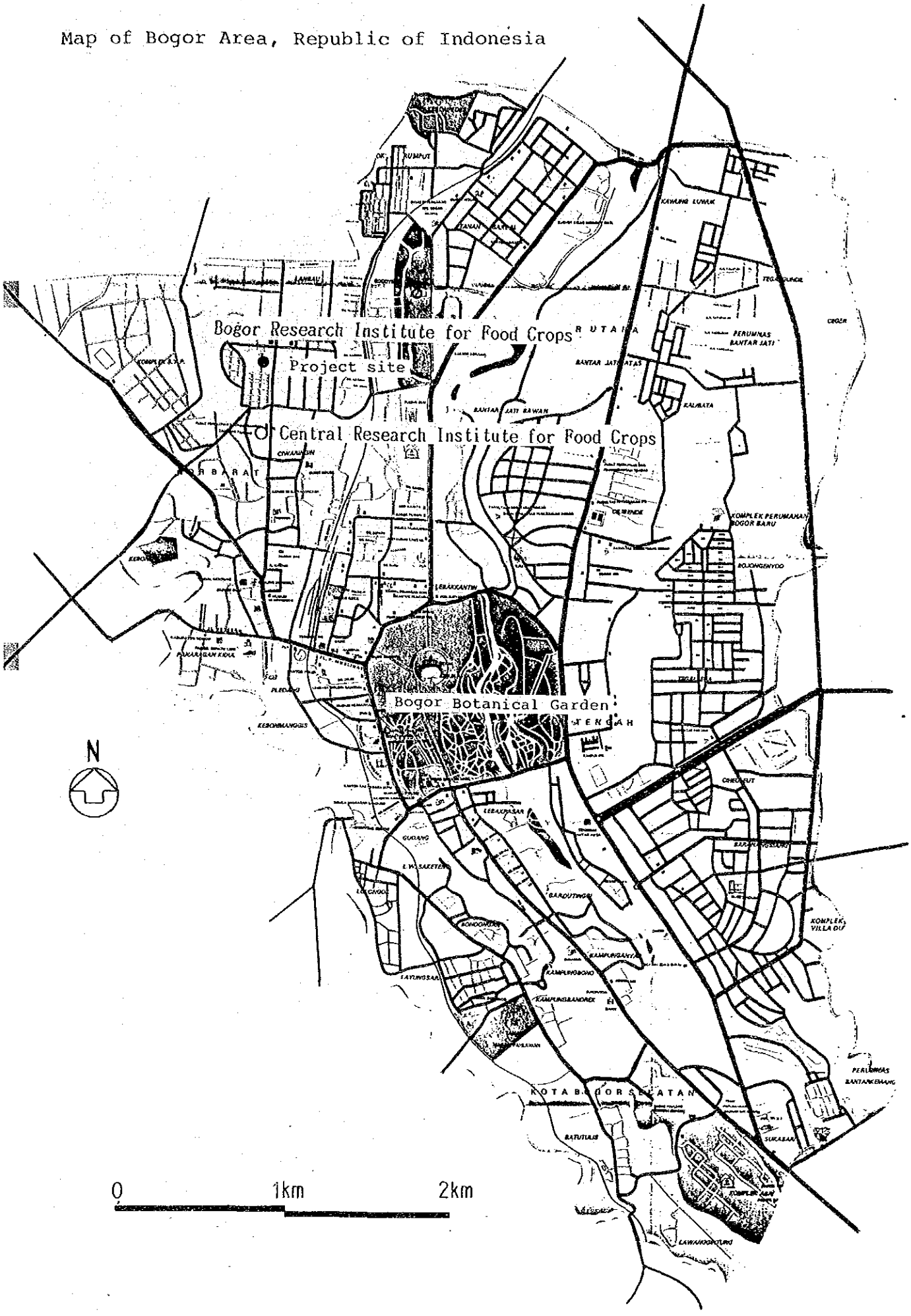


Map of Bogor Area, Republic of Indonesia



PREFACE

In response to the request of the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a basic design study on the Construction Project of Facilities for Strengthening of Pioneering Research for Palawija Crops Production and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Indonesia a study team headed by Mr. Fumio YAZAWA, Chief Researcher, Tropical Agriculture Research Center, Ministry of Agriculture, Forestry and Fisheries from October 1 to October 21, 1986.

The team had discussions on the Project with the officials concerned of the Government of the Republic of Indonesia and conducted a field survey in Bogor area. After the team returned to Japan, further studies were made, a draft report was prepared and, for the explanation and discussion of it, a mission headed by Mr. Noriaki MIWA, Official, First Basic Design Study Division, Grant Aid Planning & Survey Department, JICA was sent to Indonesia from January 19 to January 27, 1987. As a result, the present report has been 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 deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

March , 1987

Keisuke Arita
President
Japan International Cooperation Agency

SUMMARY

In the Republic of Indonesia (hereinafter referred to as Indonesia) compared with a prominent increase in the production of rice, the increase in the production of Palawija crops is stagnating with the exception of maize.

There are several problems for this situation that require a solution. Firstly, certified seeds cannot be obtained easily by farmers. Secondly, agricultural chemicals are rarely used resulting in the frequent occurance of diseases and pests. Thirdly, there are large amount of losses occuring in the stage of post-harvest handling. Fourthly, the market function is not sufficient, and farmers are forced to sell their yards at very low prices. Fifthly, there is a room for improvements in the cropping system. Sixthly, there are problems of acid soil, water in soil, fertilization, etc. In order to solve these problems, the responsibility challenging the research sector is extremely heavy, paralleled with agricultural policy measures.

* NOTE: The Indonesian term "Palawija crops" is a generic term used for upland food crops other than paddy -- it includes miscellaneous cereals, legumes, rootcrops, etc.

On the other hand, for five years after October, 1978, the Government of Japan implemented a project of strengthening of legumes in relations to cropping system research as a technical cooperation project. The cooperation was provided in research of the following four sectors regarding legumes and other upland field crops: agronomy, plant physiology, entomology and pathology, and Breeding. This project was followed up in an additional cooperation project for two years till October, 1985. In succession to these projects, another project to strengthen pioneering research of Palawija crops production started in April, 1986, for a scheduled period of five years. This project is being conducted at present.

Parallel with the series of these cooperation projects, in September, 1985, the Government of Indonesia requested the Government of Japan to provide a grant aid on buildings and equipment to strengthen pioneering research of Palawija crops in order to accelerate pioneering research of Palawija crops and to effectively implement the technical cooperation project of the Japanese Government. Based on this request, the Government of Japan decided to conduct a basic design study on the construction project of facilities for strengthening of pioneering research for Palawija crops production facilities in Indonesia (hereinafter referred to as this project). Through the Japan International Cooperation Agency, the Government of Japan sent a basic study team to Indonesia between October 1 to 21, 1986, to make a field survey.

This project calls for the construction of buildings and for supplying equipment for pioneering research of Palawija crops in Indonesia as a contribution to an increase in the production of Palawija crops. Research activities will cover the following basic research subjects: (1) Improved quality of Palawija crop seeds, (2) Improved Palawija crops culture technology under diverse environments, and (3) Improved productivity of Palawija crops applying bio technology.

This project will be implemented by the Central Research Institute for Food Crops (CRIFC), under the supervision of the Agency for Agricultural Research and Development (AARD), which is an independent organ in the Ministry of Agriculture and which conducts all research and development for increases in the production of agricultural products in Indonesia.

The Bogor Research Institute for Food Crops (BORIF), which will directly use the buildings and equipment to be provided under this project, is one of the six food crop research laboratories belonging to the CRIFC and has the following five research sectors:

Agronomy, plant physiology, plant pathology and entomology, breeding, and social economy. This research institute conducts all research regarding increases in the production of paddy and Palawija crops. The institute employs a total of 710 researchers and staff.

The site for this project is planned to be located in the BORIF complex in Bogor, 60km south of Jakarta. The BORIF complex is scheduled to gather the principal research facilities scattered in and outside of Bogor. Part of these facilities were already built two years ago using credits of USAID.

In the future, the research sectors of the BORIF will conduct research as at present, in the independent buildings inside the BORIF complex. The facilities to be constructed under this project will be the center facilities for pioneering research of Palawija crops independent of the other facilities of the every research sector.

The land area of the BORIF complex measures approximately 140,000m^2, and the land is equipped with infrastructure.

The buildings under this project will be designed paying attention to a harmony with the existing buildings, match with the master plan, easiness of operation and maintenance, and use of local materials as basic policies.

Test and research building 1,850m^2
Laboratories for seed, biochemistry, and microorganism technologies. Laboratories for common special research. Auxiliary functions.

Greenhouse 120m^2

Total 1,970m^2
(Outdoor work space to be built separately 114m^2)

Only equipment that is necessary and indispensable will be selected taking into consideration a minimum maintenance cost. The following equipment is expected to be supplied.

Seed technology sector

Dryers, threshers, cold storage, etc.

Biochemistry sector

Cold room, analytical equipment, etc.

Microorganism sector

Clean benches, micro-tomes, etc.

Common special analytical sector

Atomic absorption spectrophotometer, gas chromatograph, ultracentrifuges, etc.

A total of 15 months is estimated to be needed to implement this project after signing the exchange of note, including a consultant agreement, execution design, tendering, works contract, works, etc.

In addition to the Japanese Governmental grant aid, Rp255,242,500 (approximately ¥25,520,000) will be required as the Indonesian Government portion centering the value added tax.

This project will contribute directly to the research of Palawija crops of Indonesia and will indirectly assure a stable supply of food and will improve the trade balance of Indonesia. The Indonesian side has made all necessary preparations to implement this project. Furthermore, the technical cooperation projects related to this project have been started. In consideration of these viewpoints, this project is suitable as a candidate of a grant aid by Japan and should preferably be implemented urgently.

It is recommended that the Government of Indonesia establishes a steering committee to effectively utilize the facilities under this project, that sufficient operation and maintenance be provided after their completion, and that appropriate budgetary measures be taken for the construction and operation of the facilities.

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ABBREVIATIONS

This project:	The Construction Project of facilities for Strengthening of Pioneering Research for Palawija Crops Production in the Republic of Indonesia
The study team:	The Basic Design Study Team of the Construction Project of Facilities for Strengthening of Pioneering Research for Palawija Crops Production in the Republic of Indonesia
The facilities:	The Facilities for Strengthening of Pioneering Research for Palawija Crops Production in the Republic of indonesia
AARD:	Agency for Agricultural Research and Development
CRIFC:	Central Research Institute for Food Crops
BORIF:	Bogor Research Institute for Food Crops
BAPPENAS:	Badan Perencanaan Pembanguan Nasional
SEKNEG:	Sekretariat Negara
JICA:	Japan International Cooperation Agency

CHAPTER 1 INTRODUCTION

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(1) Background of request

The Republic of Indonesia placed an emphasis on "increased production of rice" as its development goals for the agricultural sector under its Third Five-Year Development Plan implemented between 1979 and 1984. As a result of the policies and guidance for increased production by the Indonesian Government such as rice price policies and BIMAS rice production increase plan, rice yield increased nearly 10% per annum during the plan period. The rice yield totaled 25.8% million tons in 1983, and Indonesia nearly accomplished self-sufficiency in rice.

Based on the results of its Third Five-Year Development Plan, the Government of Indonesia decided the goals for the Fourth Five-Year Development Plan between 1984 and 1989 in the agricultural sector as follows:

1) Improvements in nutrition level
2) Increase in employment opportunities
3) Increase in production of agricultural products to supply raw materials to the domestic industries
4) Maintenance of socioecological harmony while accomplishing natural resource utilization and environment conservation

Parallel with the above-mentioned development goals, four pillars for agriculture development have been decided. They are: Efficient utilization of existing farm land, new development of arable land, diversification of crops, and recovery of cultivated land whose fertility has decreased.

Increases in the production of Palawija crops will indeed become the motive power to implement these four pillars.

Under these circumstances, the importance of Palawija crops has further increased. However, in spite of the act that the demand for Palawija crops is increasing, both the planted area and yield per acre have not shown increases in the recent five years except for maize. This shows that there are many problems that need to be solved in seeds, cultivation, marketing, and other aspects.

The existing problems must be understood precisely and methods to improve them must be analyzed in order to increase the production of Palawija crops.

The task confronting the agricultural research field is therefore considered important.

(2) Preliminary study

A project to strengthen legumes in relation to cropping system research project was undertaken with the cooperation of the Japanese Government beginning October, 1978. The project ended in October, 1983 with significant results. The project was aimed at strengthening research activities concerning legumes and other food crops which comprised the cropping system and covered cooperation in the following six areas: Upland field crops breeding, upland field crops agronomy, paddy agronomy, plant physiology, plant pathology, and entomology. For each of these areas, specialists were sent from Japan both on long and short terms. Indonesian researchers were trained in agricultural organizations in Japan, and equipment, farming apparatus, machines, etc. needed for tests and research were provided in technical cooperation under the project system. Further, at the request of the Government of Indonesia, cooperation to follow up these efforts was executed. Cooperation in five areas, namely, breeding technology, agronomy technology, plant physiology, and plant pathology concerning legumes and other upland field crops, and entomology was continued till October, 1985 when the cooperation ended.

The Government of Indonesia requested the Government of Japan to start a new project "Strengthening of Pioneering Research for Palawija Crops Production." The Government of Japan accepted this request, and the Japan International Cooperation Agency sent a study team headed by Takeo Iguchi, Director, Second Agronomy Department, Tohoku Agricultural Experiment Station, the Ministry of Agriculture and Forestry and Fisheries for 12 days from September 5 to 16, 1985, to conduct a study.

On the other hand, in September, 1985, the Government of Indonesia requested the Government of Japan to provide a grant aid on a project to build facilities for research of seed technology and of microorganisms in order to efficiently execute the research connected with the above-mentioned new project.

The study team consulted the concerned parties of Indonesia and Japanese specialists regarding the project to build facilities and prepared a report regarding the request.

(3) Sending of basic design study team

After reviewing the survey results submitted by the preliminary study team regarding this technical cooperation, the Japanese Government decided to conduct a study for a grant aid, and the Japan International Cooperation Agency sent a basic design study team headed by Fumio Yazawa, Chief Researcher, Tropical Agriculture Research Center, the Ministry of Agriculture and Forestry and Fisheries from October 1 to 21, 1986.

This study team was sent to study the appropriateness of this project and to conduct a study for an appropriate basic design covering buildings and equipment for pioneering research of the production of Palawija crops.

The study team conducted a study regarding the present status of Palawija crops and actual condition for the research in Indonesia, as well as the background of this project and verified the roles, necessity, and effects of the project. The team staff also consulted and studies research details, buildings, equipment, scope of burden sharing by Indonesia, and execution, operation and maintenance organizations with the officials and researchers of the AARD and its subordinate organizations, CRIFC and BORIF, as well as with the specialists sent by Japan.

Based on the studies of the above-mentioned survey results, on the information, and on the analysis, the study team verified that this project was necessary in terms of the agricultural development policies of Indonesia and that the CRIFC was an execution organization appropriate to execute this project.

In accordance with these results, this project has been studied in detail in terms of optimum contents, size, construction schedule, etc. After consultation with experts to be dispatched for Technical Cooperation, the results of the study have been compiled in the Draft Final Report. This was submitted to the authorities in Indonesia, and a confirmation study was conducted from January 19 to January 27, 1987. As the result, a basic agreement has been reached, and the Minutes of Discussions have been exchanged with the signatures of the officials concerned.

The members of the study team, its schedule in Indonesia, list of persons visited, and Minutes of Discussion are listed in the data section at the end of this report.

This report summarizes basic designs of buildings and equipment which are decided optimal in executing this project based on the above, project cost, execution process, project evaluation, recommendations, etc.

CHAPTER 2 BACKGROUND OF PROJECT

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2-1 General Agricultural Situation

2-1-1 Natural conditions

Of the total land area of Indonesia of 191 million hectares, arable land accounts for 65.3 million hectares, 30.6% of which is forests, 19.8%, upland field including cultivated land, 11.4%, estate, 11.4%, paddy field, and 7.4%, farm houses area and farm backyard field.

Indonesia is located halfway between the Asian and Australian Continents, and the weather between June and September is a dry season due to the dry Southeast monsoons. The weather between December and March is a rainy season due to damp Northwest monsoons. The seasons between April and September and October and November are intermediate periods. However, each area has different modes of the rainy and dry seasons. For example, the period between October and March on the east coast of South Sulawesi Province particularly is a rainy season.

The rainfall is generally affected by monsoons and topography. Naturally, the precipitation is high in areas along the Indian Ocean and Java Sea which are greatly affected by damp Northwest monsoons. The precipitation is high in mountain districts than in plain districts. The annual average precipitations in Serang 10m above the sea is 1,542mm and in Bogor 250m above the sea is 4,339mm even though both areas are in West Java Province.

The temperature varies in proportion to the elevations of observation points even though it is slightly affected by the landform. The temperature is not very high even in plains because

the weather is oceanic, tropic weather rather than continental, tropic weather. The average temperature at observation points in plains is 33°C maximum, 22°C minimum, and 27°C average. The daily fluctuation of temperature is approximately 10°C, and there is no significant difference from one area to another. The relative humidity is greatly affected by the landform rather than by the elevation of the observation point. It is low in monthly average between July and October and is high between November and June. The daily fluctuation of humidity is more than 20%.

The annual average humidity at all observation points is 78%.

The average relative humidity in Bandung 791m above the sea in West Java also is 77%, while that in Tjirebon 3m above the sea is 74% and that in Bogor 250m above the sea is 83%.

These natural conditions greatly affect the agriculture of Indonesia.

(1) Abundant sunshine and high temperature and humidity provide necessary and sufficient crop growth conditions. On the other hand, they provide a hotbed for damage by diseases and pests which occur frequently.

(2) Much damage is caused to food crops during the harvesting process of rainy season crops, particularly during drying and storage of the products.

(3) The high temperature and humidity conditions greatly deteriorate the vigor of Palawija crops, particularly soybean and peanut seeds, in a short period of time.

(4) The difference in seasonal and regional rainfalls, soil diversity, differences in elevations of cultivated land, and other factors produce a cropping system which is complex and diverse for each area.

(5) The fact that there is a large amount of uncultivated land area in Indonesia offers possibilities for an increase in production of food crops, particularly Palawija crops, by increasing the cropping area.

2-1-2 Relative position of agriculture in national economy

In 1971, the agricultural sector occupied a 44% share in Indonesia's real GDP. The advances of industry and other factors have lowered this rate to 29.3% in 1983 and to 24.04% in 1984.

However, the agricultural sector continues to occupy the top position as a single sector compared with 18.7, 15.5, and 12.3% for the mining, commerce, and manufacturing industries even in 1984.

The agricultural population accounted for 54.7% of the total employed population of 1984, and the economic importance of this sector is still high.

In 1984, the production value of edible crops occupied 63.8% of the agricultural sector, and this value equals 15.9% of Indonesia's GDP. Parawija crops account for 5.5% of total food crops.

Agriculture in Indonesia supplying food to support a population surpassing 165 million is playing an extremely important role directly and indirectly vis-a-vis national economy.

2-1-3 Agricultural production

Indonesia consists of Islands, Java and Madura, which are densely populated, and Sumatra, Kalimantan, Sulawesi, and other islands except Java and Madura, which are sparsely populated. In Java, agriculture is mainly diversified agriculture of food crops centering paddy and Palawija crops, and the rate of cultivated land accounts for 65% of the total area of Java, reaching the limit of land conservation. Compared with Java, other regions are engaged in the cultivation of traditional plantation crops such as rubber and coconut, in addition to food crops. The rate of cultivated land in these regions is a low 4%.

The 1980 statistics compiled by the Ministry of Agriculture breakdowns cultivated land as follows:

Total cultivated land	16,400(1000 hectares)
Estates	2,230
Land managed by farm households	14,170
Paddy field	4,421
Paddy field annual cultivated land	7,059
Palawija crop harvest land	5,853
Farm backyard field (fruits and vegetables)	2,500

The yield of Palawija crops surpassed 23 million tons in 1984. Based on farm gate price, the production value of Palawija crops totals nearly 2 trillion rupiahs.

Tables 2-1 and 2-2 present production of principal food crops.

Table 2-1 Harvest Areas of Food Crops - 1984

In Thousand Hectares

Region	Rice	Maize	Soybeans and Peanuts	Cassava and Sweet Potatoes
Java	5,174	2,049	955	985
Sumatra	2,291	176	180	229
Sulawesi	819	424	89	105
Kalimantan	797	26	21.6	42
Nusa Tenggara	534	282	104	160
Maluku and Irian Jaya	26	21	11.6	41
Indonesia	9,641	2,978	1,361.2	1,562

Source: Directorate General of Food Crop

Table 2-2 Production Volume of Food Crops - 1984

Crop		Production	Harvest Area	Yield per unit
		Thousand Tons	Thousand hectares	Tons/Hectare
Paddy	Total	25,825	9,636	2.68
	Paddy Field	24,385	8,417	2.89
	Rain-Fed Paddy Field	1,440	1,219	1.18
Maize		5,359	3,025	1.77
Soybean		743	838	0.89
Peanut		523	522	0.98
Mungbean		169	279	0.63
Cassava		14,205	1.139	10.6
Sweet Potato		2,305	279	8.3

Source: Directorate General of Food Crop

NOTE: The paddy production volume is based on milled rice production.

2-1-4 Farm household management

Indonesian agriculture is divided roughly into farm households, which are very small in management size, and the so-called plantation agriculture managed by mainly national plantations.

Farm households cultivate food crops centering rice and Palawija crops. They also cultivate copra, pepper, tabacco, coffee, and other cash crops. The national plantations cultivate palm oil, tea, sugar, and rubber.

The ratio between farm households and plantation agriculture is 86 to 14 in area. In the 1980 population census, farm households totaled 17.47 million in number, broken down into 73.6% owner farmers, 14.9%, tenant farmers, and 11.5%, owner-tenant farmers.

The management size of farm households is extremely small as indicated by the 1980 agricultural census as follows:

Farm household size	0.25 hectares or less	34.1%
	0.25 to 0.5 hectares	29.0
	0.5 hectares or more	36.9

The number of farm households with less than 0.5 hectares totaled 45.6% in the 1973 agricultural census, and the number increased to 17.5% in 7 years.

The national-average farm household management size is 0.99 hectares. In Java, the average management size is 0.64 hectares.

This shrinkage trend of farm household management size seems to have been aggravated further due to the traditional land inheritance custom and to other reasons. There is a limit to this fractionation trend. Normally, fractionation less than 0.2 hectares is not

possible. As a result, agricultural laborers without land (buru tani) will increase in number. Buru tani totaled 7,230,741 on October 31, 1980, and 82.3% of them live in Java. Their existence closely relates to the labor forces and earnings of farm households. These farm households originally cultivate mainly food crops for self-sufficiency of food and sell approximately 20% of their total production of rice, which is their most important product, to the market. The ratio of Palawija crops sold to the market differs depending on the particular crop, area, and farm household size.

The survey of production cost shown in Table 1 in the data section shows that there are ample chances for an increase in production by farming rationalization such as the utilization of certified seeds of Palawija crops, utilization of agricultural chemicals and fertilizers, and improvements of the cropping system.

2-2 General Condition of Palawija crops

Palawija crops are a generic term used for food upland field crops other than paddy. Principal Palawija crops are maize and sorghum as miscellaneous cereals, soybeans, peanuts, and mungbeans as regumes, and cassava and sweet potatoes as rootcrops, totaling 7 crops. In addition to them, wheat, potatoes, etc. are also regarded as Palawija crops. In 1984, the production of principal Palawija crops totaled 23.3 million tons, totaling 1.954 trillion rupiahs as farm gate price in value.

The production of paddy totaled 5.673 trillion rupiahs in 1984. The Palawija crops occupy 34.4% of the total food crop production. The principal Palawija crops can be outlined as follows.

2-2-1 Maize

Maize is the second most important after food rice. Maize is eaten in some areas by mixing it with rice or as powdered food. The recent production of maize is as follows:

	Harvest Area (Thousand Hectares)	Yield per unit (Tons/Hectare)	Production (Thousand Tons)
1983	3,002	1.694	5,087
1984	3,025	1.771	5,359
1985	2,440	1.774	4,329
1986	2,792	1.920	5,361

The 1976 production of maize totaled 2.6 million tons, and maize has shown a prominent increase in yield among the Palawija crops. The penetration of a high-yield variety immune to downy midlew is the principal reason why the average yield per unit increased to 1.7 tons/hectare.

Maize is cultivated mostly in Java, accounting for 66.9% of the total harvest area, followed by Sulawesi with 16.8%, Sumatra with 6.2%, and others with 1.3%.

The annual consumption per capita as food is estimated at 26kg. However, consumption differs depending on the region such as 71.58kg in East Java and 40kg in East Nusa Tenggara depending on the production volume and eating custom.

According to an estimate made by the Directorate General of Food Crop, approximately 10%, or 500,000 tons, of maize is consumed as livestock feed parallel with the growth of the livestock industry.

2-2-2 Cassava

Cassava is one of traditional crop in Indonesia. Since it is upland crop, production charge due to precipitation year by year. The recent production of cassava is outline below.

	Harvest Area (Thousand Hectares)	Yield per unit (Tons/Hectare)	Production (Thousand Tons)
1983	1.223	9.9	12.103
1984	1.340	10.6	14.205
1985	1.292	10.9	14.056
1986	1.147	11.0	12.667

Cassava is cultivated in a large volume in Java and in Lampung and Est Nusa Tenggara Provinces. However, due to a shortage in fertilization and low yield of existing species, the yield is not sufficiently high. In 1977, two species were released. The CRIFC estimated that the yield should increase to 25 tons per hectare if fertilization and management are adequate.

As food, the annual consumption per capita is 72 kg eaten in raw. Approximately 10% of the total production volume is consumed as a starch raw material and as livestock feed in chips, in cubes, or in pellets. Approximately 400,000 to 1,000,000 tons of cassava is exported mainly to Europe (raw cassava basis).

2-2-3 Sweet Potato

Sweet potatoes are mainly produced in Java, Nusa Tenggara, and Irian Jaya and are important as a main food in the area. The production of sweet potatoes is outlined below.

	Harvest Area (Thousand Hectares)	Yield per unit (Tons/Hectare)	Production (Thousand Tons)
1983	280	7.9	2,213
1984	279	8.3	2,305
1985	256	8.4	2,161
1986	243	8.7	2,125

Three new sweet potato specieses were released in 1977. The yield of sweet potatoes is expected to increase by the use of these new varieties.

2-2-4 Soybean

The recent production trend of soybeans is as follows:

	Harvest Area (Thousand Hectares)	Average Yield per unit (Tons/Hectare)	Production (Thousand Tons)	Imported Quantity (Thousand Tons)
1978	733	0.841	617	131
1979	784	0.867	680	177
1980	732	0.891	653	194
1981	810	0.869	704	361
1982	608	0.858	521	361
1983	640	0.838	536	391
1984	838	0.886	743	400
1985	896	0.970	870	-
1986	1,185	0.994	1,177 (Estimated)	-

NOTE: Imported quantity is estimate by BULOG.

82% of production of soybeans is also concentrated in Java. Compared with the prominent increase in the production of maize, the harvest area, average yield per unit, and production of soybeans are not increasing. This is due to problems that require a solution as mentioned below. On the other hand, the demand is increasing year after year, as the imported quantity is increasing. Soybeans are eaten mainly as soybean cake or as tempe (non-salt fermented soybeans) and are an important protein source. Soybeans and peanuts are used as part of compound animal feed as meal. The demand for this purpose totaled 114,000 tons in 1982 and 200,000 tons in 1984, and these quantities were imported as meal. Therefore, the demand for soybeans as food and livestock feed is estimated at 1.2 to 1.3 million tons.

2-2-5 Peanut

The planted area for peanuts totaled 480,000 and 523,000 hectares in 1983 and 1984. The yield per hectare was 0.958 and 0.998 tons, and yield was 460,000 and 522,000 tons in these years.

The peanuts is mainly produced in Java (72%). peanuts are produced by paddy field off-season cropping, by mixed cropping with paddy and soybeans, or by upland field cropping mixing with maize, cassava, or legumes.

2-2-6 Problems to increased production of Palawija crops

Compared with perenial crops and paddy field paddy cropping, Palawija crops are intrinsically unstable to farm households in terms of income. However, the majority of farm households are destined to cultivate Palawija crops. If Palawija crops are unstable to farm households in terms of income, Palawija crops must have many problems at present that must be solved.

Generally, these problems can be summarized as follows:

(1) Certified pure-line seeds are difficult to obtain for farm households.

The principal reason is that, unfortunately, a system for penetration of certified pure-line seeds is not established at present. Farmer dislike vacant hills so that a large amount of seeds are sown. Besides the germination rate is low, unsound seedlings are many, vulnerable to diseases and pests, and for other reasons, the yield is low. This vicious cycle is repeated.

Furthermore, under the normal storage method, the viability of the seeds of soybeans and peanuts rapidly lowers after three months under the high-temperature and high-humidity, natural environment. Therefore, it is difficult for farmer to obtain seeds with vigor, to say nothing of certified pure-line seeds.

(2) Farmer cannot use agricultural chemicals against damage by diseases and pests which frequently occurs.

Agricultural chemicals are expensive for farmers and their knowledge of application time, method, and adequate quantity is not sufficient. Therefore, agricultural chemicals are not used with Palawija crops at present. This is also indicated in results of a survey by the Central Bureau of Statistics Structure of Farms Paddy and Palawija on Cost.

(3) Losses that occur during post-harvest process are extremely large.

Quantitative and qualitative losses are extremely large if threshing, cleaning, grading, and drying methods are not appropriate after harvesting even if crops are harvested after much difficulties. A lack of efficient transportation means from the field to farm household yard, lack of storage facilities both quantitatively and qualitatively, and other reasons cause the losses.

Large losses are inflicted on Palawija crops, particularly maize, cassava, and potatoes during the rainy season due to insufficient drying. For example, large qualitative losses are inflicted with maize as husking, threshing, and drying are not performed within a suitable time period due to lack of workers during the harvest season. Further, due to lack of transportation means, harvested ears ferment in the field after harvest in many cases. This has been pointed out in the survey for the East Java Maize Project.

(4) Insufficient market functions

Many small-size farmer must transport their products to the KUD to sell them at the support price. In many cases, products of farmer who do not have sufficient transportation means are bought at very low prices in their yards.

(5) Cropping system

Palawija crops are sometimes cultivated as paddy field off-season crops or in monoculture in upland field. However, in most cases, they are cultivated in intercropping or in mixed cropping. Through many years' experience, farmers know product price variation

risks, reduction of risks of damage by diseases and pests, distribution of labor force, and effective utilization of water in the soil. Therefore, the existing systems are regarded as nearly ideal in some areas, and there must be more rational methods. Other problems include acid soil, water in soil, and fertilization. Aside from measures to be taken under agricultural policies, the duties given the CRIFC, particularly the BORIF, are extremely heavy to solve these problems and to accomplish the goal for an increase in production under the Fourth Five-Year Development Plan.

2-3 Roles Played by Agricultural Sector in National Development Plan

The National Development Plan under the Third Five-Year Development Plan which covered 1979 to 1984 selected the following three items as agricultural goals:

(1) To expand returns, export, and food production to accomplish a prosperity of the agriculture society.

(2) To improve farm household income size and to expand labor opportunities to establish a steady and vigorous agricultural structure.

(3) To utilize natural and artificial resources to increase production in order to develop an efficient agricultural sector matching its potential ability.

The Forth Five-Year Development Plan covering 1984 to 1989 selected the following four items as its goals:

(1) Improvements in nutrition level
(2) Expansions in employment opportunities
(3) Increases in production of agricultural products to supply raw materials to the domestic industries.
(4) Maintenance of socio-ecological harmony while accomplishing utilization of natural resources and conservation of environment.

The policies for food crops production are made in accordance with the national development plan regarding agriculture as mentioned above. In the past, research and price policies and purchases by the State have been made centering an increase in the production of rice. However, the production of rice has nearly reached the level of self-sufficiency, therefore in Fourth Five-Year Development Plan, the

policies are shifting toward an increase in the production of Palawija crops. The budget appropriation in the past evidences that the agricultural sector is receiving much attention in the national development plan.

The Government of Indonesia provided a budget of 1,430,000 million rupiahs in the fiscal years 1984/1985 for agriculture the second largest budget after that for the Ministry of Education.

The roles of an increase in the production of Palawija crops under the national development plan are as follows:

(1) Effective utilization of cultivated land.
(2) Increase in farm household income
(3) Sufficient supply of raw materials for livestock feed.
(4) Increase in intake of plant protein.

The Fourth Five-Year Development Plan aims at increasing the production of food crops more than 4% as in the Third Five-Year Development Plan. During the Third Five-Year Development Plan, the production of rice increased smoothly by more than 10% per year due to effective research and price and investment policies to accomplish this goal.

Nevertheless, it has become clear that it will be difficult to continuously maintain this high growth for rice during the Fourth Five-Year Development Plan, and the government food policies have no alternative than to depend on an increase in the production of Palawija crops in order to accomplish the goal.

The goal for an increase in the production of Palawija crops between the start and end of the Fourth Five-Year Development Plan is as follows:

Maize	5.1%
Soybeans	18.8
Peanuts	8.7
Cassava	6.1
Sweet potatoes	2.8

2-4 Agricultural Research

Entire agricultural research is managed by the AARD, which is an external organ of the Ministry of Agriculture. The AARD has the following five central research institutes as organs under it:

- ° Central Research Institute for Food Crops
- ° Central Research Institute for Industrial Crops
- ° Central Research Institute for Forestry
- ° Central Research Institute for Fisheries

Of these five central research institutes, the CRIFC conducts research on paddy and on Palawija crops and is headquartered in Bogor. The CRIFC budget is divided into a general account budget (personnel cost, administration cost, etc.) and a development budget (research and development cost). Its budget broken down to each research institute is as follows:

Budget of the CRIFC

In Million Rupiahs

Research Institute	1985/1986			1986/1987 (Schedule)		
	General Account	Development	Total	General Account	Development	Total
1. CRIFC	350.6	270.0	620.6	439.0	391.5	830.5
2. BORIF	768.5	630.0	1,398.5	961.0	750.0	1,711.0
3. SURIF	416.8	660.0	1,076.8	523.0	792.0	1,315.0
4. MARIF	431.5	306.0	737.5	539.0	382.2	921.2
5. MORIF	338.4	625.0	963.4	440.0	878.0	1,318.0
6. BARIF	170.2	185.0	355.2	214.0	345.0	559.0
7. SARIF	182.6	1,430.0	1,612.6	230.0		230.0

NOTE:

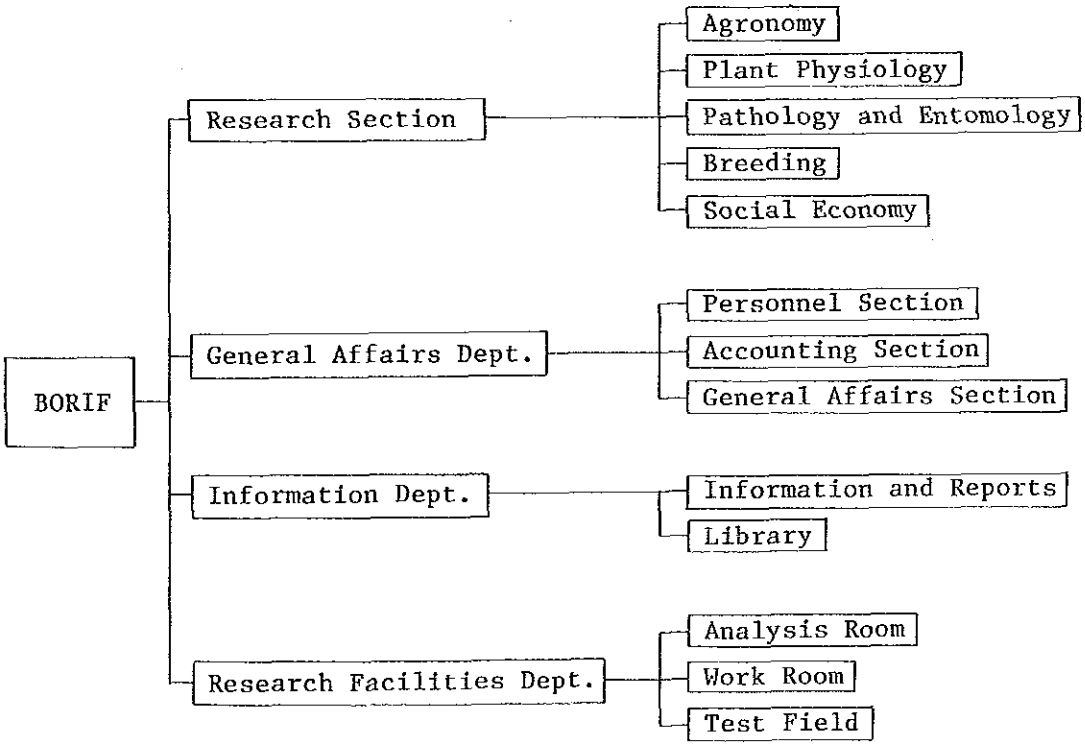
1. The budget in the CRIFC column is the headquarters budget.
2. 1 rupiah equals approximately ¥0.1.
3. Refer to paragraphs 2-4-1 and 2-4-2 for the full names of the research institutes.

The CRIFC has six food crop research institutes under it. These research institutes are located in five provinces of Indonesia and conduct research on independent research items and subjects. The research institutes are outlined below.

2-4-1 Bogor Research Institute for Food Crops (BORIF)

(1) BORIF organization

The BORIF organization consists of four departments which independently carry out their functions. They are: Research sector, general affairs department, information department, and research facilities department.



(2) Research Items of BORIF

The BORIF is located in Bogor and is engaged in pioneering research and analytics aimed at developing food crop technologies. The research items of the BORIF are listed below:

- ° Crop breeding based on hereditary resource evaluation and utilization.
- ° Research of pest group functions and research of stronger pest control including research of changing pest ecotype and strain.
- ° Research of basic plant physiology including tissue culture and nitrogen fixation.
- ° Research on agricultural economy related to cropping system.

Research of Palawija crops at the BORIF centers on pioneering and basic research and research at the MARIF centers on regional application fields.

(3) Number of researchers at BORIF by research field

Crop	Research Field	Doctors	MAs 1	MAs 2	BAs	High School Graduates	Total
Cereal Crops	Breeding	2	1	3		3	9
	Agronomy			3	1	7	11
	Physiology		1	1		3	5
	Entomology			1			1
	Pathology					2	2
	Sub-total	2	2	8	1	15	28
Legumes	Breeding	1	2	2	1	5	11
	Agronomy		5	2	1	2	10
	Physiology			2		2	4
	Entomology	1	3	1		2	7
	Pathology	1				3	4
	Sub-total	3	10	7	2	14	36
Root-crops	Breeding	1		2		2	5
	Agronomy			2		1	3
	Physiology		2	1		1	4
	Entomology						0
	Pathology						0
	Post-harvest processing			5			5
	Sub-total	1	2	10	0	4	17
Cultivation System		1	1	13	0	0	15
Palawija Crops		7	15	38	3	33	96
Rice Crops	Breeding	1	5	4	2	23	35
	Agronomy		2	6	2	5	15
	Physiology	1	5	2	5	13	26
	Entomology	2	3	9	5	7	26
	Pathology	1	0	6	2	10	19
	Social economy	0	2	8	5	2	17
	Sub-total	5	17	35	21	60	138
Total for BORIF		12	32	73	24	93	234

NOTE: The total number of employees at BORIF is 710.

(4) Technical level of researchers

At the education level mentioned in subparagraph (3) indicates, the researchers at the BORIF are conducting research mentioned in subparagraph (2) on a very high level. They sufficiently utilize and manage the research equipment listed in subparagraph (5).

(5) Present status of research equipment

1) The principal research equipment installed at the BORIF is listed below. The equipment is installed in the various research departments.

2) Most of the research equipment is fully utilized and is stored in a generally satisfactory condition.

3) Minor trouble which is easy to repair is repaired by researchers and analysts. If complex trouble occurs, the equipment is brought to the repair shop of a animal husbandry research institute located near the BORIF for necessary repairs.

4) With the exception of special gases, carrier gases can be procured in Bogor within two weeks after placing orders supplied by suppliers of domestic and imported gases.

Principal Equipment Owned by BORIF

No.	Equipment	Quantity	Research Department Installed with Equipment
1	High-speed refrigerated centrifuge with water & tube	1	Physiology
2	Flame photometer	1	"
3	Photoelectric calorimeter	1	Agronomy

No.	Equipment	Quantity	Research Department Installed with Equipment
4	Constant-temperature cultivator	1	Pathology
5	Low-temperature stocker	1	"
6	Low-temperature seed storage	1	Agronomy
7	Grain dryer	1	"
8	Automatic leaf planimeter	1	"
9	Solid kernel rate meter	1	"
10	Grain counter	1	Physiology
11	Soil crusher	1	"
12	Digital even balance	1	Agronomy
13	" " "	1	"
14	Balance stand	1	Entomology
15	Auto-still	1	Physiology
16	Light-alloy assembly net chamber facility	1	Entomology
17	Biotic microscope	1	Pathology
18	Atomic absorption photometer	1	Physiology
19	Automatic leave transpiration resistance meter	1	Agronomy
20	Soybean dryer	1	"
21	Digital balance	1	"
22	Portable planimeter	1	"
23	Automatic leaf planimeter	1	Physiology
24	Spectro photometer	1	"
25	Biotic microscope	1	Entomology
26	Laboratory biotic micrometer	1	Pathology
27	Corrosion-proof light-alloy net chamber	1	Agronomy
28	Leaf planimeter	1	Physiology
29	Clean bench	1	"
30	Multi-purpose pendulum-type automatic indicating scale (Weight 20kg)	3	Agnoromy
31	" (Weight 30kg)	3	"
32	Spectro photometer	1	"

No.	Equipment	Quantity	Research Department Installed with Equipment
33	Digital analytical balance	1	Entomology
34	Automatic leaf planimeter	1	Physiology
35	Digital universal photometer	1 set	"
36	Deep freezer	1	"
37	Scanning electron microscope	1 set	Pathology
38	Clean bench	1 set	Physiology
39	Flame photometer	1 set	"
40	Biotic microscope	1	"
41	Draft chamber	1	"
42	" "	1	"

2-4-2 Research by Food Crop Research Institutes other than BORIF

(1) Sukamandi Research Institute for Food Crops (SURIF)

Located in the northern plains of West Java, which are one of the major rice growing areas of Indonesia, this research institute mainly conducts research of food crops in irrigated areas and in damp areas by rain water.

- Studies on ways to increase the yield and incomes of wetland rice farmer
- Wetland rice farming system
- Water management at farmer's level
- Post-harvest technology of rice

The SURIF has a main test station with land measuring 350 hectares and 5 branch test stations.

(2) Malang Research Institute for Food Crops (MARIF)

Located in East Java, which has a long dry season and for which crops other than rice are important, this research institute mainly conducts research of Palawija crops as follows:

- Improved Palawija crop varieties suitable for various environments
- Seed technology
- Post-harvest technology
- Palawija-based farming system
- Utilization of Palawija crops in connection with agro-industry
- Agro-economic studies, mostly related to marketing

(3) Sukarami Research Institute for Food Crops (SARIF)

Located in damp highland of West Sumatra, this research institute is required to conduct research related to dry land under damp weather and that related to highland paddy rice as follows:

- Farming systems based on dryland rice in areas with a wet climate
- Improvement of soil fertility and productivity, and soil and water conservation
- Varietal improvement and cultural technique to increase yields and incomes of wet-land rice farmers in high-elevation areas

(4) Banjarbaru Research Institute for Food Crops (BARIF)

Located in marsh and low damp areas affected by ebb and flow in South Kalimantan Province, the research institute conducts research to solve problems facing farm households such as acid peat soil, water drainage difficulties, and high aluminum content in soil. Salt damage is another major problem. A shortage of labor force and market distribution are other problems making an increase in crop production difficult. Therefore, the BARIF conducts the following research:

- Varietal improvement of crops for tidal swamp and deep water environments
- Cultural techniques for food crops production
  Farming systems
- Agro-economics concentrating especially on labor and marketing

(5) Maros Research Institute for Food Crops (MORIF)

This research institute conducts research of dry land under dry weather and is, therefore, located in South Sulawesi. The following is the research items of this research institute:

This research institute conducts research of dry land under dry weather and is, therefore, located in South Selawesi. The institute conducts the following research:

- Farming systems for dry land with a dry climate
- Equipment and machinery suitable for these conditions
- Crop varietal improvement

2-4-3 Technical Cooperation by Japan and Its Relationship

Japanese cooperation with Indonesia dates back to 1961 when it sent specialists in connection with Indonesia's three-year plan to increase rice production. We have already stated that Indonesia has attained self-sufficiency in rice through the efforts of the Indonesian Government.

In the background mentioned in chapter 1, the project to strengthen of legumes in relation to cropping system research project was implemented with Japanese technical cooperation for a period of five years beginning October, 1978. The follow-up cooperation for another two years ended in October, 1985 with many accomplishments. At present, new project-type technical cooperation has been started beginning April, 1986 under the project to strengthen basic research to increase the production of Palawija crops.

The Japanese cooperation under this project is outlined below:

(1) Recipient of technical cooperation

Technical cooperation is provided with the BORIF which is placed under the jurisdiction of the CRIFC.

(2) Research subjects in technical cooperation

1) Improved quality of Palawija crop seeds

a. Production technology of high-quality seeds
b. Preservation technology of high-quality and high-vigor seeds
c. Disease and pest control

2) Improved Palawija crops cultivation technology under diverse environments

a. Crop adaptability and productivity improvements
b. Plant nutrition improvement technology

3) Improved productivity of Palawija crops applying bio technology

a. Applied technology of microorganisms including bioticnitrogen fixation technology
b. Tissue culture

(3) Japanese specialists

The Japanese specialist group consists of a group leader, coordinators, and specialists in the following fields:

Agronomy (upland field cropping)
Plant physiology
Plant pathology
Entomology

Specialists are also sent for short periods of time as necessary for smooth implementation of the project.

(4) Counterparts

1) The CRIFC director (project manager)
2) The BORIF director
3) Researchers as counterparts of Japanese specialists
4) Laboratory analysts
5) Field workers
6) Clerical staff including typists, clerks, and drivers and workers

(5) Joint committee

1) Purposes of the joint committee

Joint committee meetings are held at least once per year as necessary to discuss and decide annual research plans, to evaluate the implementation of annual research plans and progress of technical cooperation, and to exchange views on important matters related to technical cooperation.

2) Members of the joint committee

a. Chairman: AARD director
b. Indonesian committee members

The CRIFC director, BORIF director, MARIF director, BORIF research department managers, BAPPENAS representative, SETKAB representative, representative from Ministry of Agriculture secretariat, AARD representative, and persons nominated by the committee chairman

c. Japanese committee members

Team leader, coordinators, specialists, persons sent by the JICA, and a JICA Indonesia office representative

(6) Relationship between the proposed building and equipment and technical cooperation

The research sectors in the BORIF have been conducting pioneering research of Palawija crops independently. The elements that block increases in the production of Palawija crops are complex and are diverse. Only one research sector alone is not sufficient to solve these problems. The individual research sectors must integratedly conduct research maintaining close horizontal contact among themselves.

The Japanese specialists also conduct research and provide guidance scattered in the various research sectors with the Indonesian counterparts nominated for the individual research sectors as mentioned above.

One reason for this is that buildings and equipment to establish integrated research subjects and to conduct research do not exist. Therefore, the buildings and equipment proposed under the new project are to provide buildings and equipment that will allow transversal communications among the Indonesian research sectors centering

overall research subjects and wide and coordinated research between Indonesian researchers and Japanese specialists.

By installing freezers, cold room, sterilization rooms, and seed dryers which the BORIF do not possess at present, as well as analytical equipment of a higher accuracy, Japanese specialists and their Indonesian counterparts will be able to study research subjects that require tests with a higher accuracy.

2-4-4 Relationship with cooperation by other countries

Table 2 outlines the cooperation currently provided to the CRIFC by international organizations or under bilateral agreements regarding research of Palawija crops.

The majority of this cooperation is only technical cooperation. One exception is technical cooperation by the Netherlands to the Malang Research Institute for Food Crops (MARIF) which provided funds for buildings and equipment.

As a non-grant aid provided by USAID, an auditorium for the AARD and a main building and warehouse for the BORIF have been built within the BORIF complex. These buildings are independent buildings, and the purposes and location relationships of them with the buildings and equipment proposed under the new project are entirely different.

Therefore, the proposed buildings and equipment under the new project have been verified so as not to duplicate those aids by other countries or by international organizations.

2-5 Background and Details of Request

2-5-1 Background of request

The Government of Indonesia has planned to build a test and research building for Palawija crops for the purposes of research and development of bio technology and of microorganisms as a means for Palawija crop seeds technology, for biochemistry, and for breeding. The Government of Indonesia has requested the Government of Japan to provide a grant aid on the buildings and equipment, as well as on related facilities needed for these purposes.

The following items have been listed as the background for this request:

(1) At present, CRIFC is conducting independent research by research facilities that are independent by research sector. However, there is no integrated research building for Palawija crops.

(2) Research buildings and equipment related to seed production and storage are particularly lacking.

(3) Buildings and equipment for research of microorganisms centering rhizobia of legumes are lacking.

(4) Buildings and equipment for basic research of bio technology as a breeding means are lacking.

(5) Buildings and equipment to research, analyze, and study joint research subjects in individual research fields are lacking.

2-5-2 Details of request

1. Plan and purposes

The request envisions constructing buildings in the premises of the BORIF under the supervision of the CRIFC in Bogor, which belongs to the AARD for pioneering research and tests of Palawija crops. The buildings and equipment will be used to improve the research technical level in order to contribute to the increased production of Palawija crops through technical cooperation with specialists sent by Japan.

The project has the following purposes:

(1) Constructing a facility for seed technology and micro-organism research in order to increase production of food crops.

(2) Building a core for modern bio technology research.

(3) Strengthening pioneering research activities.

(4) Implementation of epochal projects.

(5) Application of research results to other research organs

2. Outline of the request

The buildings and equipment requested by the Government of Indonesia are as follows:

(1) Project implementation period: 2 years

(2) Execution plan

1) Building construction

Laboratories, seed storage room, staff rooms for researchers, meeting room, seed drying room, office, electric and gas supply room, rest room, seed processing room, greenhouses, storage room, etc.

2) Equipment

Diesel engines to supply electricity, cold storage warehouse, laboratory equipment, etc.

(3) Burden sharing between two governments

1) Responsibility of Japanese Government

Building construction, equipment supply, and sending of cold storage warehouse engineers and of building construction consultants.

2) Responsibility of Indonesian Government

Offices for counterparts and consultants, architects for detailed design, cost to operate equipment supplied by Japan, provision of land, road construction, foundation works, and supply of electricity and water outside the building.

CHAPTER 3 PROJECT DETAILS

CHAPTER 3 PROJECT DETAILS

3-1 Purposes of Project

This project purposes constructing facilities in which basic and pioneering research of Palawija crops in Indonesia will be conducted to increase the production of Palawija crops.

In order to accomplish this purposes, buildings and equipment will be supplied by a grant aid to be extended by the Government of Japan under this project.

3-2 Study of Request Details

Prior to making the plan for the basic design, a study of the appropriateness of the details of the request made by Indonesia was made, and the following basic policies were decided.

(1) Relative position of the facilities

At present, in addition to the main building in the BORIF complex, BORIF research buildings for the agronomy, plant physiology, plant pathology and entomology, breeding sectors, and social economy are scattered in 5 locations in Bogor. The BORIF is contemplating concentrating them in the BORIF complex in the future.

Therefore, in the near future, the individual research sectors of the BORIF will have their own buildings in the BORIF complex to conduct research as at present.

The facilities under this project will become the core of pioneering joint research and tests for Palawija crops independent of those existing for the various research sectors.

(2) Study of activity details

The research and test activities utilizing the proposed facilities will basically cover the following research subjects:

1) Improved quality of Palawija crop seeds.

2) Improved Palawija crops culture technology under diverse environments.

3) Improved productivity of Palawija crops applying bio technology.

(3) Study of buildings and equipment

1) A new building and equipment of the seed technology which does not exist in existing buildings will be installed, namely, equipment for seed drying and processing, large germination test chambers, low-temperature test room, and cold storage. Design will permit research of production and storage of certified seeds applying high seed technology.

2) Design will be made to allow research of crops production technology utilizing biological techniques and tissue culture technology by installing sterilization room, cold room, deep freezer and necessary equipment.

3) Design will be made to allow processing of new research subjects by giving an analytical ability with a higher accuracy by providing high-accuracy and high-speed biochemical analytical equipment.

(4) Study of management system

The facilities utilization plan will be prepared by a joint research committee to be formed centering the researchers to operate and manage them to ensure that pioneering researchers and tests of Palawija crops will be conducted actively.

Approximately four researchers, who have been conducting research in other organizations, and about four researchers, who have completed training, will be reassigned from the plant physiology sector to the tissue culture and microorganism applied research sectors, which are new sectors, to conduct research semi-permanently. Research of the seed technology has been conducted in the agronomy sector. Part of its researchers, approximately ten persons, will be relocated to the new building to conduct research semi-permanently. The facilities will be used if research subjects or analysis items of the other research sectors, namely, agronomy, plant physiology, plant pathology and entomology, and breeding cannot be processed by the existing buildings or equipment.

(5) Study of technical cooperation

A consideration will be given so that the technical cooperation by Japan being implemented at present will make progress more smoothly and that larger results of technical cooperation will be accomplished by utilizing the proposed buildings and equipment.

3-3 Outline of this Project

3-3-1 Management System

(1) The facilities utilization made under this project

In the past, the BORIF has been independently conducting research of Palawija crops in the following five sectors; Agronomy, plant physiology, plant pathology and entomology, breeding and social economy. The buildings and equipment contemplated under this project will become the core of research activities for Palawija crops.

However, depending on actual research activities, the utilization mode of the buildings and equipment to be provided under this project will be classified as follows:

1) The individual research sectors do not have laboratories or equipment needed for this research, researchers and analysts will use the buildings and equipment provided under this project for certain periods of time by individual research sectors.

2) Researchers and analysts will semi-permanently use laboratories do not have laboratories or equipment needed for research by themselves.

Example: Majority of microorganism research and part of seed technology

3) For processing of joint research subjects spreading to the individual research sectors, researchers and analysts to be grouped by joint research subjects will use the buildings and equipment for certain periods of time.

(2) Management system

1) The facilities utilization plan

The facilities utilization plan shall be made in accordance with a research plan to be prepared by a researcher group headed by the BORIF director, a function like a Palawija Crops Research Joint Committee.

2) Administrative system

A manager responsible for maintenance and administration of buildings and equipment shall stay inside the buildings to prevent theft, fire, etc. Therefore, guards, night watchman, and janitors will be needed.

3) The number of researchers who will use the facilities are estimated as follows:

Number of Researchers to Use the Facilities
for Research and Administrative Staff (Estimate)

	(Laboratory Director) Researcher	Researcher	Analyst	Administrative Staff	Total (Persons)
Micro organism	1	3	4		8
Bio chemistry	1	3	4		8
Seed technology	1	4	5		10
Manager and Administrative Staff	(Subsection Chief) 1		-	3+5	9
Total	4	10	13	8	35

3-3-2 Research activities

The study team interviewed Indonesian researchers and Japanese specialists sent to Indonesia regarding the present status and future schedules of Palawija crops research and studied the actual conditions. The research subjects for the moment centering Japanese specialists are as follows:

(1) Establishment of technology for stable supply of certified seeds

It is extremely important to accurately produce certified pure-line seeds of high-yield and good-quality varieties suitable for each area and for each cropping season and to meet the demand in order to increase the production of soybeans in accordance with a plan.

1) Production technology for certified pure-line seeds

Planned cropping will be possible by easily and accurately producing high-yield and high-quality pure-line seeds. Research for this purpose will be conducted.

2) Establishment of economical soybean and seed storage technology

Secure supply of high-germination rate and low-price seeds is extremely important to planned cropping of soybeans. Research to accomplish this will be conducted.

3) Analysis of conditions that affect soybean germination rate

It is known that soybeans maintain a high germination rate if they are stored in a low-temperature and low-humidity environment. Judging from the electric power supply

situation and availability of buildings and equipment in Indonesia, it will not be possible to use low-temperature low-humidity seed storage warehouses in various locations. Therefore, research will be conducted regarding other low-cost and easy germination-preservation technology to replace it, including the problem of damage by diseases and pests.

4) Search for high-germination rate, high-yield, and stable varieties

Varieties that maintain a high germination rate even under natural environmental conditions are possible. All varieties including those existing at present will be considered.

(2) Establishment of techniques to increase in production economically

A selection of good-quality, high-yield, and stable varieties that are suitable to various regions is extremely important to Indonesia which widely spreads south to north and east to west, with differences in elevation and in meteological and environmental conditions, with a large variety of soil types, and with various cropping types such as dry and rainy seasons.

1) A criterion in selecting varieties is established by understanding breeding reaction characteristics of main soybean varieties by variations in environment conditions to know types of varieties that promise the highest stability and yield. For this purpose, a selection of breeding reaction of suitable varieties of principal soybean varieties under environment conditions by region and by season will be made.

More stable cropping types and suitable varieties are selected as a technology to stabilize production of inter- and mixed-cropping soybeans.

2) Properties of soil have been analyzed to a considerably high extent. Countermeasures and research incorporating improvements of physical properties are important to further improve the soil productivity and for vigor of food roots.

a) Improvement techniques of soil physical properties

An overall countermeasure techniques including cultivation methods is studied to improve the vigor of roots.

b) Defective soil improvement countermeasures

Research of improvement methods by using coarse-grain quicklime and coarse-grain ground dolomitic limestone, which are expected to retain effects for a long time by their use. Research of economical effects by the use of low-cost and low-density compound coarse-grain stones.

c) Selection and fertilizing of multi-purpose organisms

Research of selection and fertilizing methods of plants that also meet other requirement such as killing namatodes, rather than fertilizing of organisms only to improve physicochemical properties of soil that have been used in the past.

d) Technology to increase yield by effective utilization of soil water

Effects of soil water by breeding period on yield of soybean breeding and already analyzed. Research of effective application of them.

(3) Ecosystem of occurrence for the principal disease and its control techniques

The production of soybeans is reduced very substantially by diseases. The principal diseases are analyzed and techniques to control them economically will be established.

1) Ecosystem of occurrence for seed epidemic disease

a) Germination obstruction by seed epidemic diseases

b) Significance as primary infection source of plants by seed infection

c) Secondary infection factors and damage extent

SSV, SMV, CMMV, PCRMV, etc. cause problems as virus diseases, while purple stain of seed becomes a problem as molds. New knowledge about the existence of molds that inhibit germination if seeds are preserved for a long time can be expected.

d) Lowering of germ (poison) carrying seed ratio by selection

e) Disease control by chemicals, heat treatment, etc.

f) Experiment for varification to produce high quality seed by means of providing seed farm

(Control by chemical and pick up of virus infested individual)

(4) Ecosystem of occurrence of principal pests and its control

The ecology of principal pests of soybeans will be analyzed, and techniques to economically control them will be established.

1) Ecosystem of occurrence for the principal pests is continuously observed at points with different environmental conditions for soybean cultivation as in paddy field and in upland field.

2) The growth condition of principal pests will be analyzed, and the breeding methods for them will be established and the development of atract trap to the principal pests such as soybean stem miner.

3) A density survey method and control techniques will be established by developing an enticement trap for principal pests such as soybean stem miner.

(5) Biotechnology

Growing points and other tissue culture are considered as main subjects, and training of tissue culture researcher, as a breeding means, is planned for the future. Some researchers are conducting research of technology using bio technology facilities at Bogor Agricultural University Industrial Crop Institute.

(6) Microorganisms

Research of rhizobium is mainly conducted. At present, 35 strains have been sampled and preserved. Of them, five strains of rhizobia japonicam, namely, R_{19}, R_{21}, R_{24}, R_{28}, and R_{31} are considered premising as soybean rhizobia. The identification of other strains and research of its effects, etc. are not advancing at present due to a lack of facilities and equipment.

3-3-3 Outline of the facilities

The following facilities will be provided under this project:

(1) Buildings and equipment to make tests for quality improvements of Palawija crop seeds

(2) Buildings and equipment to make biochemical tests regarding quality improvements of Palawija crops, storage, enzymes, viruses, soil, etc.

(3) Buildings and equipment to conduct research of microorganisms and of tissue culture to improve the Palawija crops productivity

(4) Buildings and equipment to prepare and analyze samples

(5) Buildings and equipment to make culture tests under sunshine

The functions of laboratories and analysis rooms to be installed in the proposed facilities based on the above-mentioned outline are as follows:

(1) Buildings and equipment to make tests for quality improvements of Palawija crop seeds

1) Laboratory-3 (Seed technology)
To measure principally physical properties (grain shape, thousand-kernel weight, volume weight, etc.) of seeds brought from the field, dried, and prepared.

Principal equipment:

Infrared moisture meters, handy moisture meters, automatic grain counters, constant-temperature and constant-humidity germination test chamber, top-pan balances, and center laboratory tables (large) and chairs.

2) Seed processing rooms (1), (2), (3)

Research seeds are dried in a large quantity quickly without lowering their germination ratio.

Principal equipment:

Dryers, threshers, seed cleaning machines, seed finish dryers, center laboratory tables (medium) and chairs, and side sinks.

3) Cold storage

Research seeds will be stored. Ante room will be provided to enhance the heat insulation effect of the storage chambers.

Principal equipment:

Cold storage and seed storage racks.

4) Low-temperature test room

Seed activity tests under various temperature conditions will be made.

Principal equipment:

Center laboratory tables (medium) and chairs.

(2) Buildings and equipment to make biochemical tests regarding quality improvements of Palawija crops, storage, enzymes, viruses, soil, etc.

1) Laboratory-2 (Biochemistry)

Plant physiological and pathological analysis of seeds, soil, etc. will be made. Analysis including sample preparation, resolution, titration, etc. will be conducted.

Principal equipment:

Freeze dryers, hot-air dryers, fume hoods, center laboratory tables (large) and chairs, side sinks, and shelf for chemicals.

(3) Buildings and equipment to conduct research of microorganisms and of tissue culture to improve the Palawija crops productivity

1) Laboratory-1 (Microorganisms)

To conduct culture medium preparation (weighing, mixing, dissolution, pH correction, and differentiation of culture medium components).

To conduct identification of root nodule bacteria and tissue culture of growing points, anthers, etc.

Principal equipment:

Auto still, auto clave, inverted system microscope, table and chair, rotary microtome, incubator, rotary shaker, center laboratory table (large) and chairs, shelf for chemicals, and side sink.

2) Sterilization room

To conduct culture of root nodule bacteria, tissue culture, and enzyme tests.

Ante room will be provided in order to prevent the pollution of air in the sterilization room, which is a clean space, and in order to prevent dangerous substances which occur during a test from spreading. A locker room and showers will be installed.

Principal equipment:

Clean benches, shelf for tissue culture, and central laboratory table (medium) and chairs.

(4) Buildings and equipment to prepare and analyze samples

1) Special analysis room (1)

To prepare and store samples and for other purposes. Equipment that generates vibration, etc. is specially installed in this room to separate it from other precision equipment.

Principal equipment:

Ultracentrifuge, deep freezer, and centrifuge

2) Special analysis room (2)

To conduct sample preparation and analysis of organic and inorganic substances, viruses, etc.

Principal equipment:

Atomic absorption spectrophotometer and hood, gas chromatograph, crude protein analyzer, and liquid chromatograph.

3) Cold room

This laboratory is mainly for enzyme tests. Ante room will be installed to enhance the heat insulation characteristic of the labatory.

Principal equipment:

Cold room and center laboratory table (medium) and chairs.

4) Balance room

Chemicals, samples, etc. are weighed.

Principal equipment:

Chemical balance, table, and chair.

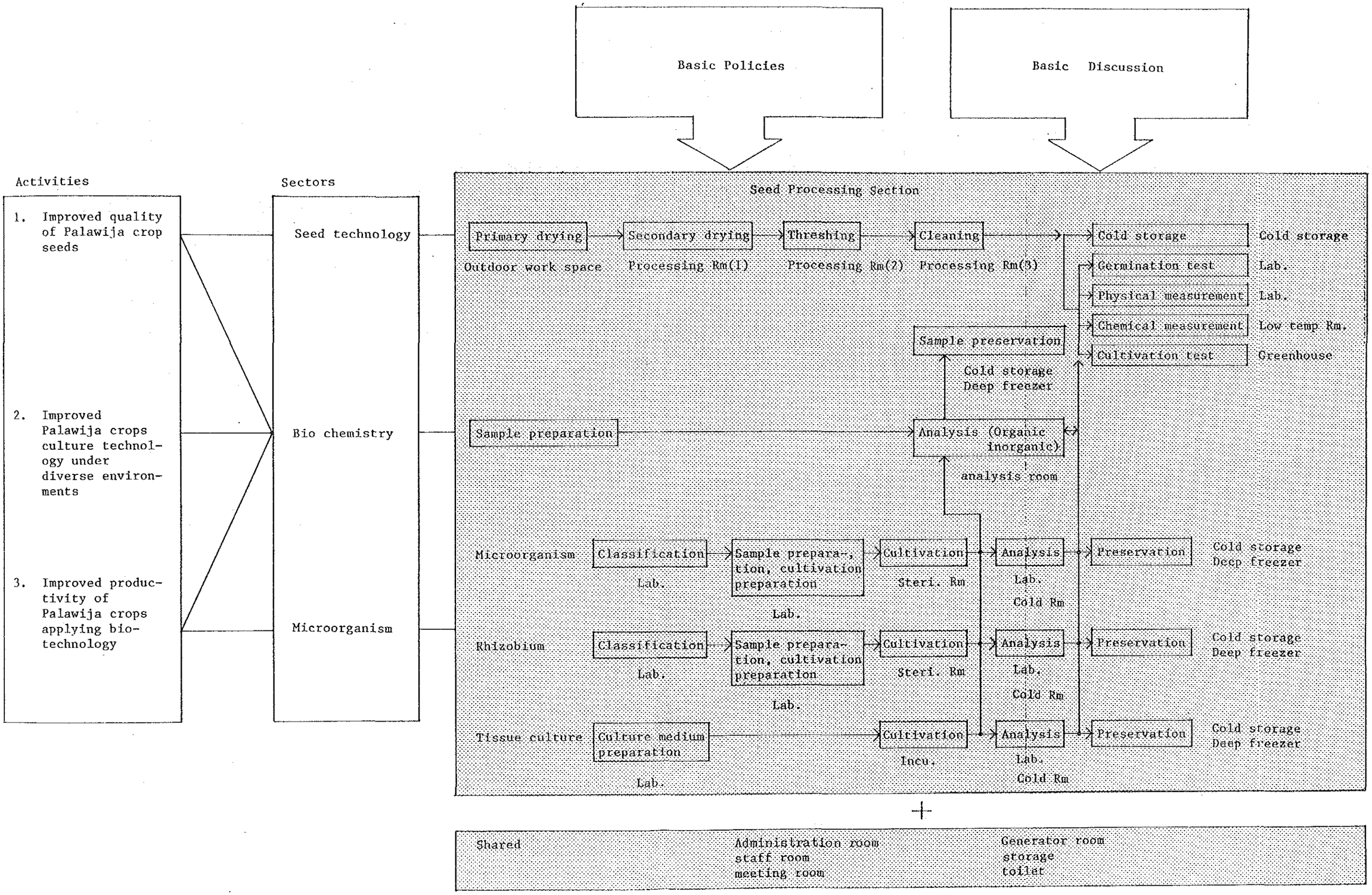
(5) Buildings and equipment to make culture tests under sunshine

1) Greenhouse

To conduct culture tests by pots, hydroponics, etc. under sunshine.

Principal equipment:

Photosynthesis meter.


Basic Policies
Basic Discussion
Activities
Sectors
Seed Processing Section
1. Improved quality of Palawija crop seeds
2. Improved Palawija crops culture technology under diverse environments
3. Improved productivity of Palawija crops applying biotechnology
Seed technology
Bio chemistry
Microorganism
Primary drying
Secondary drying
Threshing
Cleaning
Outdoor work space
Processing Rm(1)
Processing Rm(2)
Processing Rm(3)
Cold storage
Germination test
Physical measurement
Chemical measurement
Cultivation test
Cold storage
Lab.
Lab.
Low temp Rm.
Greenhouse
Sample preservation
Cold storage
Deep freezer
Sample preparation
Analysis (Organic inorganic)
analysis room
Microorganism
Classification
Lab.
Sample preparation, cultivation preparation
Lab.
Cultivation
Steri. Rm
Analysis
Lab.
Cold Rm
Preservation
Cold storage
Deep freezer
Rhizobium
Classification
Lab.
Sample preparation, cultivation preparation
Lab.
Cultivation
Steri. Rm
Analysis
Lab.
Cold Rm
Preservation
Cold storage
Deep freezer
Tissue culture
Culture medium preparation
Lab.
Cultivation
Incu.
Analysis
Lab.
Cold Rm
Preservation
Cold storage
Deep freezer
Shared
Administration room
staff room
meeting room
Generator room
storage
toilet

3-3-4 Selection of equipment

(1) Basic policies for equipment selection

The equipment to be installed in the facilities must be planned to fully demonstrate its functions after sufficiently understanding the purposes and nature of the facilities. The equipment types and specifications shall be selected based on the following basic policies:

1) Only equipment which is truly needed for research in the buildings and only types that are indispensable will be selected.

2) The sizes and number of equipment will be necessary and sufficient ones. Excessively large sizes and numbers of them will not be required.

3) Analytical equipment will be selected based on easiness of operation and ruggedness in specification will be selected provided the performance is the same.

4) Equipment, particularly freezers, cold room, will be selected based on specification and design that assure low operation and maintenance costs.

5) Carrier gases and other consumable supplies shall be selected based on local procurement possibilities.

6) Since technical cooperation has been provided by Japan to the CRIFC, the equipment and specification level will be such that Indonesian researchers are able to sufficiently utilize, operate and maintain by guidance of Japanese specialists.

(2) Discussion on equipment

The BORIF researchers concerned and Japanese specialists discussed on equipment types, functions, and quantities for three fields - seed technology, biochemistry, and microorganism. The discussions and agreements are summarized as follows:

1) Seed technology sector

a) Sample to be tested will be dried and prepared by sunshine (a concrete drying yard will be needed for this purpose) or by machine (layer=type dryer for preliminary drying before threshing and with steams and leaves) in primary drying. Samples are then threshed in a thresher and are cleaned in a cleaning machine. Samples are then finish dried. The volume of test seed samples for finish drying is 80 kg x 5 varieties x 4 tests x 3 items (maize, soybeans, and peanuts) x 2 seasons = approximately 9,600 kg. Seeds have to be finish dried within 30 days after harvesting, and dryers that do not impair seed vigor and quality are required.

b) Initially, the Indonesian side thought hereditary resource preservation in addition to preservation of research seeds in cold storage. However, the preservation period, preservation amount, and setting of preservation temperature for hereditary resource preservation are entirely different from those of research seed preservation in terms of scale, maintenance costs, etc. And only seeds for research purposes will be preserved in this project.

Therefore, the freezer setting and scale will be as follows:

Preserved sample amount	3,600 kg
Research samples	60 kg x 5 varieties x 4 items = 1,200 kg
B.S.	200 kg x 3 varieties x 4 items = 2,400 kg
Preservation method	Temperature 5°C. Bagged and preserved on shelves matching 5°C.
Preservation period	Maximum 1 year

c) Photosynthesis meter

Measurement of photosynthesis (CO_2), which directly affects an increase in production of Palawija crops, is also important to measurement of photosynthesis functions to the plant in stand. A type that permits measurement outside laboratories is preferred to a fit up type. The meter must be handled of approximately 100 samples by a researcher without an assistant. Transpiration and photosynthesis have a close relationship, so a meter that can simultaneously measure both to the plants on stand is needed.

Photosynthesis measurement requires a continuity, and personnel allocation of a researcher (or a measurer) was also discussed.

d) Constant-measurement and humidity germination test oven

There was a desire to set the temperature between -20 and +85°C, humidity (R.H.), between 20 and 95%,

temperature accuracy, ±0.5°C, and humidity accuracy, ±3%, approximately. This was connected with the necessity to conduct tests on botanical properties of seeds, relationship between germination ratio and viability on one hand and seeds infested by diseases and pests on the other, and germination tests by difference in environments such as temperature and humidity.

The capacity should allow tests of 300 of petri dishes x 3 ovens for each type of germination tests (by temperature and humidity, by variety, by crop, and by test item).

2) Biochemistry sector

The equipment types and performance was discussed after fully discussing research items with the researchers concerned as the equipment will be the main equipment to be used in plant physiology and plant pathology research.

a) Cold room

Tests of various enzymes that affects the vigor of seeds will mainly be conducted, and a constant-temperature and humidity condition will be required. Taking into consideration the test scale, the size of the room will be a necessary minimum scale, that is, approximately 18 m^2.

The temperature and humidity setting ranges and temperature and humidity accuracies shall be the same as those of the cold storage for the seed technology sector.

b) Crude protein analyzer

In biochemistry analysis, measurement of nitrogen requires analysis of the largest number of samples. However, analysis by the conventional Kjedahl method requires a very long time, and the number of test samples is limited. As a result, the number of test has not been sufficient. By using the crude protein analyzer, tests can be performed with a higher accuracy.

3) Common test sector

This sector will have equipment that can be used for research of seed technology, biochemistry, microorganisms, and other fields.

a) Ultracentrifuge

This equipment is indispensable to separation, extraction, and refining of living body substances such as substances in cells, enzymes, hormone, and viruses. Separation speed and accuracy are decided by the centrifugal acceleration.

Therefore, ultracentrifuges that have a high rotation speed, a short rotor acceleration and deceleration time, and memory device for operating conditions in Indonesia where power failures frequently occur, will be required. The rotary types will be limited only to several types which have the highest universality.

b) Atomic absorption spectrophotometer

A photometer is needed that can analyze aluminum and approximately 70 other elements at a high sensitivity and with a high accuracy, assuring quick, easy, and safe operation. A hydrogen compound generating auxiliary device that analyzes several elements at a high sensitivity is needed.

c) Gas chromatograph

The wishes of the Indonesian side to have a combination of a hydrogen flame ionization detector and thermal conductivity detector will be studied.

4) Microorganism sector

Taking into consideration the present level of research, the research scope of the bio technology fields will be limited to tissue culture such as growing points, anothers, etc. Therefore, necessary equipment was studied taking the scope and grade into consideration.

Equipment necessary for research of microorganisms such as rhizobia has also been studied.

a) Clean bench

The preferred specification is 10 in cleanliness class and dust collection efficiency of 99.99% (with 0.3 μm seed diameter), or higher.

b) Incubator

The equipment should allow adjustment of the temperature, humidity, and illumination with a high accuracy and unform temperature and humidity distributions.

c) Rotary microtome

The preferred specification is a cutting range of 2 to 20 μm and horizontal moving range of the sample holder of approximately 40 mm.

5) List of equipment discussed

The following is the outline of the equipment to be supplied for the building:

a) Equipment related to seed technology

b) Equipment related to biochemistry

c) Equipment related to shared tests

d) Equipment related to microorganisms

The following table compares the equipment desired by the Indonesian side and that agreed to be supplied after consultation between the Indonesian and Japanese sides as mentioned above.

Requested Equipment		Planning Quantity	Remarks
Equipment	Quantity		
I. Seed Technology Sector			
Primary dryer	2	1	
Seed finish dryer	1	1	
Infrared moisture meter	2	1	
Moisture meter	4	3	
Thresher	2	1	
Cleaner	2	1	
Grain counter	2	1	
Constant-temperature and constant-humidity germination laboratory	3	3	Chamber type
Electronic balance	10	1	
Photosynthesis meter	1	1	Fixed type is changed to portable type.
Test seed storage rack	5	5	
Center test table (with 6 chairs)	2	2	
Cold storage	2	1	
Side sink	1	1	
Seed storage rack	5	5	
II. Biochemistry and Shared Test Sectors			
Atomic absorption spectrophotometer	1	1	

Requested Equipment		Planning Quantity	Remarks
Equipment	Quantity		
Gas chromatograph	2	1	
Crude protein analyzer	1	1	
Ultracentrifuge	1	1	
Centrifuge	1	1	
Deep freezer	2	1	
Auto still	3	1	
Auto clave	3	1	
Freeze dryer	2	1	
Hot air dryer	1	1	
Microbalance	5	1	
Incubator	5	1	
Fume hood	2	1	
Inverted system microscope	1	1	
Laboratory table	2	2	
Shelf for chemicals	4	1	
Side sink	8	2	
Liquid chromatograph	1	1	
III. Microorganic Sector			
Rotary microtome	2	1	
Clean bench	3	1	
Incubator	4	1	
Rotary shaker	3	1	
Glassware			

The following equipment was mentioned, but was not included in the list of equipment to be supplied:

Requested Equipment		Planning Quantity	Remarks
Equipment	Quantity		
Computer	4	0	
Flame photometer	2	0	
Colony bacterial counter	2	0	
Soil sterilizer	2	0	
Fractional destillation	2	0	
Growth chamber	2	0	
Balance	15	0	
Microscope	8	0	
Hot plate	6	0	
Water bath	2	0	
Digital PH-meter	3	0	
Automatic strirrer	6	0	
Hot air cabinet	3	0	
Wire mesh basket	50	0	
Hot plate-cum-magnetic stirrer	12	0	
Pressure cooker	6	0	
Heat regulated	12	0	
Filter membranes	12	0	
Hypodermic syringes	12	0	
Trolley	6	0	
Laminar air flow cabinet	3	0	
Steamer	6	0	
Rubber stopper	100 each	0	
Instrument stand	12	0	
Forcep	48	0	
Scalpels	24	0	
Spatule	24	0	
Cork borer	6	0	

Requested Equipment		Planning	Remarks
Equipment	Quantity	Quantity	
Air conditioner	12	0	
Stainless steel or Teflon sieves	6	0	
Soil sieve	6	0	
Haemocytometer	6	0	
Rotary platform shaker	6	0	
Humidifier	6	0	
Shelves with fluorescent tubes	3	0	
Cells suspendor	3	0	
Electron microscope	1	0	

(3) Selection of equipment

After consultation between the Indonesian and Japanese sides as mentioned in (2) above, the following equipment has been selected to be supplied under this project:

No.	Equipment	Quantity
I.	Seed Technology Sector	
1.	Dryer	1
2.	Thresher	1
3.	Seed cleaner	1
4.	Seed finish dryer	1
5.	Infrared moisture meter	1
6.	Handy grain moisture meter	3
7.	Automatic grain counter	1
8.	Constant-temperature and constant-humidity germination test oven	3
9.	Top-pan balance	1

No.	Equipment	Quantity
10.	Photosynthesis meter	1
11.	Seed storage rack	5
12.	Laboratory table (Large)	1
13.	" (Medium)	2
14.	Chair for center test table	10
15.	Cold storage	1
16.	Side sink	1
II.	Biochemistry Sector	
1.	Freeze dryer	1
2.	Hot air dryer	1
3.	Laboratory table (Large)	1
4.	Chair for laboratory table	4
5.	Cold room	1
6.	Shelf for chemicals	1
7.	Side sink	1
8.	Fume hood	1
III.	Shared Test Sector	
1.	Atomic absorption spectrophotometer	1
2.	Hood for atomic absorption spectro photometer	1
3.	Gas chromatograph	1
4.	Crude protein analyzer	1
5.	Ultracentrifuge	1
6.	Centrifuge	1
7.	Deep freezer	1
8.	Chemical balance	1
9.	Table for chemical balance	1
10.	Chair for chemical balance	1
11.	Laboratory table (Medium)	1
12.	Chair for laboratory table	2
13.	Liquid chromatograph	1

No.	Equipment	Quantity
IV.	Microbiology Sector	
1.	Auto still	1
2.	Auto clave	1
3.	Inverted system microscope	1
4.	Table for inverted system microscope	1
5.	Chair for inverted system microscope table	1
6.	Rotary microtome	1
7.	Clean bench	1
8.	Incubator	1
9.	Rotary cultivator	1
10.	Laboratory table (Large)	1
11.	" (Medium)	1
12.	Chair for laboratory table	6
13.	Shelf for chemicals	1
14.	Side sink	1
15.	Shelf for tissue culture	1
V.	Glassware Sector	
1.	Glassware	1 set
2.	Shelf for glassware	12

3-3-5 Building Design

(1) Basic design policies

The basic policies for building design shall be established based on building function, characteristics, economy, and maintainability, as well as on easiness of operation. The basic design items are described below:

1) The facilities will be built inside the BORIF complex. The building shape, layout, etc. shall conform to the purpose of the BORIF complex master plan.

2) The facilities will be used to conduct particularly advanced and precision research concentratedly within the BORIF research sectors and will have functions and modes different from those of other buildings in the BORIF complex. However, the design of the building should match that of the other buildings.

3) Future extensions should be possible along certain principles within the entire master plan even if future extensions become necessary.

4) Locations to be utilized commonly and separately among the research sectors should be clearly understood, and their mutual relationship should be made appropriate.

5) A low operation and maintenance cost shall be one of the most important items.

6) As a research facility, future changes, replacement, repairs, and checks of pipes, wires, cables, ducts, etc. should be easy.

7) Setting of environmental conditions that permit the test equipment to demonstrate its performance shall be given a priority for special laboratories.

8) Good environmental conditions under high-temperature and high-humidity weather conditions must be assured.

9) The spirit of the building which cannot be measured numerically should be given an importance.

10) All the construction materials shall be procured in Indonesia. The ordinary construction methods that are used in Indonesia shall be used, such as concrete pillars, beams, and slabs and block walls coated with mortar and finished with paint.

11) Materials will be common, but the selection and execution of them shall be of a high class.

(2) Setting of building size

The following building size is set to allow research mentioned in 3-3-2 to be conducted smoothly.

Room name	Area m^2		Persons	m^2/person
Administration room	20.25	4	(Researchers) (Clerks)	7.2 4
Meeting room	59.5	14	(Researcher) (Clerical)	4 2.8
Staff room	136.5	13	(Director) (Researcher)	20 7.2
Laboratory (1) Micro organism (2) Bio chemistry (3) Seed technology	 63.7 72.8 84	 4 4 5		 16 " "
Sterilization room	42		Work force scale to be calculated based on equipment installation	
Cold room	43.4		"	
Special analysis room (1) (2)	20.3 41.3		" "	
Balance room	10.5		"	
Seed processing room	168		"	
Cold storage	40.6		"	

Room name	Area m^2	Persons	m^2/person
Low temperature room	43.4	Work force scale to be calculated based on equipment installation	
Instrument & glassware	43.4	"	
Stock room for dangerous chemicals	20.3	"	
Storage (1)	20.3	"	
(2)	9.6	"	
Stock room for gas cylinders	9.6	"	
Generator room	43.4	"	
Toilet (1)	23.6	1 set each for males and females	
(2)	20.5	"(Local style)	
Kitchenet	7.75		
Annex building Greenhouse	120	Calculated based on research scale (pot test, hydroponic culture)	

(3) Discussion on building

Basic matters related to the buildings were discussed between the Indonesian representatives and Japanese specialists regarding functions, maintenance and administration, and relationship with the master plan of the BORIF complex.

1) Functions

Tests or analysis for research to be conducted in the facilities will continuously use analytical equipment and facility beginning with sample preparation to measurement and storage. To ensure that these functions are conducted smoothly, the building will be designed to be a one-story building.

2) Operation and maintenance

A low running cost is especially necessary.

a) Minimum air conditioning facilities will be installed, and the building will utilize natural draft.

b) The building will have a high floor to allow easy replacement of equipment pipes, etc. expected in the future.

3) Relationship with master plan of BORIF complex

a) Taking into consideration the existing buildings (BORIF main building) and future plans, the roof profile must be of a flat roof type rather than a mode that accentuates an inclined roof in order to harmonize with the other buildings.

b) The building plot for this facilities will use Block 2. Thus, the Block 3 position will shift slightly northward compared with the master plan. However, this has been verified to cause no problems.

Refer to 3-4 for the BLOCK 2 and BLOCK3.

3-3-6 Outline of project site

(1) Location and ground

This facilities are scheduled to be built inside the BORIF complex located approximately 2 km northwest of the Bogor Botanical Garden in Bogor, approximately 60 km south of Jakarta.

The BORIF main building and warehouses are built in the BORIF complex, and the buildings of this project will be built near the center of BORIF research buildings scheduled to be built in the future.

The ground is nearly flat. At present, part of the ground is used as a test plantation. Weeds have grown on the remaining ground.

(2) Natural conditions

The weather of Indonesia is tropical weather and is divided into two parts, the rainy season between October and March in the following year and the dry season between April and September. The average annual temperature is approximately 27°C, and the temperature does not fluctuate very much throughout the year.

According to monthly meteological data of the MUARA, the humidity is between 72 and 92%, averaging 83%. The annual rainfall is approximately 4,300 mm, approximately 3 times that of Tokyo. Attention must be paid to the construction period and assembly of construction processes. Lightning occurs frequently, and lightning rods meeting the local conditions must be installed. In Indonesia, a seismic belt runs through Sumatra, Java, and Bali, and an aseismatic design will be needed for the buildings.

(3) Present situation of site

The ground in the BORIF complex is nearly flat. The site for the buildings can be leveled merely by weeding. The total area of the ground is about 140,000 m^2. The east and north sides face roads and the west side, a canal, to clearly set border lines. The Central Research Institute for Industrial Crops is located in the south, and the ground is clearly separated. The land owner is verified to be the AARD, and the area has complete infrastructure services, etc. In comparison with similar facilities in the area, the ground size is considered appropriate.

(4) Geological features

According to the ground survey data obtained during the construction of the BORIF main building, the ground for the new building has been verified to require no support by piles, and a direct foundation construction method to place the building foundation directly on the bearing ground will be used.

(5) Public infra-service, etc.

1) Roads

The east side of the BORIF complex faces a paved road approximately 7 m in width and the north side, an unpaved road approximately 6 m in width. The main approach to the BORIF complex at present is through the main gate facing the road on the east side, and graveled roads are built to the various facilities. The approach to the new building will use the existing roads by extending them.

A back entrance is provided facing the road on the north side, and this road can suitably be used for construction purposes.

2) Electric power

A room for the PLN is provided in the BORIF complex to receive 555 kVA. Power to the new building can be obtained by branching from this source.

The voltage is 220 and 380 V and the frequency, 50 Hz. At present, both 220 and 110 V are used in Indonesia. However, as a tendency, the voltages are being unified to 220 V. The

BORIF complex is standardized to 220V, and the new building will use 220 V as a standard voltage.

3) Telephone

Telephone lines are available from the road on the east side of the BORIF complex, and two lines are installed in the existing BORIF main building.

A telephone switching system will be installed in the BORIF main building and branch lines will be extended to the new building.

4) Water supply

A well with a depth of 100 m exists in the BORIF complex, capable of supplying 120 ℓ/min. This well can be used for this project in both quality and quantity.

The BORIF is planning to connect to city water supply in 1987. A city water pipe 100 mm in diameter runs to a point near the main gate of the BORIF complex facing the road on the east side. Due to a shortage in the water supply capacity, additional city water pipes cannot be installed. A new water supply facility is planned in 1987, and new connections will be possible.

5) Drainage

No sewarage pipes are installed in the ground around the proposed project site. Vital water is processed in purification tanks and is drained into the ground through infiltration tanks.

Rainwater is discharged into a stream on the west side of the complex.

6) Gas

There is no city gas supply facility. Propane gas is available using cylinders.

3-4 Master Plan

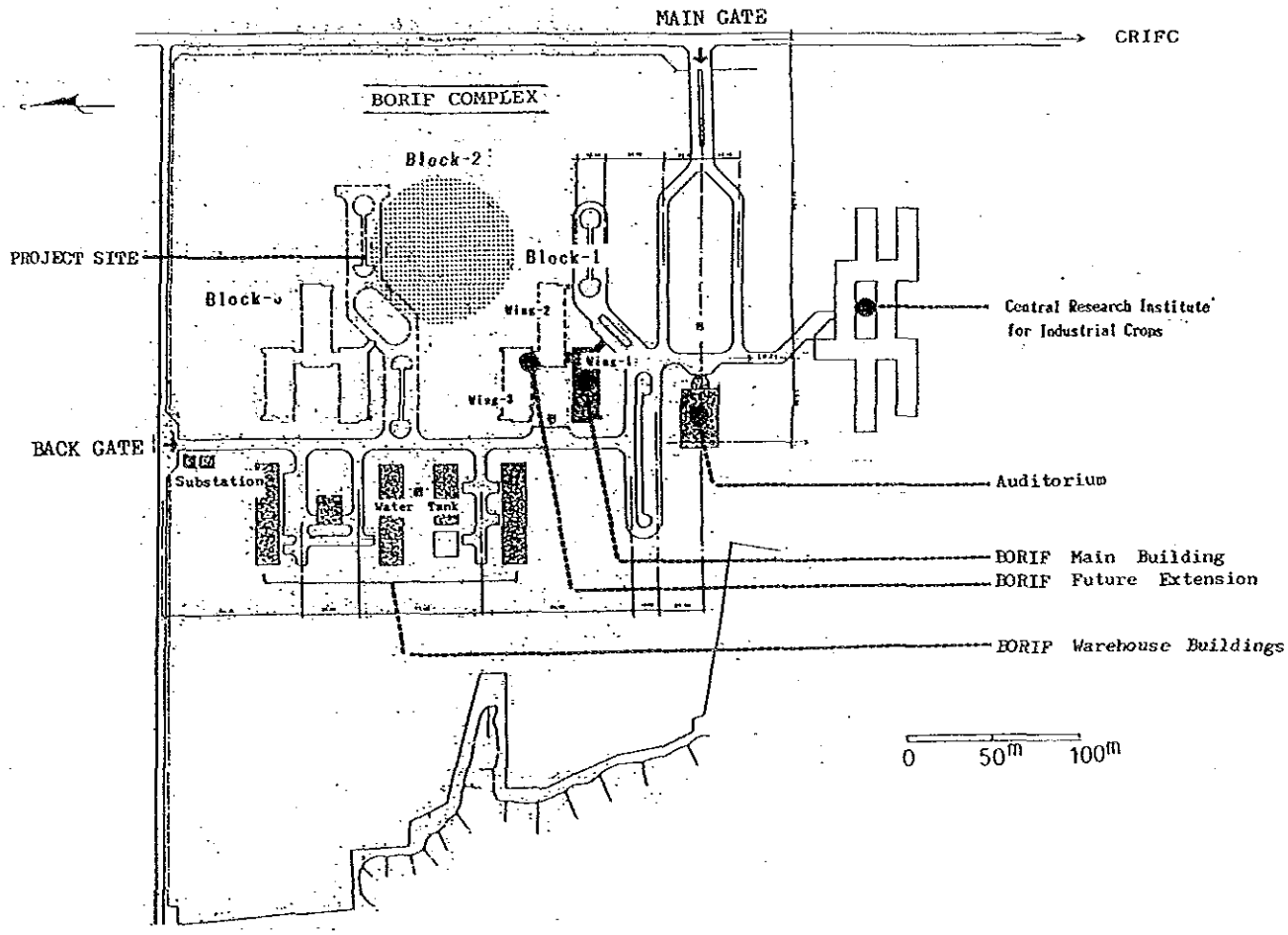
The project site to build the new buildings and the land around it is owned by the AARD, and facilities related to the AARD are built on it. As shown in the drawing, the auditorium in the center, the Central Research Institute for Industrial Crops in the south, and part of the BORIF facilities in the north have been built and are in use.

The group of facilities of the BORIF are called the BORIF complex, and a blueprint for the entire master plan has been prepared. According to this master plan, the BORIF complex consists of warehouse buildings and nine research buildings. The warehouse buildings and one research building were completed two years ago and are now in use.

The BORIF has five research sectors, and the main research facilities of these research sectors are scattered in six locations in Bogor at present. The BORIF is contemplating gathering these facilities in the complex.

The total floor area of the building planned under the master plan is approximately 16,000 m^2, and the building layout is characterized by several symmetry axes.

By further accentuating these symmetry axes, the axes of the existing buildings and of the new buildings will become axes that mutually amplify to achieve a design harmony.


MAIN GATE
CRIFC
BORIF COMPLEX
Block-2
Block-1
Block-3
PROJECT SITE
BACK GATE
Wing-2
Wing-1
Wing-3
Substation
Water Tank
Central Research Institute for Industrial Crops
Auditorium
BORIF Main Building
BORIF Future Extension
BORIF Warehouse Buildings
0
50m
100m

CHAPTER 4 BASIC DESIGN

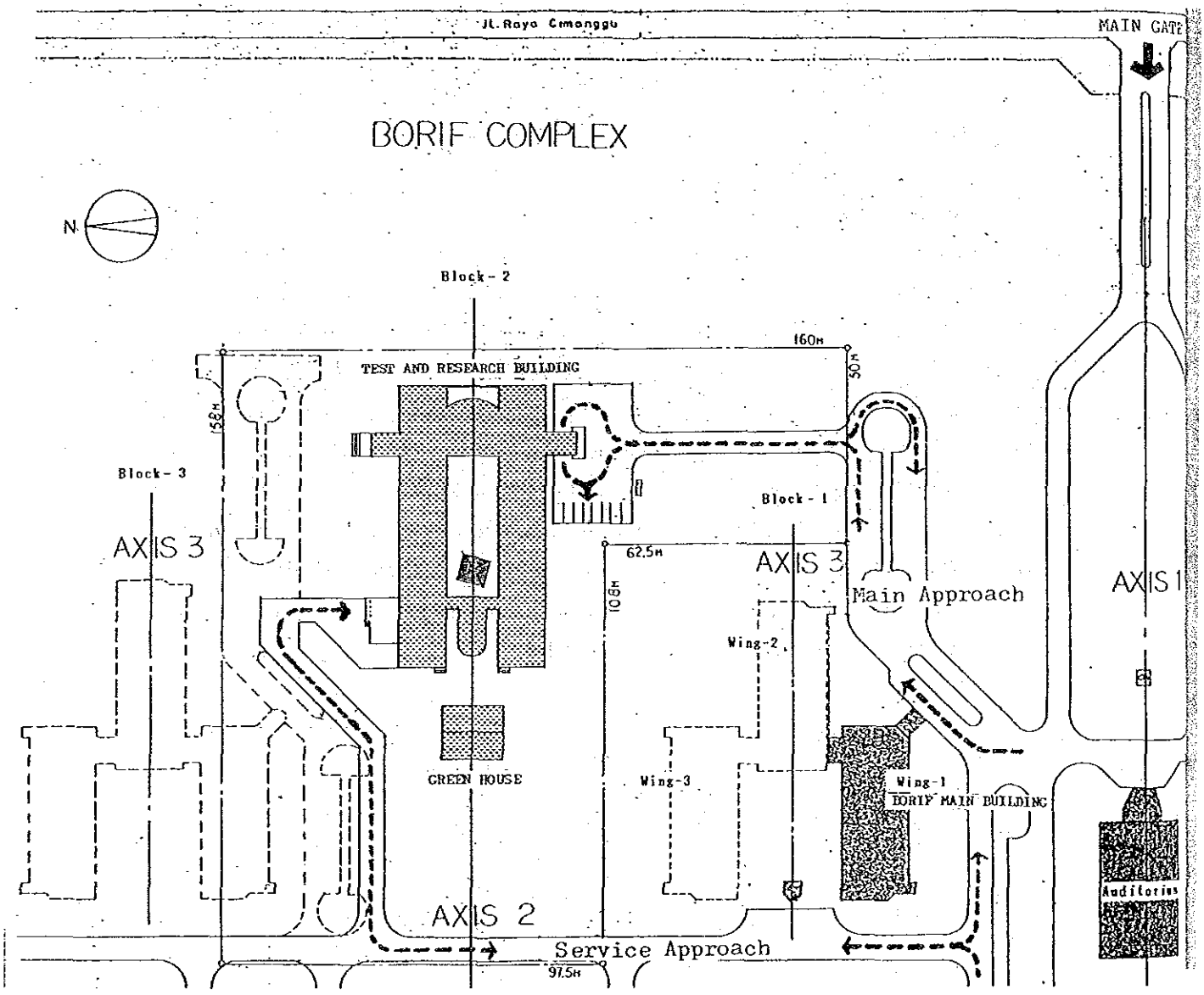
CHAPTER 4 BASIC DESIGN

4-1 Basic Plan

4-1-1 Block plan

The project site will be approached by extending the existing roads inside the BORIF complex. People and ordinary vehicles will approach through the existing BORIF administration building, and the samples will be carried through the road in the west of complex.

A master plan has been prepared for the BORIF complex calling for concentration of the presently scattered BORIF facilities. The master plan has been prepared by the AARD and covers nine research main buildings (3 x 3). They accentuate axis (Axis 1 and 3) east to west together with the existing warehouses. The facilities will be located along these axis to further accentuate these axis. The facilities along the east-west axis will be affected less by low sunshine in the east and west, and larger openings can be provided on both south and north sides, allowing uniform natural lighting in all rooms. The facilities will consist of a research building and a greenhouse. The greenhouse is located on Axis 2 so that other building will not obstruct direct sunshine to it.


Jl. Raya Cimanggu
MAIN GATE
BORIF COMPLEX
N
Block - 2
160M
50M
TEST AND RESEARCH BUILDING
158M
Block - 3
AXIS 3
Block - 1
62.5M
AXIS 3
Main Approach
AXIS 1
108M
Wing-2
GREEN HOUSE
Wing-3
Wing-1
BORIF MAIN BUILDING
Auditorium
AXIS 2
Service Approach
97.5M

4-1-2 Design plan

The design of the existing buildings in the BORIF complex is decorationless and is simple incorporating the so-called modern architectural aspect. The external finish is painted concrete. Windows are aluminum sashes, and deep eaves are provided above the windows. The facilities as a whole accentuates a horizontality. The precondition to designing this facilities is to maintain the harmony and scale unification with the existing buildings in the BORIF complex.

1) The building composition should be simple.

2) Shadows shall be created by providing deep eaves to accentuate the horizontality.

3) The roofs shall have a gentle slope as to appear as if they are flat.

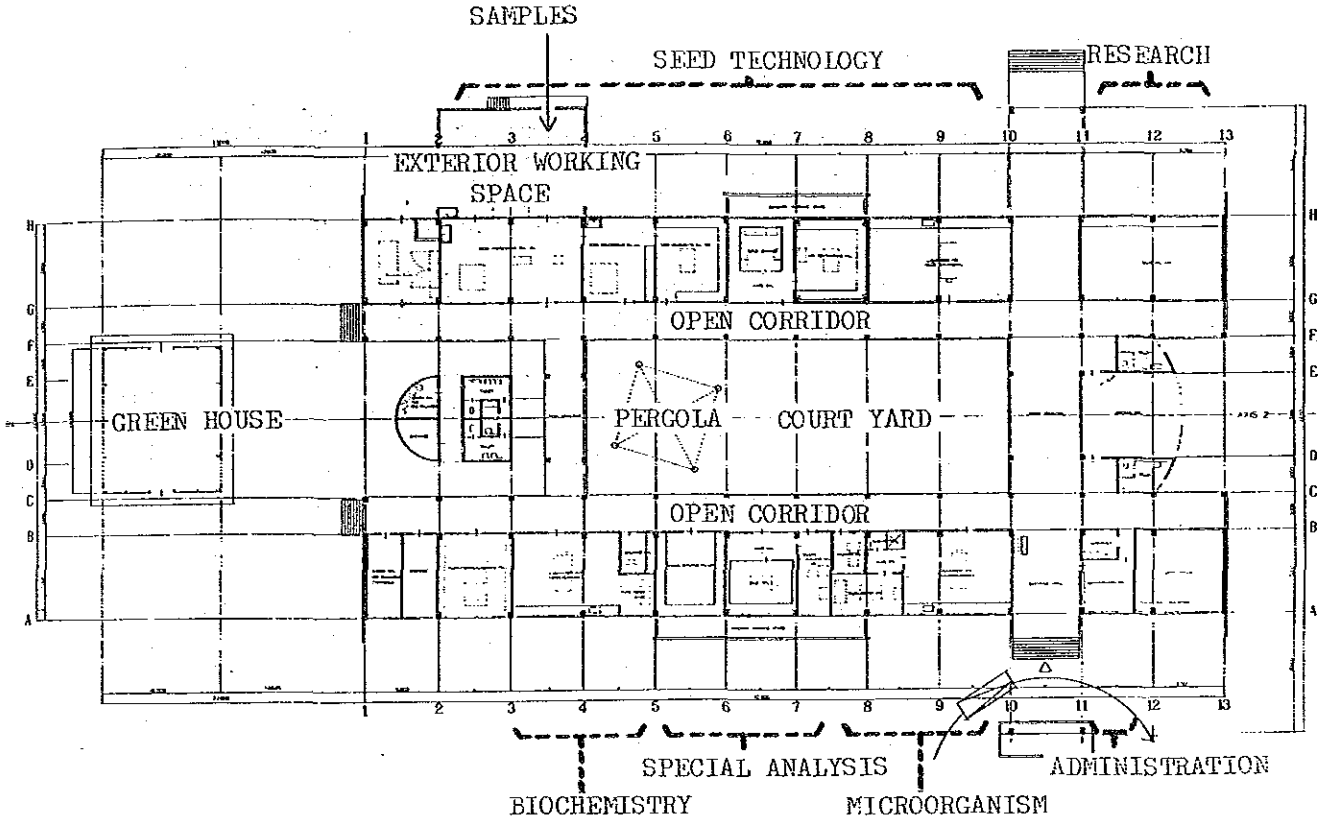
4) Roughly the same finishing materials as those used with the existing buildings shall be used.

4-1-3 Planning

At present, the BORIF has five research sectors - agronomy, plant physiology, plant pathology and entomology, breeding, and social economy. The buildings for these sectors are scattered in Bogor.

The buildings and equipment under this project are for pioneering research to improve: 1. Seeds, 2. Palawija crops production technology, and 3. Palawija crops production technology by using biological techniques. The buildings will be joint test buildings in nature, to be used by the individual sectors as required.

The individual research blocks will have a visual linkage by providing a court yard among them and to achieve coexistence between the large scale outside and intimate spaces inside. No air conditioning will be used except for special laboratories, and ventilation and efficient natural lighting will be obtained for each room by installing corridors whose one side is open. The rooms will be connected using open corridors as traffic lines enclosing the court yard.

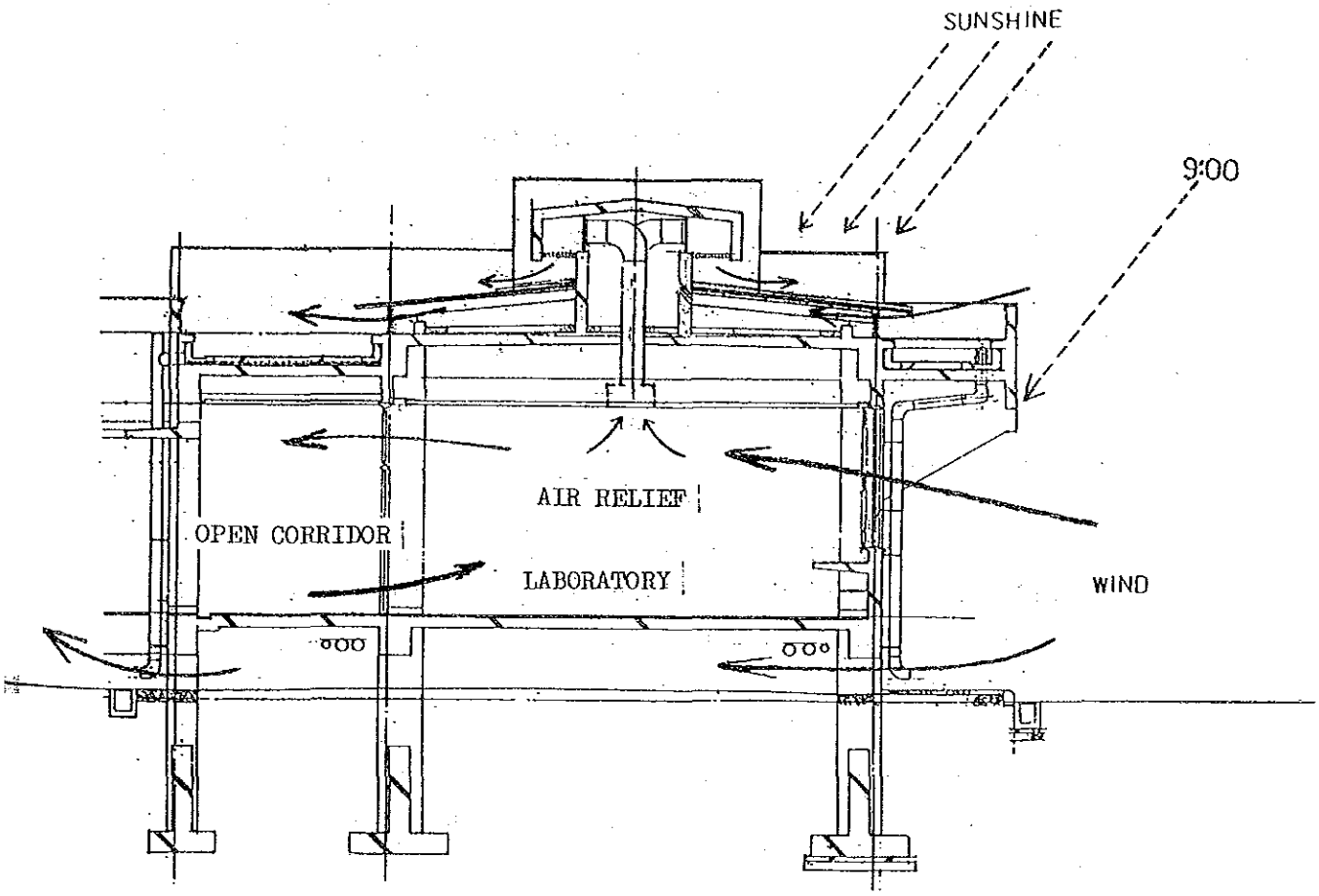

SAMPLES
SEED TECHNOLOGY
RESEARCH
EXTERIOR WORKING SPACE
OPEN CORRIDOR
GREEN HOUSE
PERGOLA
COURT YARD
OPEN CORRIDOR
SPECIAL ANALYSIS
ADMINISTRATION
BIOCHEMISTRY
MICROORGANISM

4-1-4 Section planning

The building will be a one-story building and will have a high floor (1.2 m high above the ground) for easy replacements and changes of piping, wiring, etc. in the future. The high-floor building will be effective from the standpoint of humidity control, ventilation, etc. These elements are essential to sample harvesting, preparation, and storage.

The roof will be made of concrete slabs with aluminum covering. This construction prevents water leakage, enhances heat insulation, and lowers the running cost. The deep eaves shield direct sunshine to reduce the cooling load inside the rooms and assure uniform natural lighting and good room environment.

As mentioned, this facilities will have no air conditioning except for special laboratories. Under this condition, high ceilings are indispensable. However, taking economy into consideration, the ceiling height will be 3 m. Assuming that no air conditioning facilities will be installed, ordinary laboratories will be ventilated 5 times per hour and laboratories that will use chemicals, 10 times per hour. Ventilation machines will be installed as necessary. However, for natural ventilation effect, one side of the corridors will be open.



SECTION PLANNING

4-1-5 Structural planning

(1) Project policies

1) To use a structural system optimal to the site condition, climate, building size, and use purposes.

2) To use a structural system that takes fully into consideration the local construction material supply capability, material quality, architectural technology, etc. The structural materials will be procured entirely in Indonesia.

3) To use a simple and clear structural system, economical and durable.

(2) Structural design

1) As a principle, the structural system will be ferroconcrete rigidframe construction, which is the common structural system in Indonesia. Walls will have concrete or bricks filled in the framework.

2) The structure is simplified by uniformly allocating pillar spacings as a pillar layout suitable to support the vertical load.

3) The greenhouse will have a steel construction with pillars and beams becoming smallest members to minimize effects of sunshine.

4) Design standard

At present, Indonesia allows the use of the Indonesian National Architectural Structure Standard, Architectural Movable Load Regulation, Ferroconcrete Structural Regulation, ASTEM, BS, and JIS, as structural design standards. The buildings will be planned in this project in accordance with the JIS standard.

5) Design load

The design load will be set as follows:

a. Fixed load

The unit volume weights of principal materials will be as follows:

Ferroconcrete	2.4 tons/m^3
Red brick	2.6 "
Aluminum roof bed	1.0 "

b. Movable load

The movable loads of typical rooms are set as follows:

	For floor structural calculations	For main beam, pillar, & foundation	For seismic force
° Administration office, meeting rooms, staff rooms	300kg/m^2	180kg/m^2	30kg/m^2
° Laboratories	300kg/m^2	180kg/m^2	80kg/m^2
° Roof	90kg/m^2	60kg/m^2	30kg/m^2
° Corridors	350kg/m^2	320kg/m^2	60kg/m^2
° Warehouse	500kg/m^2	350kg/m^2	150kg/m^2

c. Seismic force

A seismic belt runs through Indonesia, and a large number of earthquakes have been recorded. This project sets the seismic force to be K = 0.1 meeting its structural plan in accordance with the Japanese earthquake load standard after taking the Indonesian seismic load standard into consideration.

d. Wind pressure

Based on data of maximum wind pressures in various parts of Indonesia, a wind velocity of 20m/sec and wind pressure of $20\sqrt{h}$ kg/m^2 will be used.

6) Principal structural materials

Based on the JIS standards of Japan, the following allowable unit stresses will be used:

a. Concrete

Design 28 day strength	Fc = 210 kg/cm^2
Slump	15 cm

b. Reinforcing steel

Type	Long Term	Short Term	JIS Material
Ordinary round steel	1,600 kg/cm^2	2,400kg/cm^2	SR24
Deformed round bar	2,000 kg/cm^2	3,000kg/cm^2	SD30
	2,200 kg/cm^2	3,500kg/cm^2	SD35

c. Steel frame

Type	Long Term	Short Term	JIS Material
H-section steel	1,600 kg/cm^2	2,400kg/cm^2	SR41
Steel plate	1,600 kg/cm^2	2,400kg/cm^2	SR41

4-1-6 Utility planning

A rational equipment plan matching this project will be set taking into consideration economy in maintenance and management, easiness of maintenance and checks, and installability based on the general local conditions.

(1) Electrical installation

Electrical Installation	Local Condition	Study Item	Selection
Generator	Yes	Installed for air conditioning of research and storage equipment in excessive voltage drops that cannot be handled by voltage stabilizer of for power failures.	Yes
Laboratory illuminance and lighting outlets type	200 - 400LX Direct mounting type	Conforms to local conditions. "	300LX Direct mounting type
Office illuminance and lighting fixture type	200 - 400LX Direct mounting type	Conforms to local conditions.	300LX Direct mounting type All plug sockets used with equipment are equipped with ground.
Telephone facilities	Yes		Yes
Fire alarm system	Sensor push-button and bell	Smoke sensors will be installed in rooms that will contain equipment which will emit heat and in rooms that will contain a large number of equipment. Buttons with a bell will be installed in other rooms.	Yes

Electrical Installation	Local Condition	Study Item	Selection
AVR facilities	Installed in some facilities.	A voltage stabilizer to prevent voltage drops has to be installed as a large number of research, observation, and measuring instruments do not indicate readings correctly due to their precision if a voltage drop occurs.	Yes
Voltage	110V 220V 380V	Most of the equipment will receive power supply at 220V. However, some low-temperature constant-humidity ovens, low-temperature seed storage chambers, etc. use power supply at 380V.	220V 380V

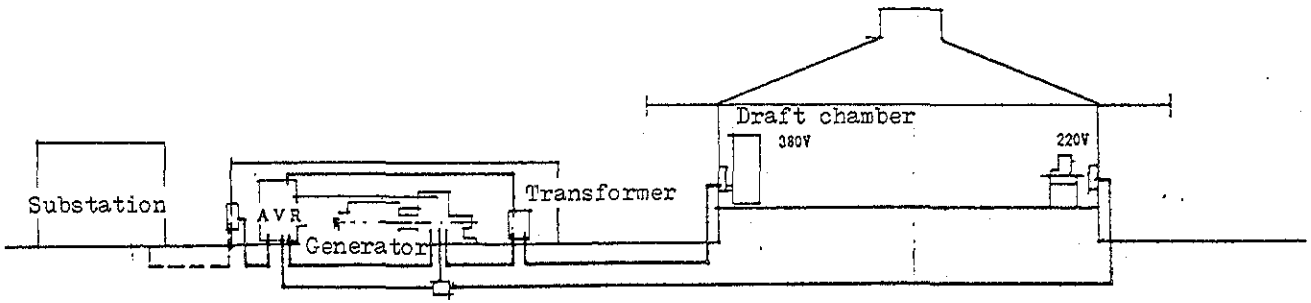
(2) Water supply and drainage installation

Water supply and Drainage Installation	Local Condition	Study Item	Selection
Water supply quantity			$7m^3$/day
Water supply system	Gravity system	Conforms to local condition	Gravity system
Heat source for hot water	LP gases are generally used.	Conforms to local condition.	LP gas
Drainage system	Direct discharge, septic and suction tanks	Considering special characteristics of research and after studying similar facilities in the region, the building will separate laboratory waste water and toilet drainage water and will process them separately. An open retention sedimentation tank will be installed to accelerate evaporation of the solvent that has entered the laboratory drainage system to retain more than one day and to prevent gases flowing back to pipes. Chemicals used in laboratories are not discharged to the drainage system, but are recovered in recovery containers immediately. The apparatus used in tests is immersed in a detergent to sterilize. This method is used in Indonesia, and the used detergent is neutralized and is flowed to the drainage system.	Retention and suction tanks will be installed in the laboratory drainage system and septic tank and suction tanks will be installed in the filth water system.

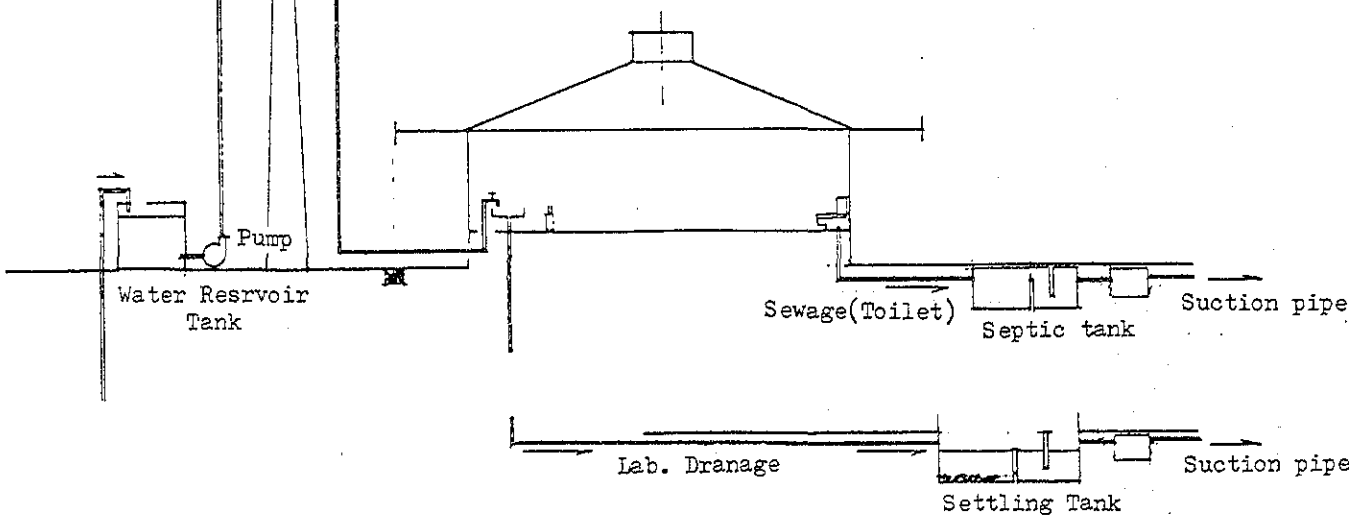
Water supply and Drainage Installation	Local Condition	Study Item	Selection
Gas equipment	LP gas	Conforms to local condition.	LP gas
Firefighting equipment	Outdoor hydrant	To be installed in accordance with guide rules of Indonesia.	Outdoor hydrant
Piping material ° Water supply pipe	Steel pipe	Conforms to local condition.	White gas pipe
° Waste water pipe	Vinyl chloride tube	Conforms to local condition.	Vinyl chloride tube
° Filth water pipe	Vinyl chloride tube		Vinyl chloride tube

POWER SUPPLY SYSTEM

WATER SUPPLY & DRAINAGE SYSTEM



POWER SUPPLY SYSTEM



WATER SUPPLY & DRAINAGE SYSTEM

(3) Air conditioning installation

Air Conditioner	Local Condition	Study Item	Selection
Air conditioner heat source	Electric power	Conforms to local condition.	Electric power
Air conditioning (cooling) system	Central air conditioning system. Room air conditioner	System matching room use purpose. 100% OA air conditioning system will be used in sterilization room. To conform to local condition.	Room air conditioners are installed in special rooms, and package-type air conditioners is to be used in sterilization rooms.
Room temperature and humidity ° General rooms	During cooling DB 24 - 26°C RH 50%	Set temperature and humidity will be slightly higher to lower the running cost.	DB 27 - 28°C RH 78%
° Storage chambers		To conform to use purpose.	
° Exterior temperature and humidity	Indonesia DB 35°C RH 78%	Conforms to local condition.	
Degree of air conditioner and dust collection	Equivalent to room air conditioner prefilter	To match room use purpose.	Neutral filter (sterilization room) and prefilter will be used.
Number of ventilation operations ° General rooms	5 to 7 times/hr	Conforms to local condition.	5 to 7 times/hr. More than 10 times/h for rooms that will use harmful chemicals.
° Toilets, warehouses, etc.	15 times/h	Conforms to local condition.	15 times/h

Air Conditioner	Local Condition	Study Item	Selection
° Operation system	Separate operation	Conforms to local condition.	Separate operation
° Air conditioner operation hours	As a principle, approx. 7h/day	Conforms to local condition.	7h/day. 24-hour operation in stock chambers.
Automatic control equipment			
° Equipment control	Separate control	Conforms to local condition.	Separate control
° Warning system	None	Warning system will be installed to safeguard samples in stock rooms.	Only warning system is installed.
Staff required for management	Custodians will be stationed.	Shall be a method easy for operation and management.	Shall be a system easy to operate by custodians and by researchers.

(4) Ventilation facilities

Ventilation method is a particularly important problem for laboratories that will handle chemicals. The proposed building will be a one-story building, and air will be introduced from desired locations in the ceiling of rooms to underneath the roof through vertical ducts. Air will be emitted through the top part of the roof. This solves repollution by deposition of harmful substances in ducts by using many horizontal ducts as generally used and will be particularly effective in this building.

4-1-7 Material planning

Architectural materials will be selected taking into consideration building uses and functions, meteorological conditions, ambient environments, construction methods, material procurement conditions, etc.

The following requires special attention in selecting materials for the proposed building:

(1) To meet performance and functions required for research and tests.

(2) To have sufficient resistance and durability: Resistance to chemicals, weatherability, and waterproofness.

(3) To allow easy maintenance work. Cleanliness can be maintained easily.

(4) To harmonize well with existing buildings.

1) Principal exterior finishing materials

		Finishing Materials to be Used in Building of This Project	Finishing Materials Generally Used with Similar Buildings in Indonesia
Research Building	Roof	Roof slabs + aluminum roof material	Roof tile
		Roof slabs + asphalt water-proofing	Roof slabs + water-proof paint coating
	Exterior walls	Acryl paint coating on placed concrete	Acryl paint coating on placed concrete
	Fittings	Aluminum sash	Aluminum sash

		Finishing Materials to be Used in Building of This Project	Finishing Materials Generally Used with Similar Buildings in Indonesia
Greenhouse	Roof	Wired glass	Wired glass
	Exterior wall	Stainless steel netting,	Stainless steel netting
	Fittings	Aluminum sash	Aluminum sash

NOTES

1. To select materials that prevent water leakage and that have high heat insulation effects, as well as weatherproof, to lower the running cost.

2. This is the most suitable material for the prevention of water leakage.

2) Principal interior finishing materials

		Finishing Materials to be Used in Building of This Project	Finishing Materials Generally Used with Similar Buildings in Indonesia
Laboratory Sterilization room Special Analysis Room (1 Balance Room (2)	Floor Baseboard Wall Ceiling Fitting	By welding long vinyl chloride sheet *1 Vinyl baseboard Mortar and paint Asbestos board and paint Aluminum sash	By welding long vinyl chloride sheet Terrazzo topping Mortar and paint Asbestos board and paint Aluminum sash
Staff Room Administration Office	Floor Baseboard Wall Ceiling Fitting	By welding long vinyl chloride sheet Vinyl baseboard Motor and paint Rock wool acoustic board *2 Aluminum sash	Terrazzo block Terrazzo block Mortar and paint Gypsum board and paint Aluminum sash
Entrance Hall Corridor	Floor Baseboard Wall Ceiling	Ceramic tile 300 x 300 Terrazzo block Mortar and paint Rock wool acoustic board	Teazzo block Teazzo block Mortar and paint Rock wool acoustic board
Toilet	Floor Baseboard Wall Ceiling	Mosaic tile 100x100tile Asbestos board and paint Plywood flush and paint	Mosaic tile 100x100 tile Plywood flush and paint Plywood flush and paint

NOTE:

*1. Optimal material that resists chemicals as chemicals will be used, that keeps rooms clean (materials that will have seams or joints are not suitable), that has a good workability (hard materials such as terrazzo easily fatigue and break), and for other reasons.