BASIC DESIGN STUDY
ON
THE VEGETABLE AND FRUIT
RESEARCH AND DEVELOPMENT PROJECT
IN
THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

AUGUST, 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

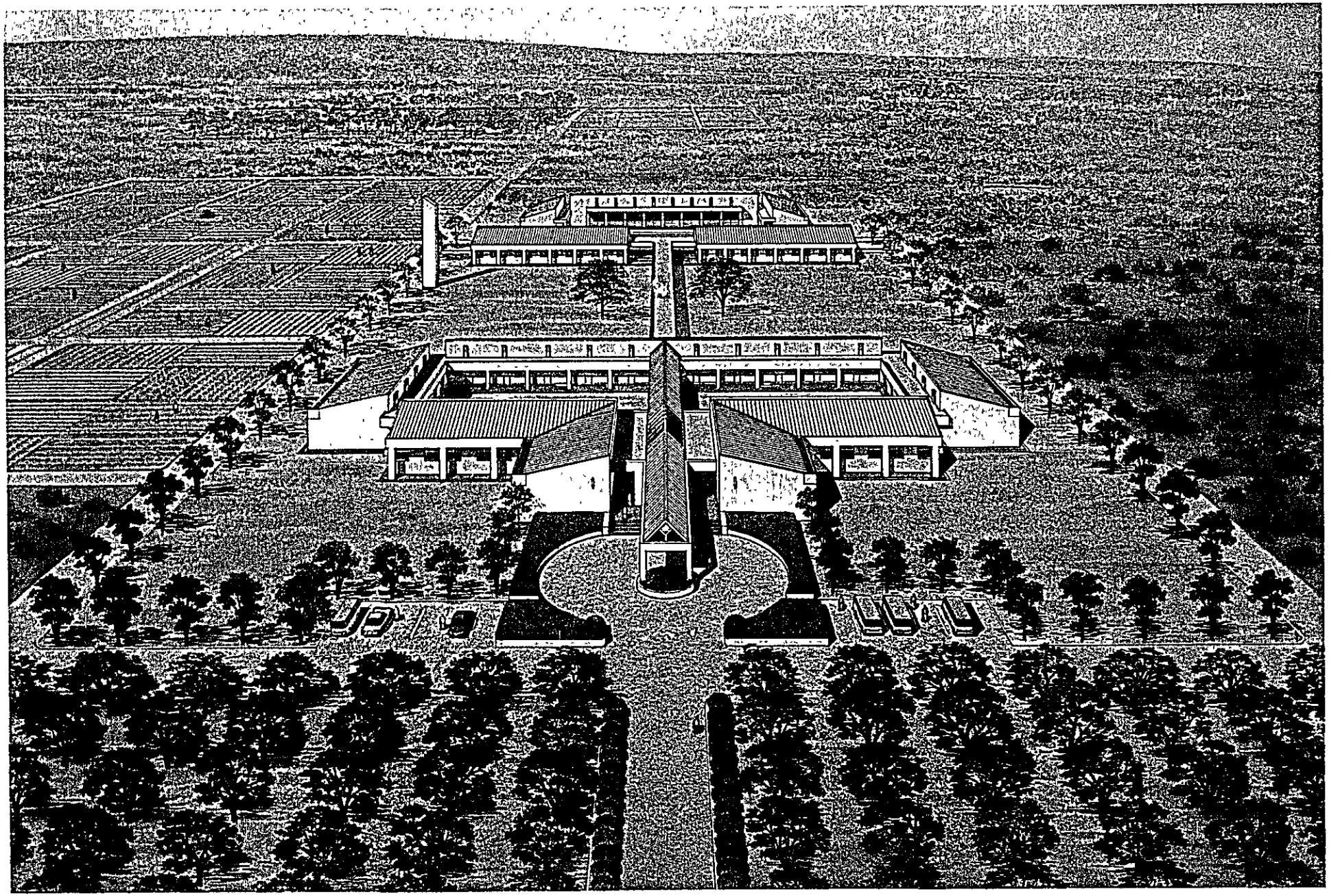
In response to the request of the Government of the Socialist Republic of the Union of Burma, the Government of Japan decided to conduct a Basic Design Study on the Vegetable and Fruit Research and Development Project and entrusted the survey to the Japan International Cooperation Agency (JICA). JICA sent to Burma a study team headed by Dr. Isao Iwagaki, Okitsu Branch, Fruit Tree Research Station, Ministry of Agriculture, Forestry and Fisheries, from April 1 to April 21, 1984. The team had discussions with the officials concerned of the Government of Burma and conducted a field survey. After the team returned to Japan, further studies were made and 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 Socialist Republic of the Union of Burma for their close cooperation extended to the team.

August, 1984

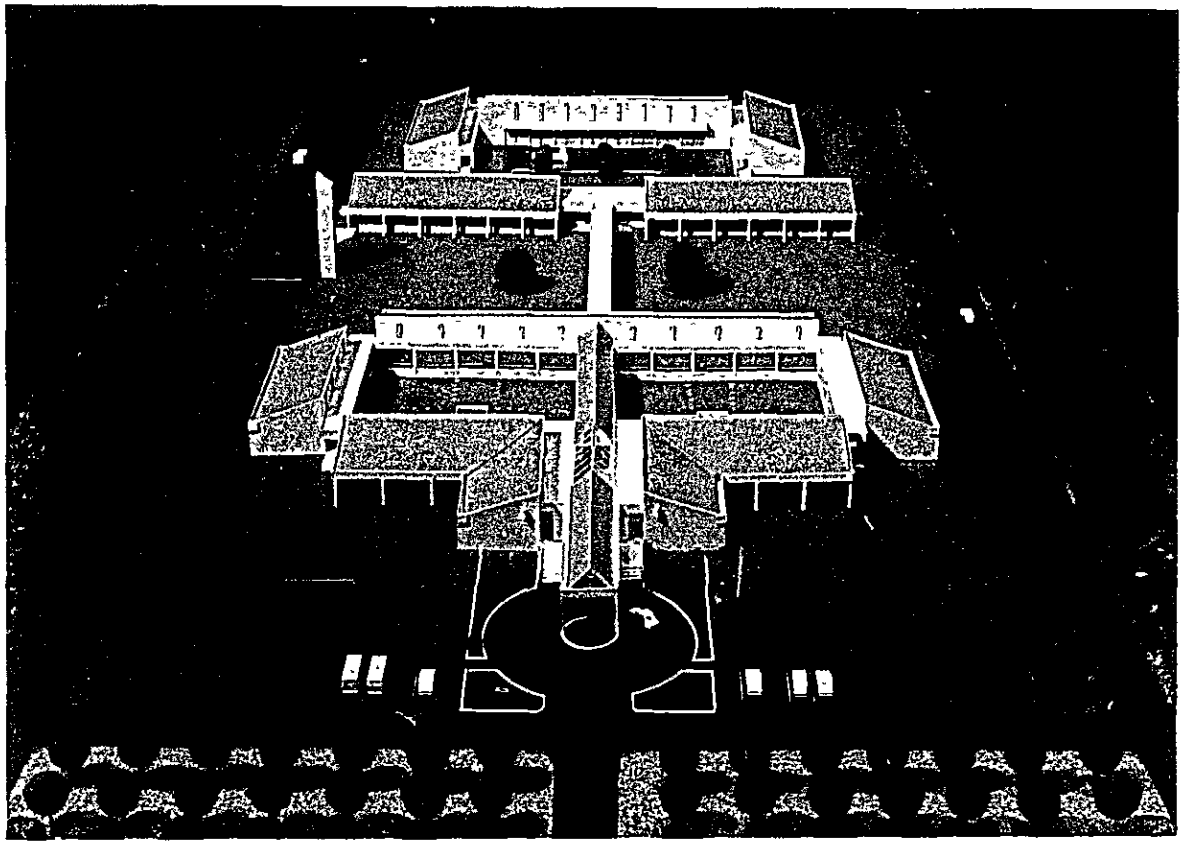
Keisuke Arita

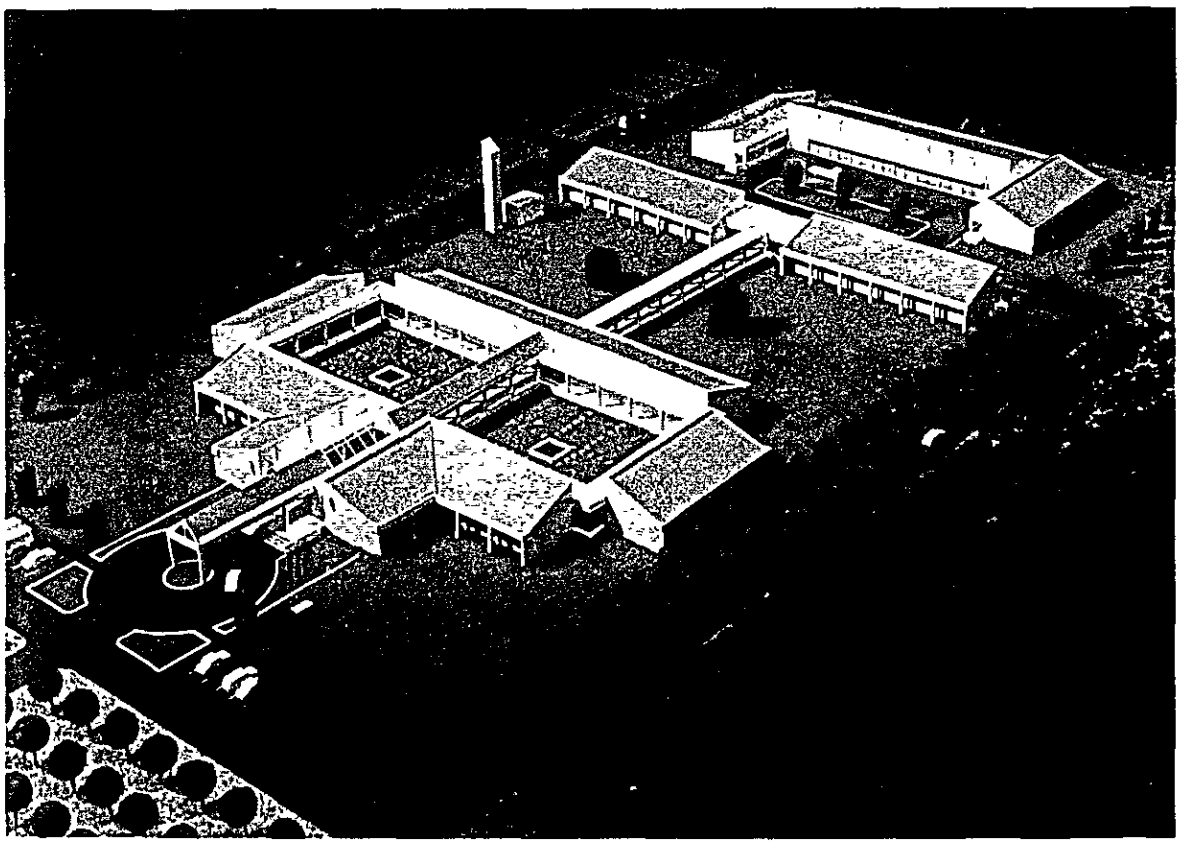
Keisuke Arita
President
Japan International Cooperation Agency



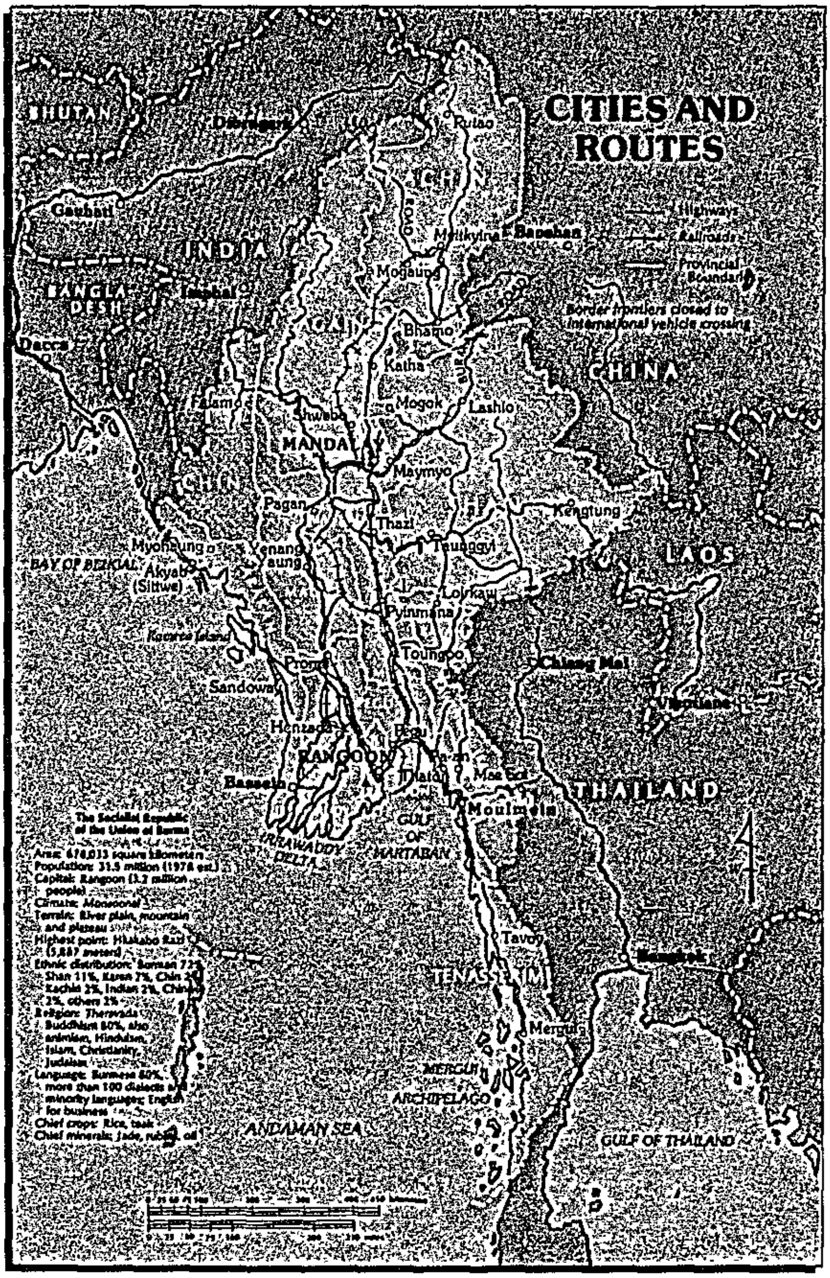
THE VEGETABLE AND FRUIT RESEARCH AND DEVELOPMENT PROJECT

PERSPECTIVE



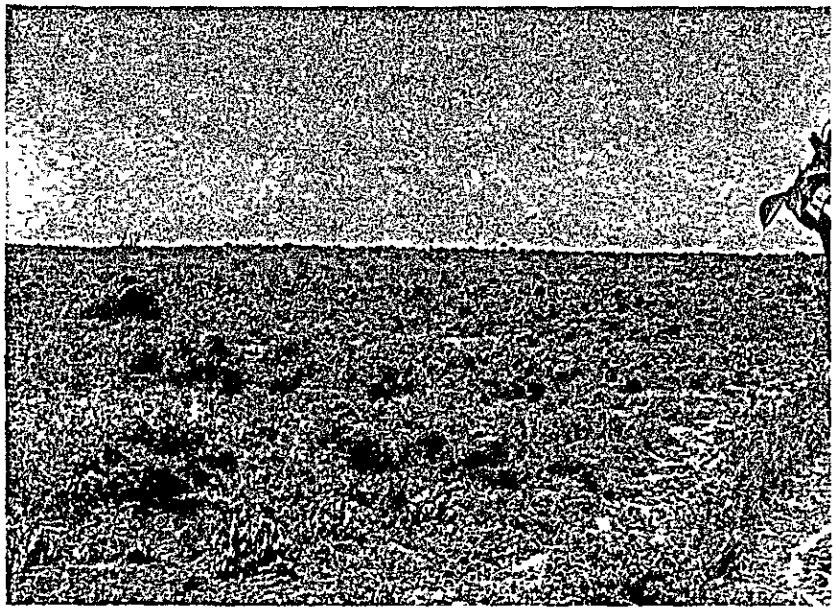


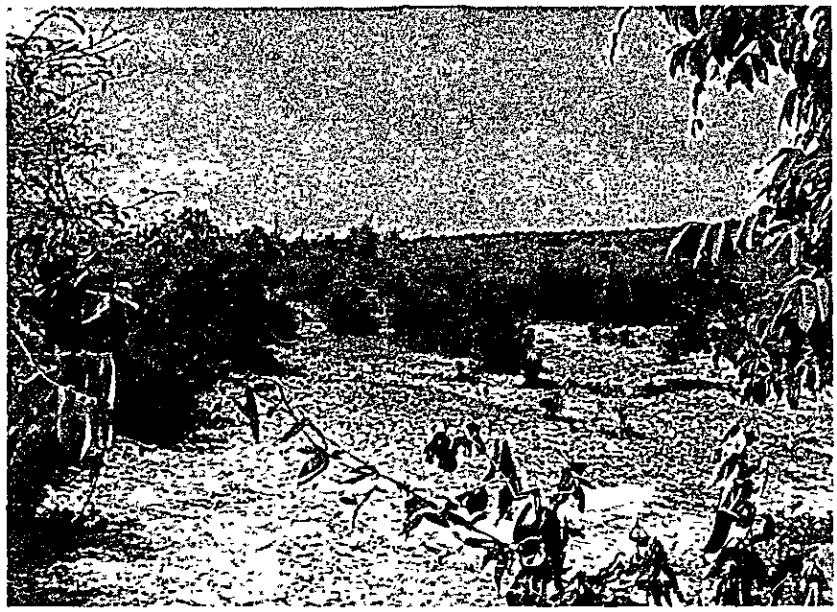
MODEL

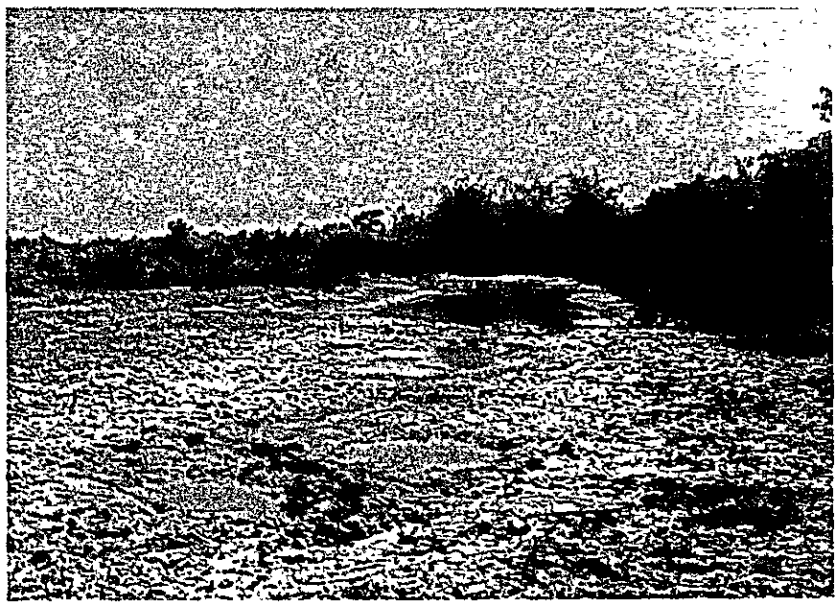

CITIES AND ROUTES
Highways
Railroads
Provincial Boundaries
Border frontiers closed to international vehicle crossing
BHUTAN
INDIA
BANGLA DESH
CHINA
LAOS
THAILAND
Gauhati
Dacca
Putao
Myitkyina
Mogaung
Bhamo
Katha
Mogok
Lashio
Shwebo
MANDALAY
Maymyo
Pagan
Thazi
Taunggyi
Kengtung
Myohaung
Akyab (Sittwe)
BAY OF BENGAL
Loikaw
Pyinmana
Toungoo
Prome
Sandoway
Henzada
Pegu
RANGOON
Bassein
Thaton
Moulmein
Mae Sot
GULF OF MARTABAN
IRRAWADDY DELTA
Chiang Mai
Tavoy
TENASSERIM
Bangkok
Mergui
MERGUI ARCHIPELAGO
ANDAMAN SEA
GULF OF THAILAND
The Socialist Republic of the Union of Burma


Minhla
Nyaunglebin
Shwegyin
Ingabu
Henzada
Tharrawaddy
Lemyethna
Nyaungkhashe
Kyonpyaw
Pegu
Thanatpin
SITE
Danubyu
Kyaunggon
Pantanaw
Kayan
Thongwa
RANGOON
Syriam
Bassein
Thaton
Belin
Shwegun
Pa-an
Gulf of Martaban
Martaban
Moulmein
Chaungzon
Kawkareik
Mudon
Pyapon
Amherst
Thanbyuzayat
SOUTH OF BURMA
Railroads
Highways
Irrawaddy Delta

MAP OF BURMA

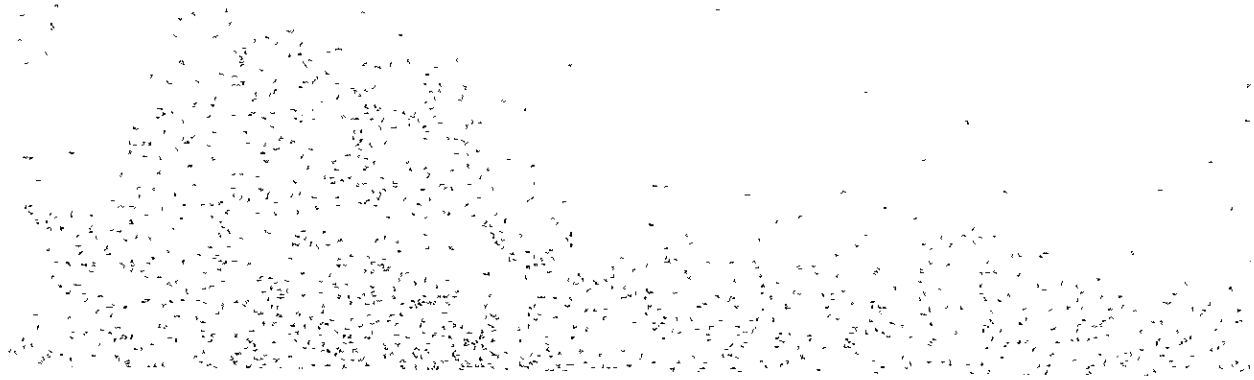






CONSTRUCTION SITE
FOR MAIN CENTER

SUMMARY



SUMMARY

The Socialist Republic of the Union of Burma is traditionally an agricultural country, which is now trying to transform itself into an agricultural and industrial country based on agricultural production. The economy of Burma is largely supported by export of agricultural products, especially of rice, which makes up 40 percent of the total exports. Various attempts have been made to increase the production of rice. These attempts proved to be steadily effective.

On the other hand, export of rice is now facing severe conditions in the international market, such as the depreciation of the price of exported rice. Therefore, the next step is to improve the quality and to promote diversification of products in order to enlarge export of other agricultural products, as well as to improve the international competitive power of rice.

Burma makes it a principle to be self-sufficient in providing its own food supply. Its policy is first to meet the domestic demand and then to export the surplus of the products.

Therefore, first of all, it is important to improve the productivity of all agricultural products as well as rice for which measures to improve its productivity have been taken.

Burma has a long history of cultivating vegetables and fruits. Its natural resources, rich in variety, has a large potential in increasing their production. In spite of these conditions, full-scaled researches in increasing their production has not yet been made and there still remains latent in their development.

On the other hand, the effect of vegetables and fruits on the nutrition and health of the people is immense. The improvement in quality and productivity of various agricultural products may contribute greatly in export. The Government of Burma recoginizes these potencialities and is seeking a way to launch a full-scale development project in increasing vegetables and fruits production. As the first step, the Government of Burma requested Japanese Grant-Aid Assistance for establishing necessary facilities such as the Vegetable and Fruit Research and Development Center, and procurement of necessary equipment for those facilities including Technical Cooperation from Japan.

Although Burma is blessed with fertile soil and a varied climate –from a temperate climate to a tropical one–, the present situation in vegetables and fruits production is limited. The vegetables and fruits acreage now is very small compared with the total acreage of cultivated land, and the yield per acre is also small. Moreover the production is sometimes suspended in certain seasons. These circumstances and a lack of transportation make it impossible to sustain a permanent supply throughout the year. In order to solve these problems, the commencement of fundamental research, starting with the collection of proper breeds is essentially needed. Because considerable time and technical improvement are indespensable for this research, the most effective and full-scale research must be swiftly launched.

The Government of Burma recognizes the importance of these problems, and is now pushing this project as one of the important projects of the Agricultural Development Projects which

concerns the Fourth Four-Year Plan of the Twenty-Year Long-Term Plan.

The long-range objectives of this project are; to meet the domestic demand; to improve the nutritive conditions of the people; to export the surplus to acquire foreign currencies. In order to achieve all these objectives, the improvement in both quality and quantity of vegetables and fruits production is regarded as an immediate target.

This project, therefore, will start with a fundamental researches in the following four (4) sections:

1. Breeding
2. Cultivation
3. Disease and insect control
4. Soil and plant nutrition

For these researches and developments, a Main Center is to be built at Hlegu about 60 km northeast of Rangoon, with four (4) main laboratories of Vegetable Research, Fruit Research, Disease and Insect Control Research, and Soil and Plant Nutrition Research, as well as other facilities such as experimental rooms, fields for practical experiment investigation and essential equipment and materials for these investigations. There are also designate six (6) farms out of the existing experimental farms of the Agricultural Corporation for this project and to supply them with essential equipment, making one of them Sub-Center. The contents of this project are as follows:

1. Main Center

Area:	100 ha.	
Location:	Hlegu, Rangoon Div.	
Building:	Approx. 4,600 m²	
	Main Building	
	Farm Supervision Building	
	Community Building	
	Storehouse	
Experimental Field:	For vegetables	6 ha.
	For fruits	35 ha.
Equipment:	For research	
	For experimental farm	

2. Sub-Center

Area:	30 ha.
Location:	Maymyo, Mandalay Div.
Equipment:	For research
	For experimental farms

3. Five (5) Regional Experimental Farms

Total area:	800 ha.

Location:	Madaya, Mandalay Div.
	Kyaikhto, Mon State
	Ma-ubin, Irrawaddy Div.
	Taunggyi, Shan State
	Haka, Chin State
Equipment:	For research
	For experimental farms

The cost of the project is estimated to be 2.19 billion Yen (Japanese Grant-Aid) and the necessary construction period is approximately 13 months, supposing that the consturction should start 3 months before the rainy season.

The Agriculture Corporation belonging to the Ministry of Agriculture and Forests will be responsible in the execution of this project. One independent division will be established for this particular project in the Agricultural Corporation, and will be operated under the supervision of the Managing Director of the Agriculture Corporation. The nation-wide extension of the results of this project is so programmed as to produce a steady effect through cooperation with various agencies in charge within the Agriculture Corporation.

When breeding and cultivating technique is improved owing to the execution of this project, vegetables and fruits in Burma will be diversified and improved in quality which will hold promise for the improvement of productivity to a great extent. Research of diseases and insects control, soil and nutrition will support the stable improvement. This fundamental research and development will have great influence in the society and the economy of Burma, as follows.

1. Increase of the supply for the domestic consumption will make the better nutritive balance of the people and help to improve the health standard.

2. Under the condition that the transportation and distribution network will be well established, the market for vegetables and fruits, which is now no more than on-the-spot consumption, will be extended, and the stability of the supply throughout the year will be possible.

3. When the production of vegetables and fruits promises a cash income, some of the farmers will specialize in growing vegetables and fruits. This will contribute to the economic development of farm areas and can help to ameliorate the economic disparity between rural and city.

4. A surplus brought about by the improvement in productivity and quality will be exported so that measures for acquiring foreign currencies will be established.

5. Introduction of processing and preservation techniques will enlarge the marketability of vegetables and fruits, which promises a new role for production of vegetables and fruits

in the diversification and industrialization of agriculture.

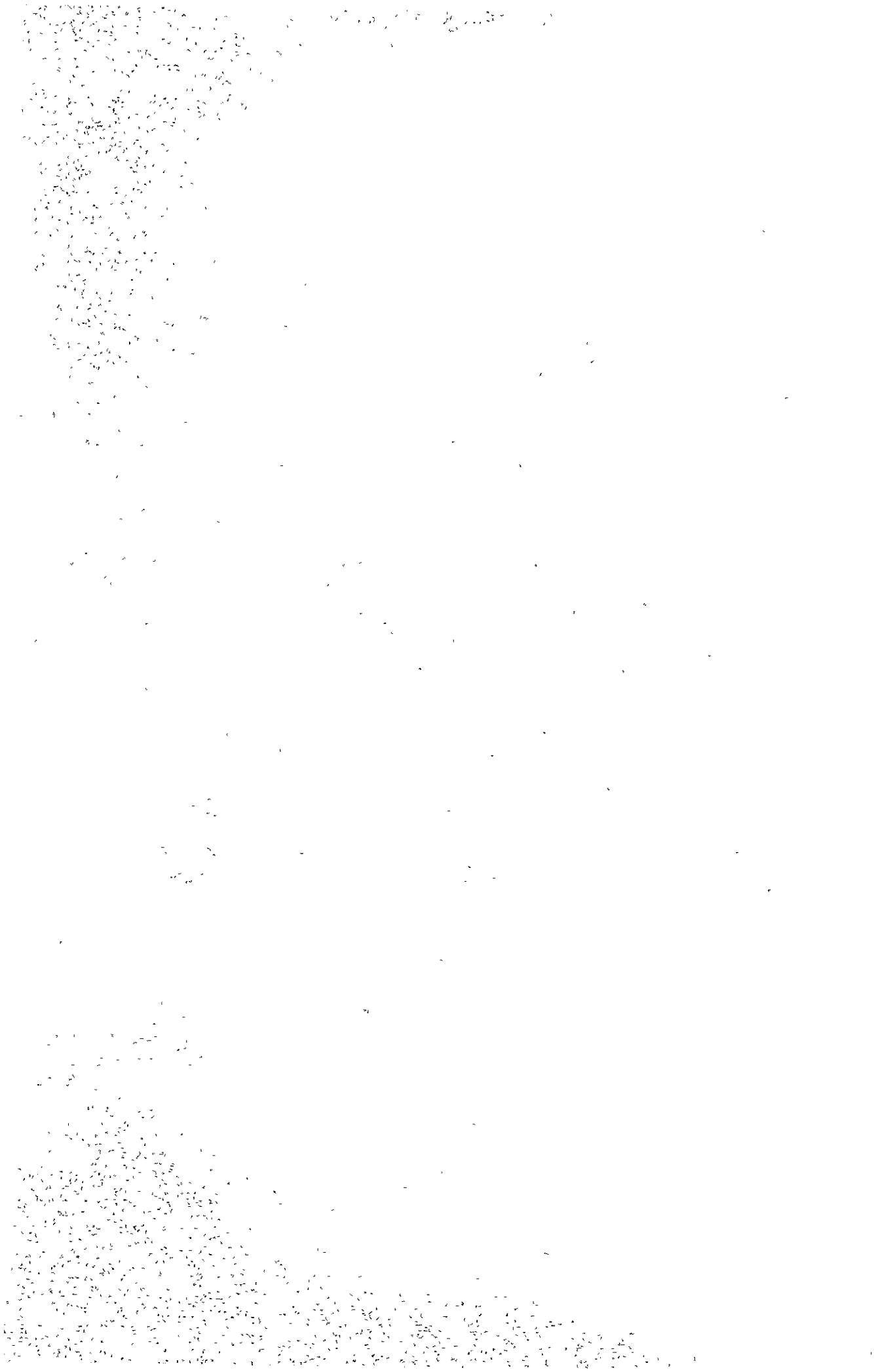
Thus this project is the first, fundamental attempt to improve the productivity and to promote diversifications of vegetables and fruits in Burma, and promises great benifits in the future. The Government of Burma, therefore, is trying enthusiastically to promote this extremely significant project.

However, there surely exist certain problems which are to be solved urgently in regard with the construction and the management systems after the completion of the construction.

The first problem to be solved is the schedule. Burma has a long rainy season from the middle of May to the middle of October whose precipitation is great. Therefore, earth works should be completed before the rainy season, and without the completion of earth works before the rainy season, all the construction works will not be able to be completed within the proposed schedule. Secondry, as there is presently no access road from the main road to the site where the Main Center is to be built, the construction of this access road, included in the scope of works by Burma, should be completed before the main construction works are commenced. This is an essential and indispensable condition to start the construction works. The period for all procedures after Exchange of Notes (E/N), for preparatory works such as construction of access road and for main construction works from commencement to completion of the works are very tight, in order to complete this project by the end of March, 1986, it is indispensable that whole schedule is to be traced strictly to the planned schedule without any delay.

Finally, there is a problem regarding the number of researchers after the completion of the construction and the commencement of research and development activities. A considerable number of researchers in each field are required in this project. However, the number of researchers of vegetables and fruits at present in Burma is very small. Under these circumstances, the Japanese technical cooperation is to be needed in order to make the research in various fields effective, from fundamental research to extension techniques of research results, and also to make the grant-aid from Japan fruitful.

CONTENTS



CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

In response to the request by the Socialist Republic of the Union of Burma (hereinafter referred to as the Government of Burma) for the implementation of the Vegetable and Fruit Research and Development Project, the Government of Japan sent, through the Japan International Cooperation Agency, the first preliminary study team to the site for eleven (11) days from August 8 to August 18, 1983. They studied the background and the contents of the request through exchanging opinions with the authorities of the Government of Burma which were participating in this project. They also studied the possibility of the implementation of the project and the appropriateness of the Grant-Aid Assistance in establishment of the Research and Development Center and procurement of materials and equipment.

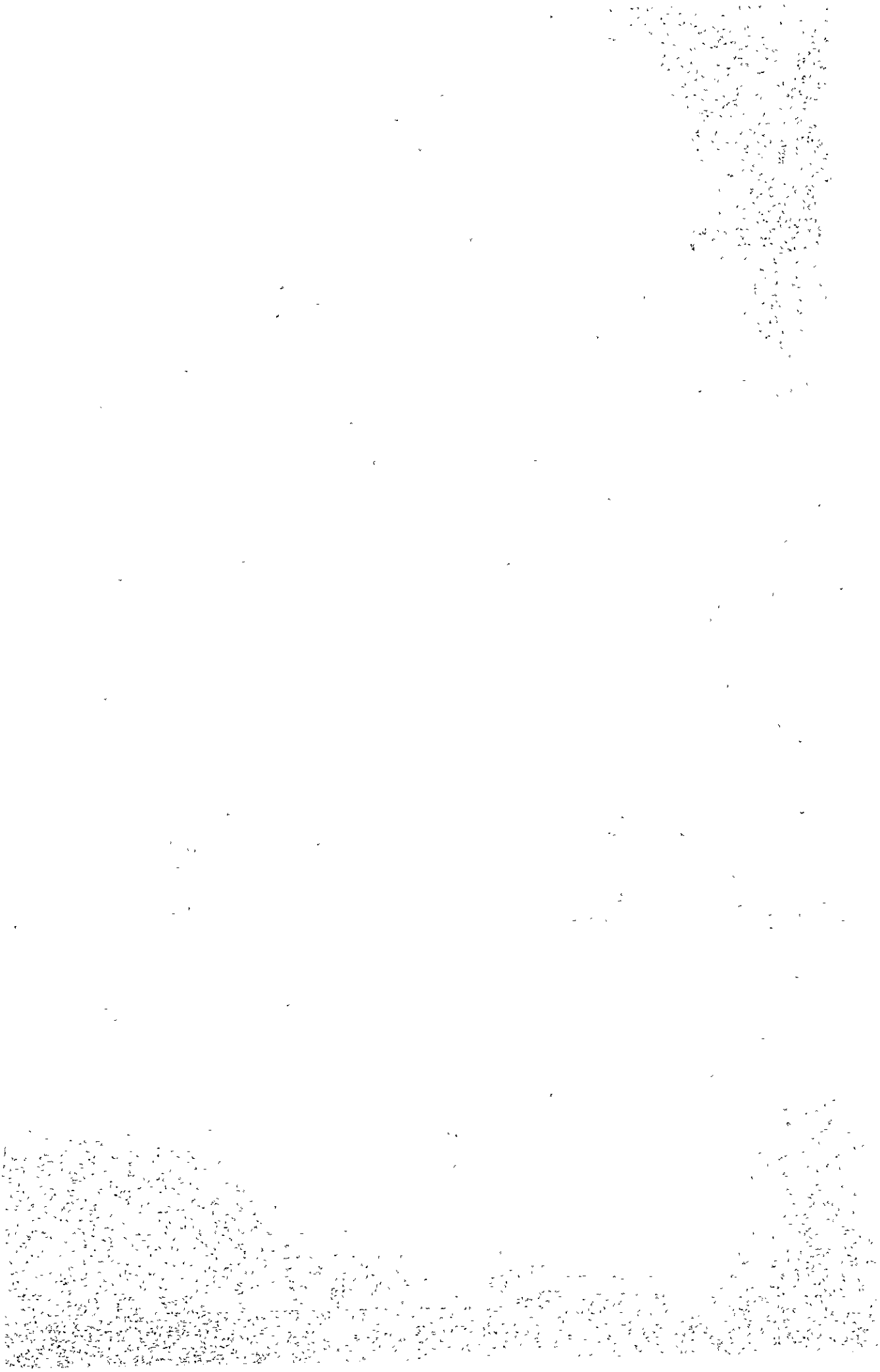
Later, however, the Government of Burma informed the Government of Japan of the change of proposed site location for the Main Center from Mingaladon to Hlegu. In response to this request, the Government of Japan sent the second preliminary study team for six (6) days - from February 6 to February 11, 1984 – to investigate the newly proposed site, and agreed to the proposal of changing the site location to Hlegu.

Based upon the survey of the two (2) preliminary study teams described above, the Government of Japan dispatched a Basic Design Study Team on April 1, 1984, which stayed for twenty-one (21) days until April 21 to investigate the following items concerning the appropriateness of the Grant-Aid Assistance for the implementation of the project.

1. Analysis of the background and the appropriateness of the project.
2. Technical and economic investigation for the implementation of the project.
3. Determination of the optimum function and scale of the project.
4. Reconnaissance of the project site (including investigation of the Regional Experimental Farms).
5. Confirmation of the organization which would be responsible for the undertaking.
6. Confirmation of the schedule for the implementation of the project.
7. Collection of data for computation of the total cost of the project.

This Basic Design Study Report describes the outline of the project, based on the information on the above survey items which was acquired by the site investigation and the discussion with the authorities in charge of this project of Burma.

CHAPTER 2
BACKGROUND OF THE PROJECT



CHAPTER 2 BACKGROUND OF THE PROJECT

2–1 POSITIONING OF THE PROJECT

2–1–1 Agriculture in Burma

Burma has been developing at its own rate as an agricultural country traditionally, blessed with abundant agricultural resources. It is needless to say that agricultural production, which occupies 40 % of its GDP, is the greatest support of the economy of Burma. There are 9,209,000 people who work in agriculture. They occupy 63.6 % of the working population (Statistics of 1983–84). This ratio is gradually decreasing because of the tendency toward population concentration in the urban area. This tendency is not only true in Burma but is a world-wide phenomenon. However, the ratio of workers in agriculture among the woking population is much larger than the 13.82 % which comprises industrial population. It may be said in comparison that 8.5 % of the Japanese working population works in agriculture.

Rice is a major product of the agruculture in Burma. The vast paddy fields in the Irrawaddy River area is the main producing area of rice. The rice acreage occupies 49 % of the total acreage of 25,450,000 acres (Statistics of 1982–83). However, the rate of enlargement of the acreage of sesame, maize, wheat, and so forth is higher than that of the enlargement of the rice acreage. In this way, diversification of the agricultural production is in progress.

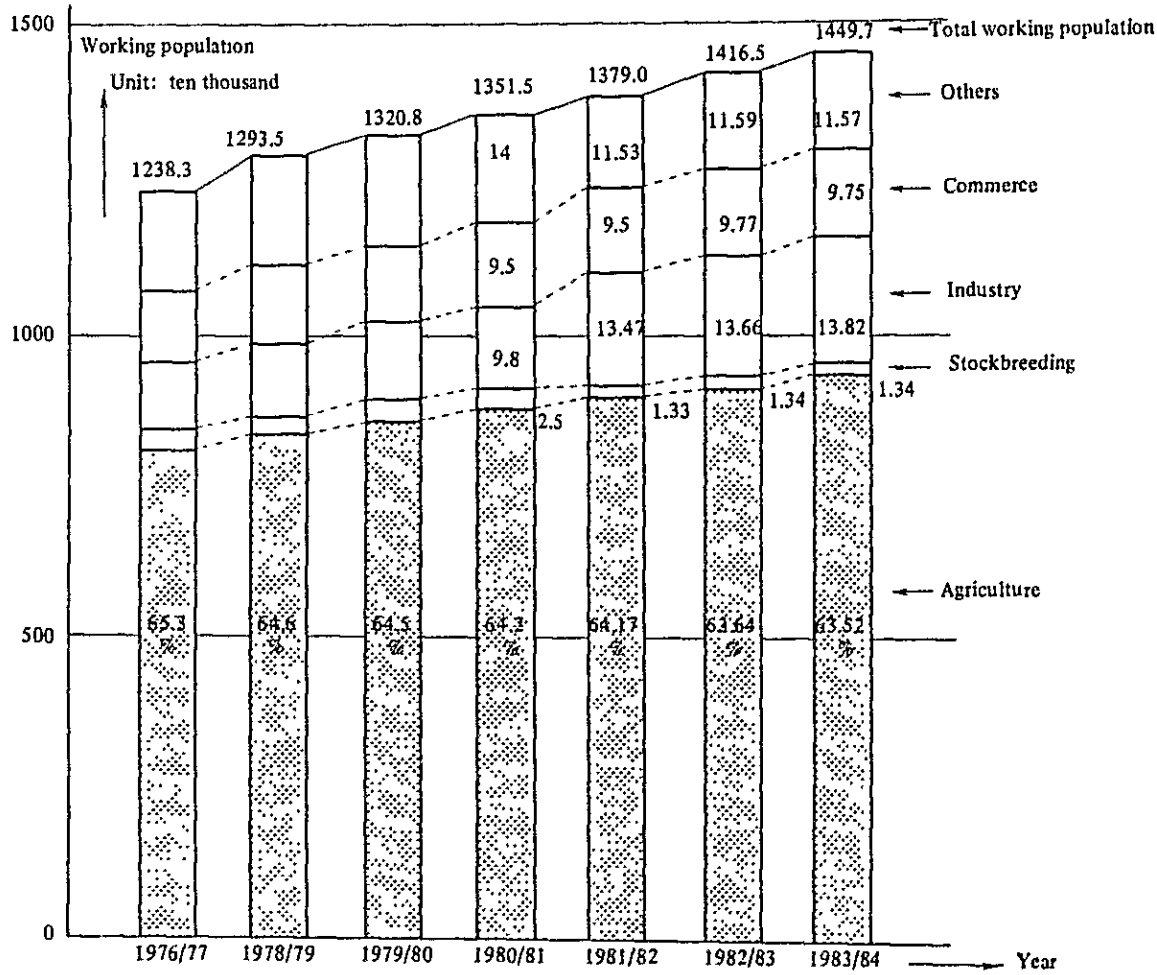
From the view point of exports, agricultural products are a matter of consequence constituting the majority of exported products. The amount of agricultural products exports firmly occupies 56.5 % of the total export of 3,452,800,000 Kyats. (Statistics of 1982–83) Out of this percentage, rice has traditionally occupied a major part and continues to be slightly over 40 % of the total export. Pulse, jute, natural rubber, maize, and so forth hold the next largest percentages in exports after rice.

Burma holds self-sufficiency of foodstuffs as a principle government policy. Therefore, the agricultural production, especially that of rice, is very important. The surplus is exported after domestic demand is satisfied. The export of agricultural products greatly influences the balance of international payments of Burma. Therefore, a high yield variety of rice is being introduced and diffused. Related policies are being put into action in order to increase the amount of surplus which will help to acquire the strength for international competition. As a result, the level of rice production which had decreased at one time, has greatly increased. This in turn has made it possible to increase the average annual GDP by 6.3 % in the past five years. This is not due to enlargement of the rice acreage but entirely to improvement in productivity and to the implementation of a system of multiple cropping. For example, production of rice before hulling, increased 200 % from the year 1972/73 to the year 1982/83, but its acreage did not change.

When observing these past fluctuations, it can be said that the economy of Burma is greatly influenced by the agricultural production, particularly that of rice. Because of this influence,

governmental policies to improve productivity of rice as well as to develop the related industries will be continuously executed as well. However, there are many problems such as the decline in price of the exported rice and the high international competition in the quality of rice. Therefore, not only the improvement of productivity of rice, introducing a high yield variety, but also the improvement in quality and quantity of agricultural products in general, is required.

In order to satisfy these requirements, it is necessary to implement various policies to diffuse multiple cropping with irrigation of farm lands, to develop arable land, and to diversify agricultural production.



· Quoted from the Report to the Pyithu Hluttaw

Fig. 1 The Transition of Organization of Work

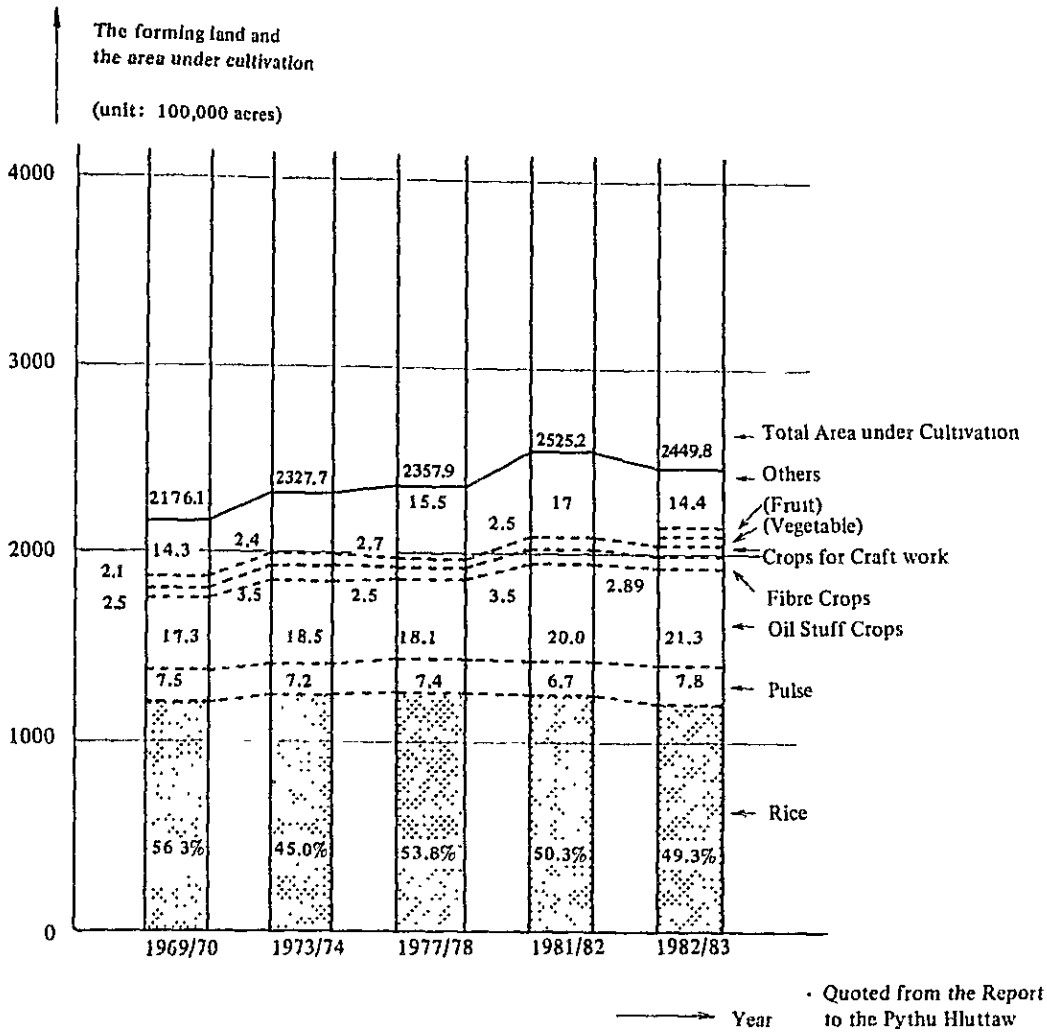


Fig. 2 The Transition of Land Utilization

	year	Amount FOB (million kyats)	Rate of Articles (%)				
			Agri-cultural	Forest Products	Minerals & Gems	Marine Products	Others
EXPORT	1978/79	1852.7	29.2	49.1	15.6	3.1	2.5
	1979/80	2696.0	56.9	20.7	17.1	3.0	1.7
	1980/81	3225.1	54.6	24.7	14.5	2.9	1.7
	1981/82	3452.8	56.5	22.5	13.7	3.6	3.1
	year	Amount CIF (million kyats)	Rate of Article (%)				
IMPORT			Machineries	Raw Materials	Tools and Parts	Con-struction Materials	Transpor-tation Machineries
	1978/79	3223.7	41.8	23.8	9.6	8.2	7.6
	1979/80	4200.9	44.0	20.0	11.4	10.7	7.2
	1980/81	4464.6	30.7	29.3	16.3	11.5	3.2
	1981/82	5057.0	29.4	27.3	12.6	9.6	8.7

Fig. 3 Trade

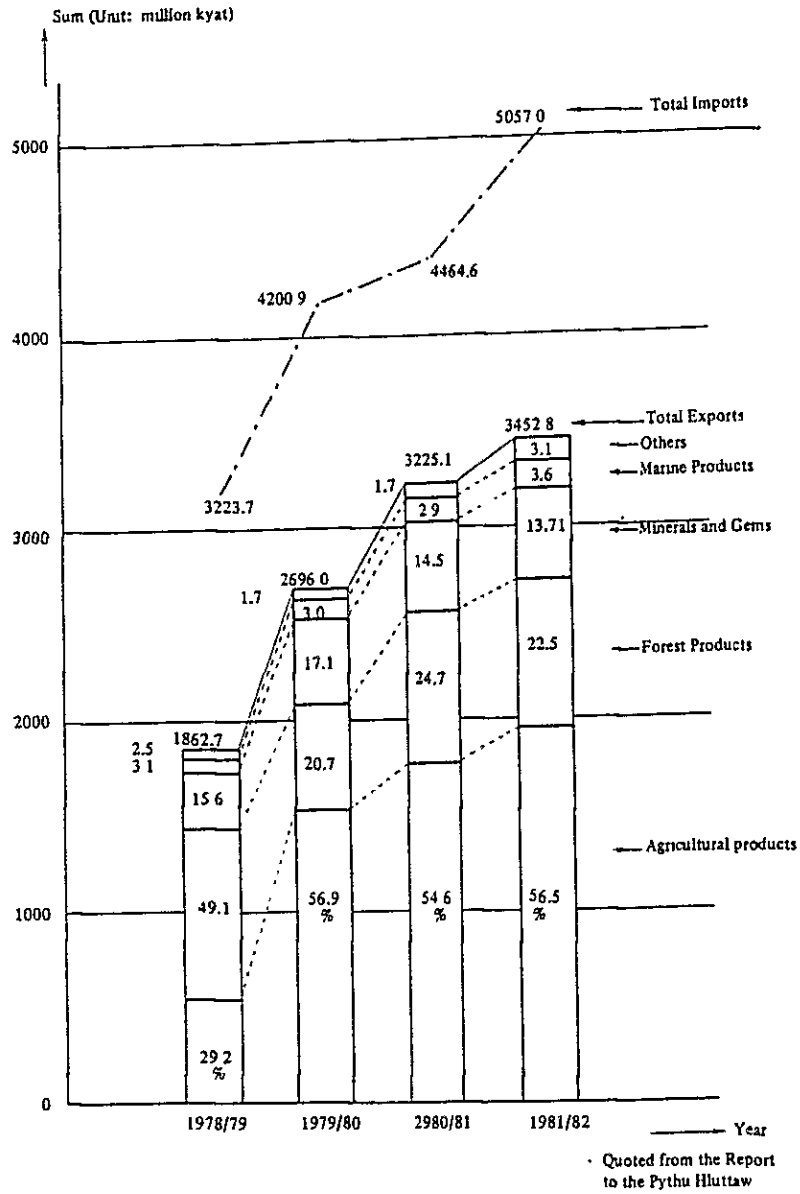


Fig. 4 The Transition of Exports by Type of Commodity

2–1–2 Economic Development Plan of Burma – A Long-Term Plan –

The economic development policy of Burma which is being put into action is based on "The New Twenty-Year Plan" issued in 1974. This plan is composed of five four-year plans. The second four-year plan (1974/75–1977/78) which started in the midst of the first four-year plan, and the third four-year plan (1978/78–1981/82) were completed with satisfactory results. This year is the third year of the fourth four-year plan. The major objectives of this plan are to raise the living standard of the people of Burma and to transform Burma into an industrialized country based on its agricultural production, which shows that the governmental policy of diversifying from an agricultural country to an agricultural/industrial

country is being put into action.

In order to achieve these objectives, major subjects were considered in the following priorities:

1. Development in agriculture and forestry, and increase in exports of products.
2. Development of industries which will produce substitutional commodities which Burma is importing at this moment.,
3. Promotion of heavy industries based on the domestic mineral resources.

As can be seen in these subjects, the development of agriculture is primary emphasized. The policies which stress agricultural development based on these major objectives were implemented by each of the four-year plan to bring satisfactory result. By the second four-year plan, a fine result of annual economic growth of 4.7 % was recorded and by the third four-year plan, that of 6.5 % was noted. Of this percentage, the agriculture section greatly exceeded the set goal of a 5.8 % annual growth rate and achieved 8.5 %, which greatly contributed to the economic growth of Burma during this period.

2—1—3 Agricultural Development Project

The economic development of Burma will, for the time being, be carried out by continuing a style which is dependent on agriculture and agro-industries. The government of Burma listed the following three points as most important for agricultural development.

(1) Achievement of self-sufficiency in the supply of foodstuffs. Full production of raw materials for the promotion of agro-industries.

(2) Increased acquisition of foreign currencies by increasing agricultural products exports.

(3) Saving foreign currencies by developing industries which produce substitutional commodities which Bruma is now importing.

In order to achieve above objectives, the government of Burma established, under the leadership of the Burma Socialist Program Party, "Agriculture and Livestock Study Group" which covers all government-related agencies including the Ministry of Agriculture and Forests. Major guidance of the agricultural development project was set up by this Study Group. Now the third four-year plan has been completed and the fourth four-year plan has started and the objectives of the plans are being satisfactorily achieved.

The primary objective of the agriculture section in the fourth four-year plan is the enlargement of planted acreage. Enlargement by approximately 1,000,000 acres is being scheduled. Half of it is for an increase in multiple cropping. Although, there will be some cut backs in the rice acreage because of the planting transfer from rice to other plantations, but the pro-

ductivity will increase as a result of the continuation of the introduction of high yield varieties. At the same time, focus will be put on an improvement in quality. The plan to introduce high yield varieties will also cover other agricultural products. This is a countermeasure to strengthen rice exports which are facing uncertain elements in the international market. It is also a measure to improve quality and to promote diversification of other agricultural products.

The agricultural development projects in connection with the fourth four-year plan consist of twenty-four (24) projects, and are compiled into the "Project Progress Chart 1983, Agricultural Corporation", as an interim report.

Types of Projects

The twenty-four (24) projects are classified into four (4) types, depending on the sources of the financial assistance:

(1)	World Bank Project	7
(2)	Asian Development Bank Project	4
(3)	United Nations Development Programme Project	7
(4)	Bilateral Project	6
		(Total 24 Projects)

Furthermore, the above twenty-four (24) projects are divided into two categories depending on the conditions of progress:

(1)	On Going Project	12
(2)	Pipe Line Project	12

As of April, 1984, ten (10) out of twelve (12) Pipe Line Projects had been budgeted. Therefore, there are at present a total of twenty-two (22) On-Going Projects.

2—1—4 Vegetables and Fruits Research and Development Project

The Agriculture and Livestock Study Group has set the basic guidance for horticultural development which is thought to be an important sector of agricultural development in Burma.

Objectives described in the guidance are to increase horticultural production in order to satisfy domestic demands and to export surplus products. In order to achieve the above objectives, the project. "Vagetable and Fruit Research and Development Project" was established.

This project is classified in accordance with the types and categories of projects as follows:

* One of the Bilateral Projects
* One of the Pipe Line Projects

This project is one of the 24 important projects of the fourth four-year plan, and financially, it is considered to be one of the Bilateral Projects, and one of the Pipe Line Projects whose budgeting has not yet settled. The 24 projects listed above are regarded as the most important ones planned according to the fourth four-year plan. These projects are authorized by several organizations, such as the Agriculture Corporation and the final decision making organization, the Council of Ministers. After the authorization, they are given priorities in receiving budgets, organizing systems of implementation and so on.

This project is planned in two (2) phases:

Phass 1: To improve breeds of vegetables and fruits by organizational research and development and to diffuse them

Phase 2: To promote production as much as possible to meet a commercial scale, based on the results of the Phase 1

In order to carry out the plan, in Phase 1, the building of a new Research and Development Center for Vegetables and Fruits and annexed experimental farm are being planned. At the same time, it is being planned that all necessary equipment is to be provided in the new Research and Development Center and six (6) Regional Experimental Farms which are to be designated out of the existing experimental farms. The Grant-Aid Assistance requested to the Government of Japan is related to the Phase 1. At the same time, the technical cooperation following after the completion of the construction is also requested.

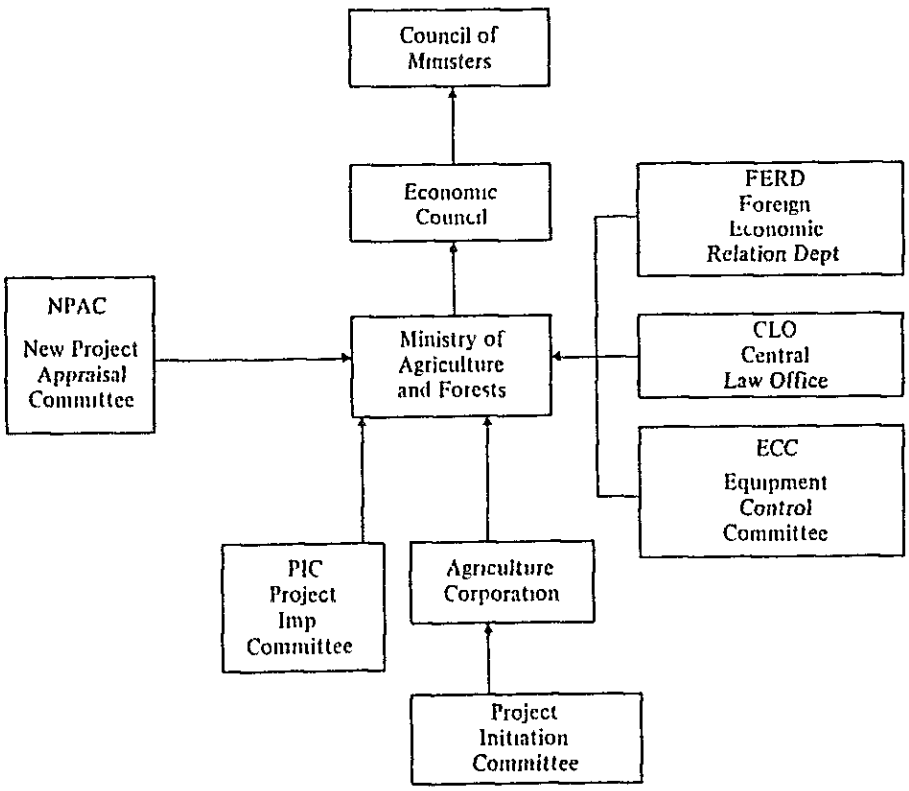


Fig. 5 Project Approval Flow

2–2 PRESENT CONDITION OF THE PRODUCTION OF VEGETABLES AND FRUITS

2–2–1 The Overview

Burma, unlike other Southeast Asian countries, is blessed with a variant climate. The climate of Burma varies from tropical to temperate. It has great potential for crop cultivation due to both climate and soil conditions. Also, the creation of export market in the surrounding countries is highly feasible.

In spite of these conditions, research and development in the modern production of vegetables and fruits has not yet been taken into action, although the rice has been greatly developed as the basic product of the country. They seem to be at the point to start the first step.

In Burma, vegetables and fruits have been produced for a long time, and of course various kinds are presently being cultivated throughout the country. However, most of the cultivation is done in the farmers' spare time, and the quantity and quality of the supply is far from satisfactory, where there exists plenty of room for improvement. The number of farmers who are engaged solely in vegetables and fruits production is small and their agricultural techniques are not well developed. Due to a fluctuation of seasonal production, particularly a decrease in production during the rainy season, a lack of an adequate means of transportation from the producing district and a lack of preserving techniques, most of the products are consumed only where they are produced.

The reasons why the production of vegetables and fruits remains low in spite of the great potential for development, as far as natural conditions are concerned, are as follows:

1) inadequacy of breeds
2) insufficient research and limitation in extension of its information
3) insufficient research and limited ability for giving out information.
4) insufficient experience in treatment, processing, and transportation of products, and lack of facilities for that.
5) lack of fertilizer, agro-chemicals, and farming tools.
6) lack of adequate means of transportation and infrastructure.

Vegetables and fruits significantly influence the nourishment of the people. From the dietetic point of view, it is necessary to eat various types of food to lead a healthy life. Simplicity in the variety of foods cannot satisfy the need. Vegetables and fruits play a big role in filling a deficiency in nourishment.

In Burma, the characteristic of nourishment shows a high level of caloric intake but about 80 % of the total caloric intake is seemed to be made up of starchy foods. (Statistics by OECD and FAO, 1977)

Compared to the above, the percentage of starchy foods out of the total caloric intake of the Japanese nourishment, where rice is also the main food, is about 50%. On the other hand, the consumption of vegetables per capita per day in Burma, is about one-fifth (1/5) of that of Japan. Of course, it is not appropriate to compare simply by figures since every country has different dietary customs, but still it is predictable that the verification of foods in Burma will be promoted accordingly with the improvement in people's diet.

Considering these conditions, the Agriculture Corporation is planning to establish the new Center under its control, and to carry out systematic research and development of vegetables and fruits, in order to improve the production through the spread of information, collaborating with other existing organizations participating in this project.

nation	heat volume		composition				
	real number	Japan=100	starchness	animal food	sugar	oils & fats	others
	kcal		%	%	%	%	%
JAPAN	2494	100	50.6	15.4	11.2	11.6	11.2
BURMA	2197	88	80.1	3.8	3.0	5.3	7.8
KOREA	2615	105	80.7	5.5	3.2	2.1	8.5
INDIA	1919	77	67.4	3.5	9.4	7.1	12.6
INDONESIA	2112	85	77.1	2.2	6.7	5.8	8.2
PAKISTAN	2281	91	64.1	8.9	11.9	8.5	6.6
PHILIPPINES	2184	88	68.6	9.3	9.9	4.9	7.3
SRI LANKA	2051	82	66.7	3.8	4.2	3.3	22.0

·quoted from OECD, FAO statistics

Fig. 6 Caloric Intake & The Composition of Caloric Intake

Type of Survey	Particulars	Calorie	Protein (Gramme)	Calcius (Milli-gramme)	Iron (Milli-gramme)	Vitamin A Carotain (I.U.I.)	Vitamin B1 (Milli-gramme)	Vitamin B2 (Milli-gramme)	Niacin (Milli-gramme)	Vitamin C (Milli-gramme)
1979/80 Pregnant mothers (South Okkalapa Township)	Nutritional requirement	2,200	50	1,000	30	3,000	0.9	1.3	14	30
	Daily Intake	1,643	46	242	11	2.963	0.6	0.5	9	34
	Precentage of nutrient Intake	75	92	24	37	99	66.7	38.5	64	113
1980/81 Laourers (Power Station at Ahlone Township)	Nutritional requirement	2,400	50	500	30	3,000	1.0	1.4	15	30
	Daily Intake	1,857	50	206	8	2,056	0.7	0.5	8	27
	Percentage of nutrient intake	77	100	41	27	69	70.0	35.7	53	90
1981/82 Primary Students (7–9) Years (Latha/Lanmadaw /Pabedan Towhships)	Nutritional requirement	1,800	30	400	10	1,600	0.8	1.i	13	20
	Daily Intake	1,632	36	165	8	1,203	0.6	0.4	5	17
	Percentage of nutrient intake	91	120	41	80	75	75.0	36.4	38	85

(The Report to the Pyithu Hluthaw)

Fig. 7 Position of Daily Nutritional Requirement and Intake

2–2–2 Nature of Burma

Burma is situated between lat. 10 – 28 N. and long. 92 – 102 E. Irrawaddy River that uns through the plain between Shan Highlands in the east and Arakan Mountains in the west forms a fertile agricultural region in its south area.

a. Climate

Though Burma belongs to a tropical region, the climate differs in every part of the country, varying at the seashore, in the mountain and in the middle of the land.

There are three seasons in a year:

middle of May–middle of October	: rainy season
middle of October–middle of February	: cool season
middle of February–middle of May	: hot season

From October to May, the wind blows from the north influenced by the northeastern monsoon wind, and it is dry. From middle of May, the wind begins to below from the south influenced by the southwestern monsoon wind with humid which caused a high precipitation. So the district between the Arakan Mountains district and Tenasserim coasts has plenty of rainfall, 5,000 mm/year, due to the fact that the clouds drop a great amount of rain before passing over the mountains.

On the contrary, there is little rainfall of only 900 mm/year in the middle of the country around Mandalay where the area is very dry.

The delta region where Rangoon is located, the hilly region in the west, the Shan Plateau, and the hilly region in the north all have about the same level of rainfall, 2,000 mm/year.

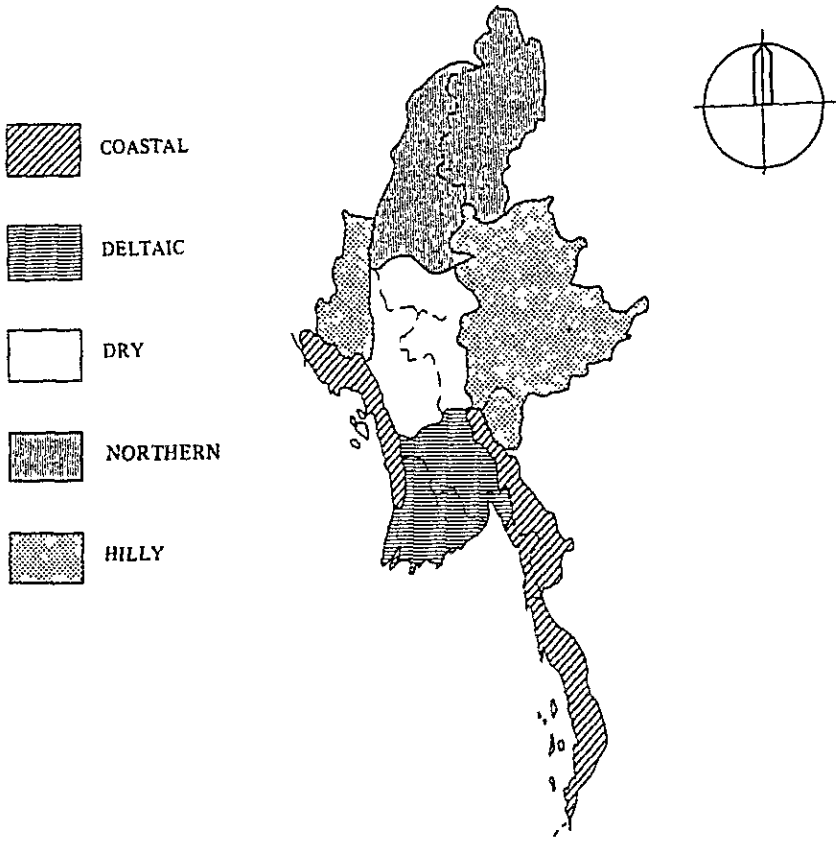
In the southern area, the difference in temperature is rather small. In Rangoon, the difference in temperature between the hot and cool season, is 5–6 °C. On the contrary, in the dry area in the middle of the land, the difference in temperature is large. In Mandalay, the difference is 11–12°C.

The average temperature in Rangoon through the year:	27°C
The average humidity in Rangoon through the year :	50% (dry season) 80% (rainy season)

b. Soil

Regarding the soil conditions in Burma, the mountains and hills of the forest ranges have fertile land. The most fertile area is the delta of alluvial soil along the Irrawaddy River. In areas where there are both high percipitation and a distinct dry season, the soil consists of laterite.

The natural conditions in Burma vary greatly from tropical to temperate. Therefore, it is possible to cultivate a variety of vegetables and fruits, and cultivation depends on the each region's climate and soil. At the same time, its potential for development of variety of crops is quite high.



ZONES	SUMMER		RAIN		WINTER		ANNUAL	
	mm	DAY	mm	DAY	mm	DAY	mm	DAY
COASTAL	533	19	3,988	99	356	17	4,877	135
DELTAIC	356	13	2,007	91	229	12	2,591	116
DRY	178	12	559	33	178	9	914	54
NORTHER	229	16	1,676	73	229	15	2,134	104
HILLY	203	19	1,499	70	279	15	1,981	104

Fig. 8 Average Normal Rainfall by Mainzones

2–2–3 Current Cultivation of Vegetables

In Burma, vegetables have been planted since long ago. The variety of geographical features, and climate make it possible to cultivate many kinds of crops.

a. Acreage of Cultivation

60% of the total acreage under cultivation lies in the plain around Mandalay in the middle of the country, in the Sagaing district and in the Shan Highland in the east. The remaining 40% lies in other areas.

The acreage under cultivation for vegetables is 222,000 ha, which is 2.24% of the total farming acreage in Burma. But all of the acreage (222,000 ha) is not used solely for cultivating vegetables. It also includes the acreage where vegetables are planted when rice or other crops are not cultivated.

In contrast, the acreage for rice occupies 49% of the total farming acreage. In terms of acreage under cultivation, there seems to be plenty of room for development in the cultivation of vegetables. On the contrary, in Japan, 43.8% and 11.9% of the total farming acreage are used for cultivating rice and vegetables respectively.

NO.	Crops	1981 – '82 Hectare	1982 – '83		
			Precentage (%)	Hectare (ha)	Acre (unit: 10,000 Acre)
1	Rice	5105339	49.00	4884260	1206.9
2	Pulse	855318	7.76	769206	190.1
3	Oil stuff crops	2118249	21.31	2113075	522.1
4	Fiber crops	276859	2.89	286873	70.9
5	Fruit (Banana + Coconut)	228952	2.38	236395	58.4
6	Vegetable (Onion + Garlic + Chilli)	201355	2.24	222237	54.9
7	Others	1385193	14.42	1402324	346.5
	TOTAL	10171265	100.00	9914370	2449.8

· the data of Agriculture Corporation

Fig. 9· The Transition of Land Utilization

(Vegetable, 1982 – 1983)

NO.	Vegetable	Amount of Production (ton)	Area of Cultivation (ha)	The crops per hectare (ton/ha)
1	Cabbage	78,228	6,006	13.02
2	Cauliflower	32,830	4,183	7.85
3	Carrot	2,626	590	4.45
4	Mustard	23,796	6,894	3.45
5	Lettuce	2,586	980	2.64
6	Radish	21,977	3,340	6.58
7	Bottle gourd	20,550	2,471	8.32
8	Water melon	35,229	5,097	6.91
9	Tomato	233,545	49,311	4.74
10	Asparagus	460	56	8.21
11	Other	183,443	45,443	4.04
12	Onion	139,321	20,204	6.90
13	Garlic	26,397	8,070	3.27
14	Chilli	43,532	69,592	0.63
	TOTAL	844,520	222,237	

· the data of Agriculture Corporation

Fig. 10 Amount of Production & Area of Cultivation

b. *Production and Supply*

Many kinds of vegetables are now being cultivated, and the variety of vegetables is as many as 122 including those with little production. But only limited kinds such as tomato, onion, cabbage, cauliflower, mustard, white radish, watermelon are of a large amount of production.

The total production of vegetables a year is 844,520 t (82/83). Tomatoes are ones with the largest production (233,000 t/year) which are produced throughout in Burma but especially in the Mandalay area. The second is onions (139,000 t/year) nearly 80% of which are produced in the Mandalay and the Magwe districts. The third is cabbage (78,000 t/year) nearly 70 % of which is produced in the Shan Highland and the Sagaing districts. The total of production of these three, tomatoes, onions and cabbage is 451,000 t, which is more than half of the total production of vegetables. Also, the acreage for planting these three vegetables occupies 40% of the total acreage under cultivation.

Amount of yield per ha. by crop is listed below:

tomatoes	4.7 t/ha
cabbage	13.0 t/ha
onions	6.9 t/ha

These figures are quite low, and this tendency is common to all vegetables produced in Burma. Taking these conditions into account, it is necessary to improve these figures in the future through research and development. In Japan, the figure of yield/ha. is as follows:

tomatoes	52.4 t/ha
cabbage	37.9 t/ha
onions	42.8 t/ha

As for seasonality and regionality of cultivation, a few varieties are developed to suit for all season cultivation and to have disease and insects resistance. Production are limited due to the lack in irrigation systems in the dry seasons of cool and hot weather, and due to diseases during the rainy season. Because of these conditions, each variety is cultivated in a certain area where the variety fits, and cultivation of each variety in a certain region is limited and seasonal. This indicates the difficulty of maintaining a stable supply of the main vegetables. Especially, observing the current seasonality and regionality of cultivation, the supply runs short from April to July.

In terms of quality, there is much room for research and development. For example, the size of tomatoes and onions is very small. Radishes and carrots are very thin and small. It is necessary to select the suitable breeds from the gathered crops for cultivation in the tropical area. This is also true in the cool area where the difference between the length of day and night is small. If such breed selection results in effective, the productivity can also be improved.

2–2–4 Cultivation of Fruits

Fruit cultivation in Burma permits yields of a wide range of fruits from that of the tropical species to that of the temperature species according to diversified climate conditions.

a. Acreage of Cultivation

The main producing area for tropical fruits naturally centers around the southern part of Burma; Irrawaddy, Pegu, Tenasserim, and Mon regions, and their cultivation acreage amounts to 67% of the entire fruit cultivation acreage in Burma. On the other hand, the cultivation acreage of fruits in the temperate zone, is smaller and cultivation is done in the highlands such as Shan and Chin or in the Mandalay region.

The total fruit cultivation acreage, which is 236,000 ha, amounts for 2.38% of the entire farming acreage of Burma which is 9,914,000 ha. Of the various kinds of fruits, banana has the largest cultivation whose acreage is approximately 40,000 ha, followed by mango and then by coconut. Both orange and apple have only a few acreage which are approximately 4,000 ha and 300 ha respectively. Also for fruits cultivation, most of the fruit farmers are cultivating them in their spare time.

(Fruit, 1982 – 1983)

NO.	Fruit	Amount of production (ton, fruit, Bundle)	Area of cultivation (ha)	The crops per hectare (ton/ha, Fruit/ha, Bundle/ha)
1	coconut (Fruit)	116,618,841	25,674	4,542.29
2	Orange (ton)	26,476	3,973.4	6.66
3	Litchi (Fruit)	30,895,100	373	82,828.69
4	Plum (ton)	41,940	3,388.4	12.38
5	Shadock (Fruit)	48,412,990	3,066	15,790.28
6	Apple (ton)	254.6	309.4	0.82
7	Mango (Fruit)	886,580,653	2,852.6	31,079.74
8	Grape (ton)	2,486.8	420.4	5.92
9	Banana (Bundle)	41,301,247	41,172	1,003.14
10	Durian (Fruit)	23,964,950	5,001	4,792.03
11	Lime (Fruit)	224,384,570	5,747.8	39,038.34
12	Pear (ton)	4,943	877	5.64
13	Other Fruits		117,865.6	
	TOTAL		236,394	

·the data of Agriculture Corporation

Fig. 11 Amount of Production & Area of Cultivation

b. Production and Supply

There are numerous kinds of fruits being presently cultivated amounting to a total of 53. According to a calculation of the number of pieces of fruits, mango, lime, coconut, and banana have the largest shares; according to weight, plum and orange have the main shares. Since the total annual prodution amount is classified separately in statistics by the number of pieces and statistics by weight, the gross volume cannot be calculated. From the view of the number of pieces, coconut production is over 100 million pieces annually. In the Irrawaddy region they are produced nearly half of this amount; and totaling production in the Tenasserim, Mon and Rakkine regions to Irrawaddy, about 85% of the total production of coconut comes from these four areas.

The annual production amount of mango is approximately 89,000,000 pieces. They are produced mainly in the Irrawaddy, Pegu and Rakkine regions. However, mango is also produced throughout the country.

On the other hand, the annual production of orange is a little more than 26,000 t, and 75% of that is produced in the Shan Heights region.

There is also great production of plum, whose annual yield is a little less than 42,000 t with 88% produced in the regions of Mandalay and Sagaing.

The annual production of grape is a little less than 2,500 t and almost the entire amount is produced in Mandalay.

Apple is also cultivated in Burma, but the annual production amount of 250 t is very small. They are produced in the Chin region.

Pear is mostly produced in Shan Height and its annual production amount is about 5,000 t.

Regarding the yield per unit area, litchi comes first with 82,800 peices/ha, followed by lime with 39,000/ha, and mango with 31,000/ha according to the number of pices.

According to weight, plum is listed on the top with 12.4 t/ha, followed by orange with 6.7 t/ha, grape with 6.9 t/ha, and pear with 5.6 t/ha.

Also for these fruits, there certainly remains room for future development and improvement.

For reference, the production per ha. of citrus fruits in Japan is 20.5 t, 11.4 t for grape, and 23.5 t for pear.

Fruits such as coconut, mango, banana, lime and pomelo are produced throughout the country and consumed in the areas where they will eventually supplied; while such fruits as durian, citrus, litchi, grape, and pear are produced in limited areas and consumed there.

In quality, banana, although many varieties have been introduced, farmers have not yet been encouraged to plant a fixed varieties. As for pineapple, although they taste very good, they are small in size. As for papaya, even within one farm, papaya with different sizes are cropped. The fact that they are propagated by seeds leads to this difference in size.

The production and supply condition of vegetables and fruits can be summarized as follows:

(1) There are many kinds but their production is low.

(2) There exists an outstanding regional imbalance in the production amount.

(3) The shipping amount is much lower than the production amount.

Furthermore, taking the conditions such as the seasonal imbalance of production, and the lack of sufficient transportation means into account, the present state of vegetables and fruits in Burma can be outlined as follows:

(1) The consumption per person is small.

(2) The production and consumption mainly take place in the same region.

(3) There are many cases, in which the supply stops depending on the season.

2–2–5 Fertilizer, Agro-Chemicals

The consumption of chemical fertilizers is increasing annually. The amount used in a year (1981/1982) was 275,910 metric tons, showing approximately 40% or more increase compared to the amount consumed in three (3) years before. These chemical fertilizers are mainly used for rice-cultivation, which occupies 80% of the entire amount of chemical fertilizers. Their consumption compared to 3 years ago has increased nearly 40%. It can be considered that the overall rate of increase of the consumption of fertilizers was due to increased consumption in rice cultivation. In fact, it was highly effective and the rice production in recent years has continued to show remarkable results. The increase in the consumption of fertilizers has surpassed that of neighboring countries. However, the consumption per unit farm land area is approximately 10 kg/ha (1979 FAO) and remains smaller than that of the neighboring countries.

On the other hand, the amount of chemical fertilizers consumed for vegetables is decreasing, contrary to the increased consumption for rice. Consumption for vegetables, which was 188 metric tons in a year of 1981/82, is remarkably small. They count for only 0.068% of the total consumption. There is also room for improvement in the future in order to raise the yield. It is probably necessary to set up a standard for the application of fertilizers according to the kind of crops and the soil conditions of each region.

Even for the agro-chemicals, consumption is increasing year by year. The total consumption for the period of 1980/81 was 96,349 gallons. The amount used for rice cultivation counted 36%, although the amount used for vegetables counted only 0.2%, which is extremely small. So far decisive damage by disease or insects which would affect the yield has not yet observed. However, since there is a fear of intrusion of new disease or insects which may be carried along with newly introduced crops in the future, one cannot negate the fear of serious damage if the present preventive techniques are applied. Therefore, there is an urgent need to establish an effective quarantine system for plants which enter from foreign countries. At the same time, there is a need to develop and improve the techniques for preventing and eliminating disease and insects.

2–2–6 Transportation and Distribution

The present main means of transportation in Burma are as follows:

(1)	Railroad	totally 4,381 km
(2)	Road for automobiles	totally 22,456 km
(3)	Waterway	totally 8,924 km
(4)	Airway	regular flights for 36 towns.

The basis of this traffic network was established a long time ago. However, this network comes to be insufficient to satisfy the current demand of transportation in later years. Regarding the transportation of goods, the road transport by trucks counts for 40%, water transport 24%, railroad transport 4%, and boats and carriages 32%.

What is required for the transportation of vegetables and fruits is to transport the goods from the production site to the consuming area as soon as possible in order to preserve the freshness. However, the present transport situation is very severe and is faced with problems such as the delay of transportation or high cost of transportation, which are to be solved in the future.

With this transportation condition being an important factor, the present marketing pattern of vegetables and fruits is based on a system where production and consumption take place in the same area. Of course, the long-distance transportation to the big cities of Rangoon or Mandalay is carried out. Thus brought to the Rangoon Central Market, cabbages from Shan Heights or Pegu, tomatoes from Shan Heights or Mandalay Division, and oranges from the Shan or Chin States. The average amount delivered per day during the harvest season is; cabbage 400 t, califlower 300 t, tomatoes 200 t, and oranges 6,000–8,000 pieces. However, supply is limited only in the harvest season and is not available in the off-season. At the same time, even during the harvest season, there exists some shortage in the supply.

The present state is such that improvements in the distribution system, transportation means, packing of goods, processing and preservation techniques are desired.

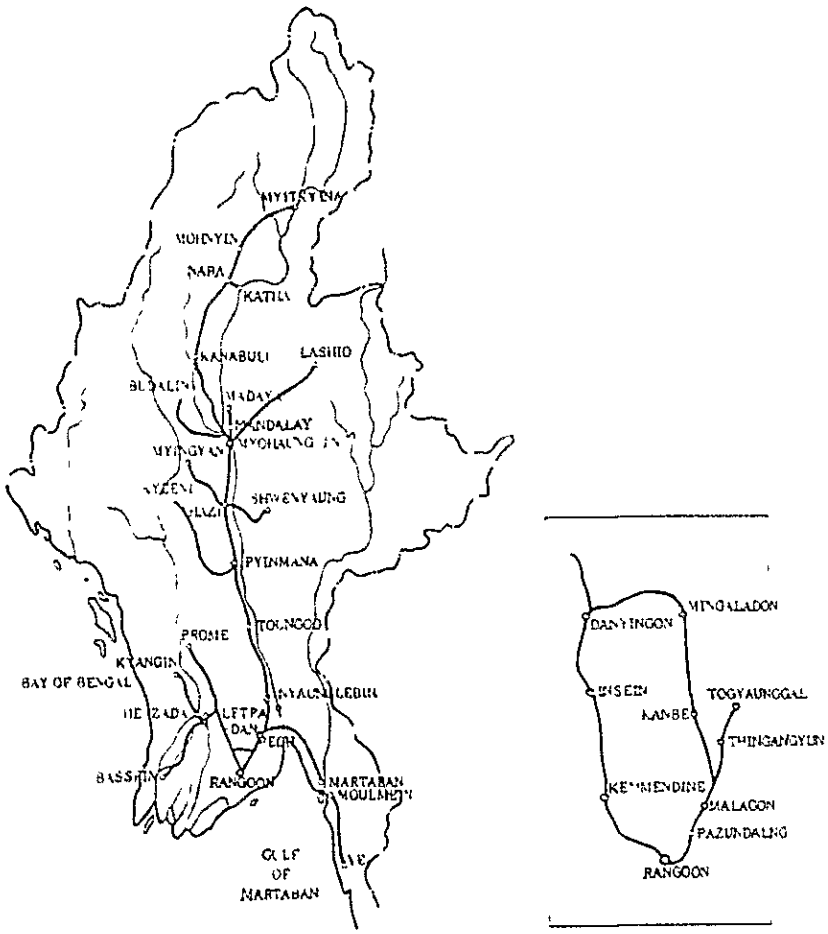


Fig. 12 The Network of Railway

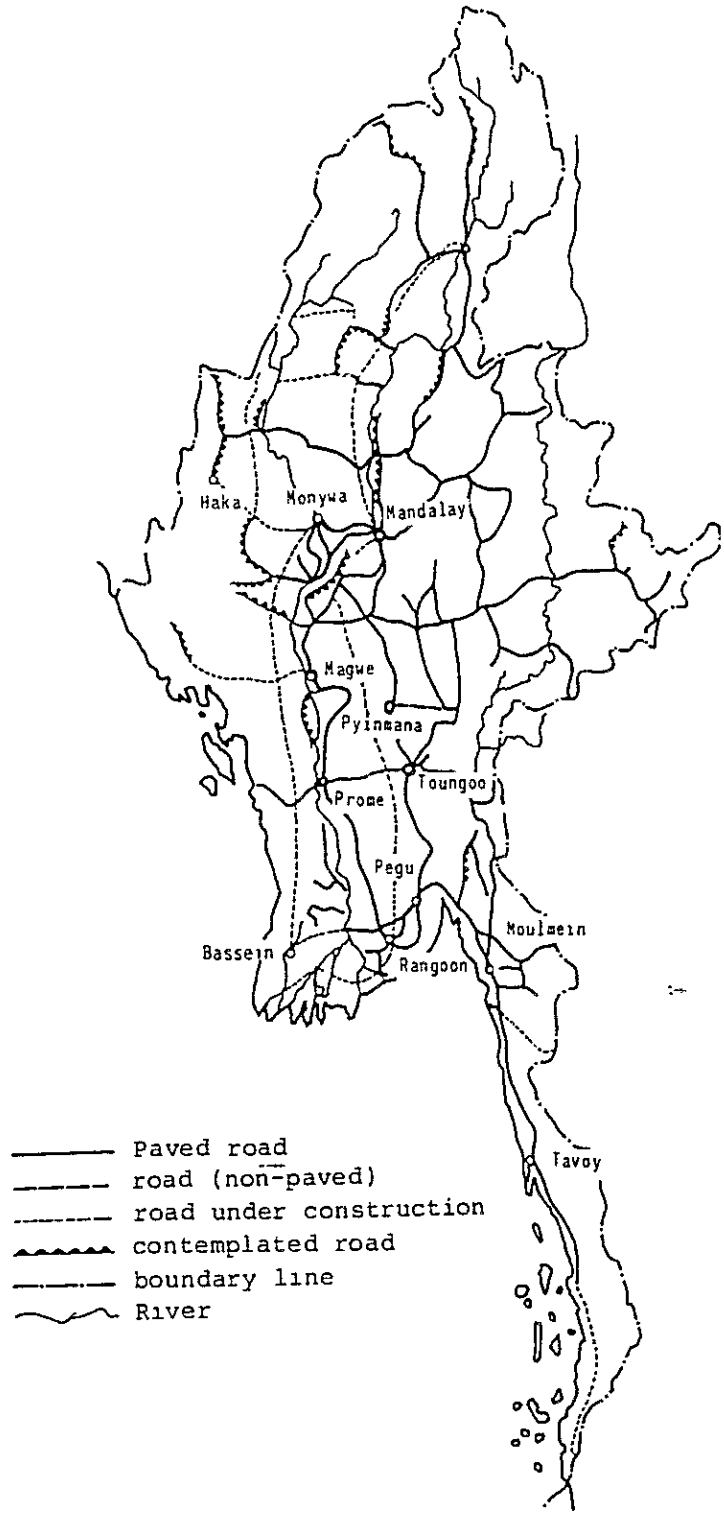


Fig. 13 The Network of Road

2–3 PRESENT STATE OF VEGETABLES AND FRUITS RESEARCH AND DEVELOPMENT

2–3–1 *Organizations*

The implementation of all the agricultural policies in Burma is performed by the Agriculture Corporation which belongs to the Ministry of Agriculture and Forests. The Agriculture Corporation is comprised of nine divisions. Among these divisions, the following three are directly involved in the research, development, and diffusion of agricultural techniques.

A.R.I. : Agricultural Research Institute
A.R.D. : Applied Research Division
E.X.D. : Extension Division

a. A.R.I. (Agricultural Research Institute)

The A.R.I. which was transferred to the present location of Yezin in 1976, is comprised of 14 departments and has 600 staff members. The basic research performed here will be passed on to the A.R.D. The Vegetables and Fruits Department, which is one of the 14 departments, was just set up in 1980. This department has one research laboratory where the research on vegetables and fruits is carried out. Due to the brief existence of this department, being only 4 years since its foundation, the present activities of research is limited at the farm-field testing stage.

b. A.R.D. (Applied Research Division)

The A.R.D. has 19 Central Agricultural Experimental Farms. Research on vegetables and fruits is performed in two of these Experimantal Farms. The experiments in applied research which will also be put into practical use are executed in these Experimental Farms. Their results are passed on to the State Farms which are under the control of the Extension Division.

c. E.X.D. (Extension Division)

The E.X.D. has extension offices of four different levels. They are performing consistent extension activities from the national level to the farmer's level. The four different levels are: the State/Division level; the township level; the village track level; and the village level. The number of staff members of the E.X.D. is more than 10.000.

The E.X.D. is comprised of seven sections. There are regional experimental farms belonging to the Horticultural Section, one of the seven E.X.D. sections. These farms are set up at vegetables and fruits cultivation zones throughout the country. There are 37 experimental farms with a total area of 2,700 ha. The experimental cultivation of vegetables is carried out at four of these farms, while fruits cultivation is performed at almost every farm.

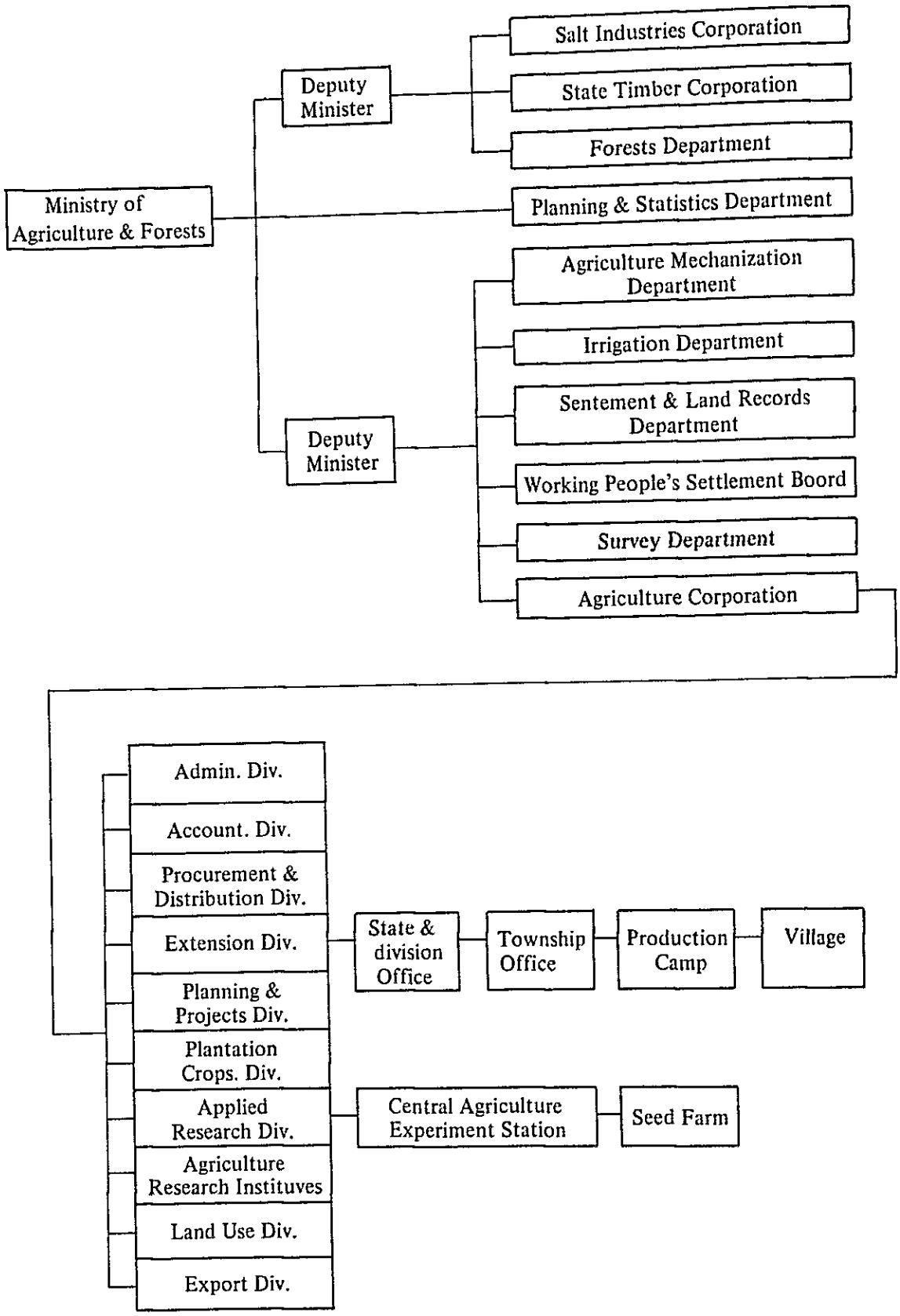


Fig. 14 Organization Chart of Agriculture Corporation

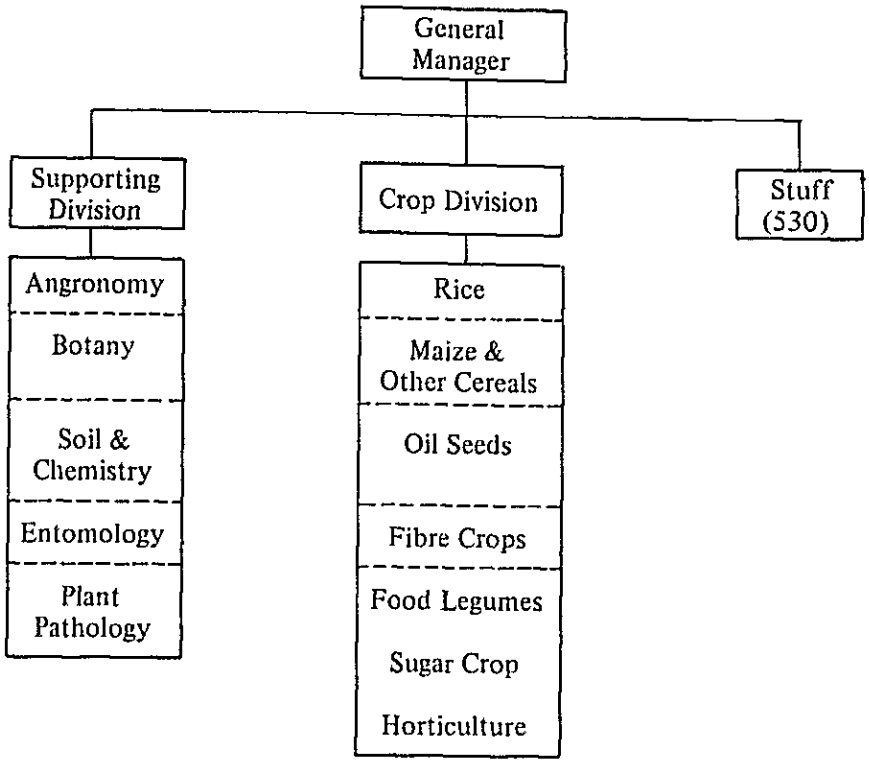
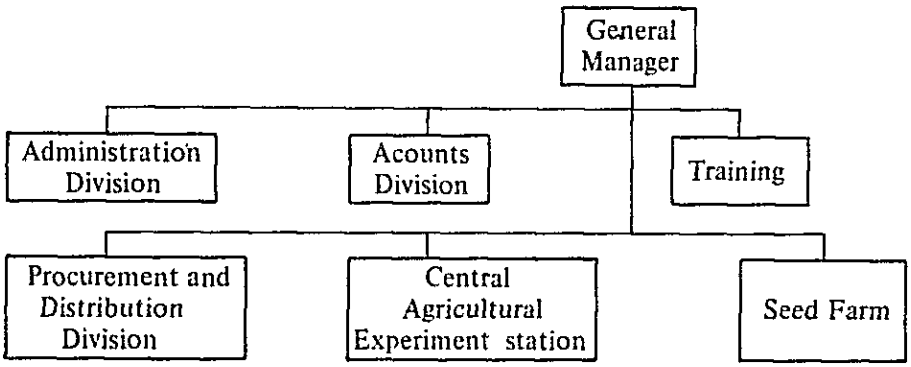


Fig. 15 Organization Chart of Agriculture Research Institute



The number of person in the research institution

(Within the province of Applied Research Division)

	Research worker	Assistant worker	Doctor	Master	Bachelor
Applied Research Div.	29	64	4	4	
Central Agriculture Experiment Station	66	594	1	3	100
Seed Farm	18	283		1	
TOTAL	113	941	5	8	100

Fig. 16 Organization of Applied Research Division

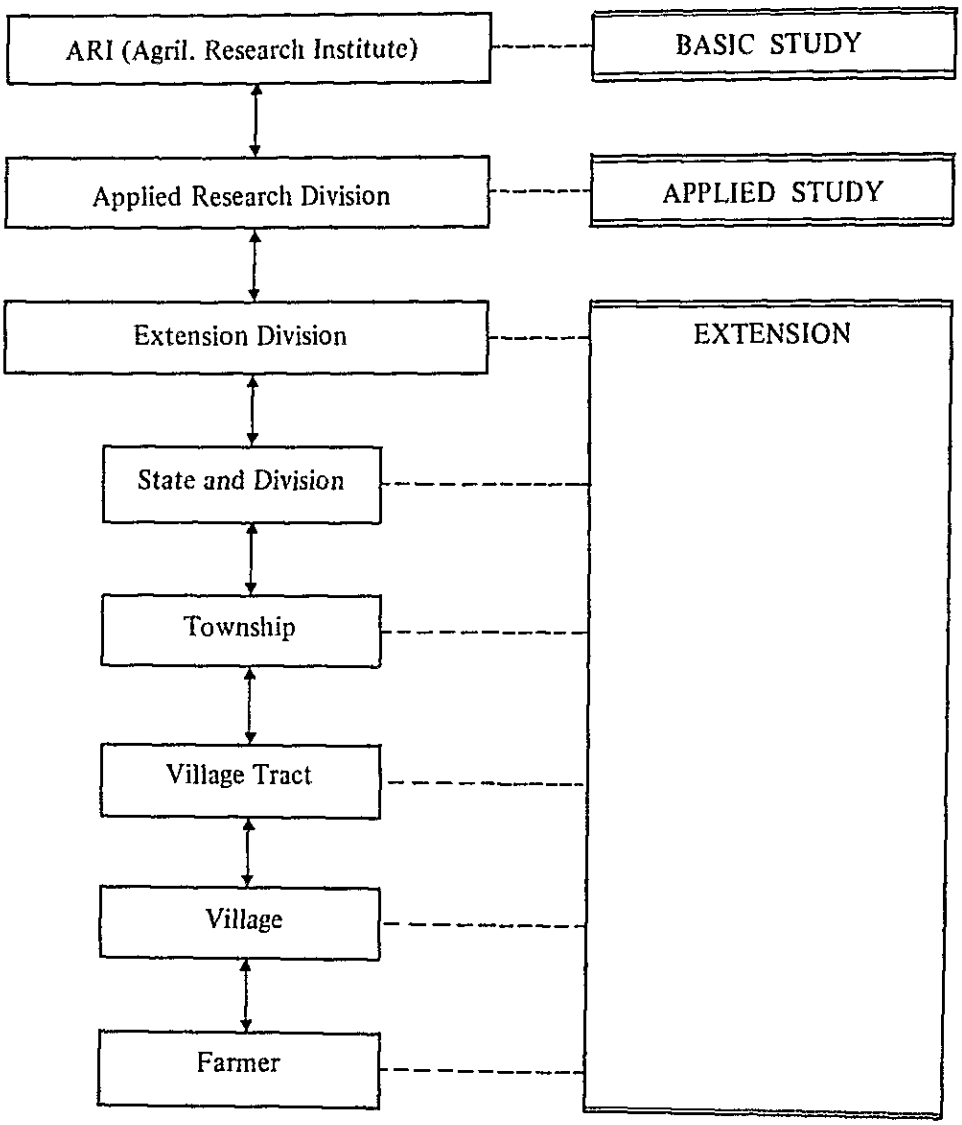


Fig. 17 Agricultural Extension System Chart

2–3–2 Outline of Agricultural Education

Considering the future of agriculture which supports the economy of Burma, the role that agricultural education plays is an important one. The educational institutions for this purpose are comprised of three stages of from the university level to the high-school level. There are 16 specialized agricultural schools with 241 teachers, 3,223 students currently enrolled, and 1,204 graduates (1981/82). Every year, the place of employment of the graduates concentrates in the Agriculture Corporation. However, employment among the graduates of the high school is low and higher among those of the University. Furthermore, practical training is provided to the farmers and to people of various strata at various extension offices of each region.

a. Institute of Agriculture

The institute of Agriculture offers classes of horticultural education such as classes on vegetables and fruits. The students are taking credits in agricultural studies in general, and are receiving education in which a considerable emphasis is placed on practical training. The number of professors and assistants in charge of Horticulture is three (1981/82). The total number of professors is 92, the students currently enrolled are 605, the graduates 276 (1981/82). The period of study is 5 years.

b. State Agricultural Institute

There are two of these Institutes: one in Pyinmana and the other in Thaton. Their main purpose is to educate people who will be engaged in education work or in the extension activities. The total number of teachers is 43, while the current number of students amounts to 633 and the graduates amount to 171 (1981/82). The period of study is 3 years.

c. Agricultural High School

There are 13 agricultural high school throughout the country, and they are engaged in the education of both extension managers and farming leaders. The number of teachers is 106, the current students 1985, the graduates 757 (1981/82). The period of study is 2 years.

After graduation from these educational institutions, the graduates will go through a two (2) months training period where they will learn about all kinds of crops. They will be employed upon completion of this training.

Grade	Institution	Education	Period Number
University (for Research and Education)	Institute of Agriculture Department of Forestry, Arts and Science University, Rangoon Institute of Veterinary	5 years 6 years 6 years	1 1 1
Junior College (for Research and Education)	State Agricultural Institute	3 years	2
University and Junior College (for Education)	Field Man Course conducted in the Central Agricultural Station by Applied Research Section, the Agriculture Corporation		19
Middle-class Education	Agricultural High School	2 years	13
Elementary Education	Periodical and Temporary Courses for Farmers, conducted in the State Farms by the Extension Division the Agriculture Corporation Instructions and Trainings conducted in Township Office established in each Township. Education of Farmers conducted in the Regional Experimental Farms by the Agriculture Corporation		14 Every Township 19

Fig. 18 The Agricultural and Forestry Educational Institutions in Burma

	1980 – 81				1981 – 82				1982 – 83			
	School of Institution	Teacher	Student	Graduate	School of Institution	Teacher	Student	Graduate	School of Institution	Teacher	Student	Graduate
Agricultural High School	13	91	2,009	715	13	106	1,985	757	9	130	1,515	653
State Agricultural Institute	2	40	571	146	2	43	633	171	6	45	1,006	–
Institute of Agriculture	1	92	834	169	1	92	605	276	1	92	958	289

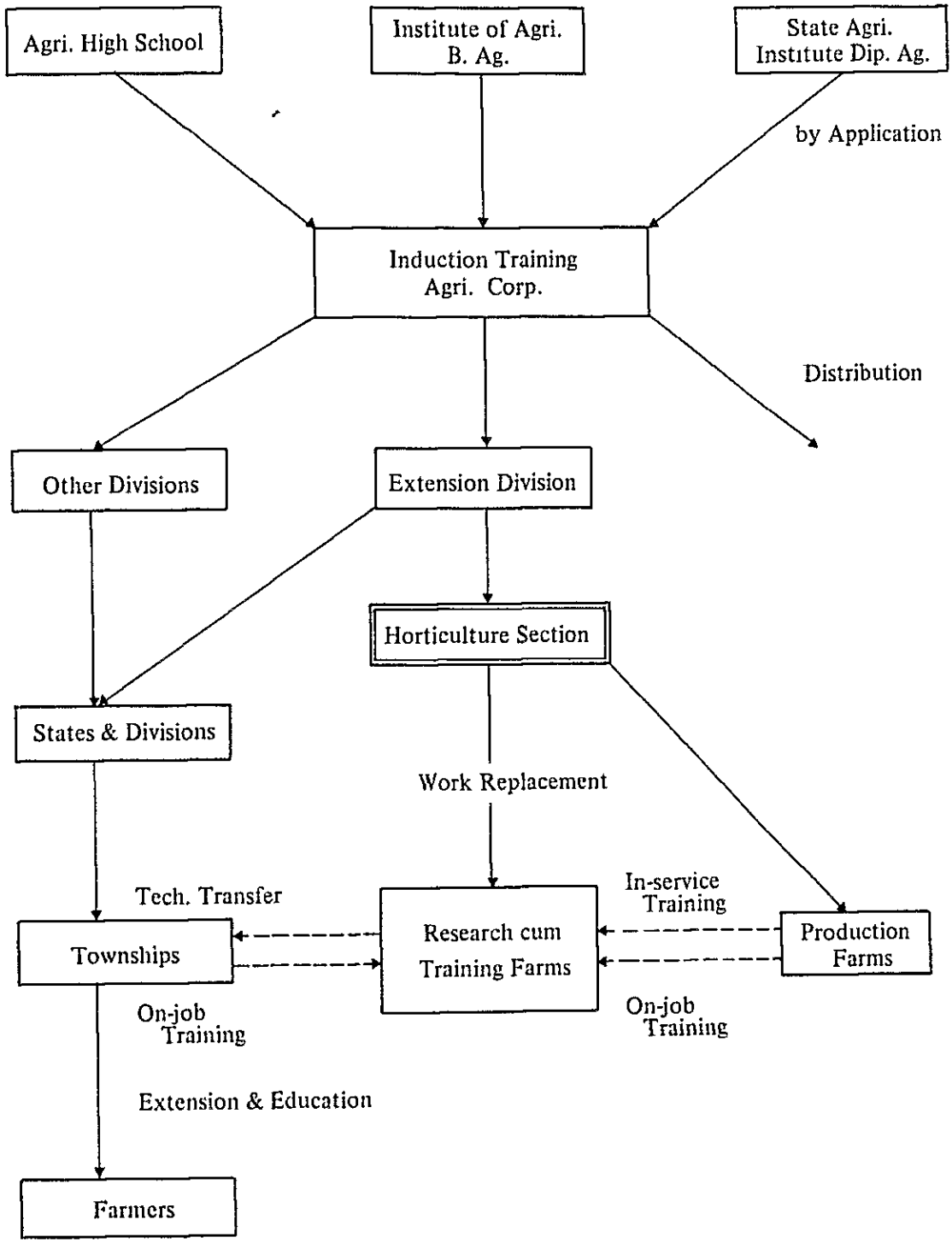
Number of Graduates of Agricultural Schools and Employees of Agricultural Government Offices

	Graduate				Employee of the Agriculture Corporation			Empolyee of the Others	
	1980–81	1981–82	1982–83	1983–84	1980–81	1982–83	1983–84	1980–81	1982–83
Agricultural High School	715	757	653	–	206	–	–	108(52)	–
State Agricultural Institute	146	171	–	–	102	269	–	46(45)	245(92)
Institute of Agriculture	169	276	289	–	144	269	274	46(32)	193(72)

Note: ( ) means the rate of the Employees of the others among the Employees of the Agriculture Corporation.

Fig. 19 Number of Graduates of Agricultural Schools

Fig. 20 Education & Extension of Horticultural Crops in Burma



CHAPTER 3
OUTLINE OF THE PROJECT

CHAPTER 3 OUTLINE OF THE PROJECT

3–1 OBJECTIVE OF RESEARCH AND DEVELOPMENT

This project is prepared as the first step to achieve the following long-term objectives in developing vegetables and fruits:

(1) to supply the local market demands

(2) to improve the nutritive balance of the people's diet through the consumption of various vegetables and fruits

(3) to acquire foreign currency by exporting the surplus

The objective of this project is to establish the "Vegetable and Fruit Research and Development Center" with its experimental field and also to equip the Sub-Center and five (5) Regional Experimental Farms in order to begin full-scale research and development.

As described in CHAPTER 2, Burma is now facing a shortage in various aspects of vegetable and fruit production because of a delay in the full-scale research and development. This is occuring in spite of the development potential of its land and its long history in cultivation of vegetables and fruits.

This project is to be the initial source for improving the situation, and will also be the core for developing vegetables and fruits, as the sole full-scale research institute in Burma.

3–1–1 Research Object

Judging from the current situation of research activity for vegetables and fruits in Burma, it is to be required that every research items planned by this project establish the fundamental stage. As proper requirements, four (4) research divisions are selected:

a. Breeding (vegetable and fruit)

   (1) Collection and selection of plants

   (2) Cross-breeding

   (3) Tissue culture

   (4) Breeding of disease resistance variety

   (5) Plant genetics

b. Cultivation (vegetable and fruit)

   (1) Plant growing method

   (2) Plant physiology

   (3) Seed production and propagation

(4) Protected cultivation

(5) Storage and transportation technology

(6) Irrigation method

(7) Agrometeorology

c. Plant Protection (vegetable and fruit)

(1) Plant protection from disease

(2) Plant protection from harmful insects

d. Soil and Crop Nutrition

(1) Soil science

(2) Crop nutrition

(3) Fertilization method

These research items shall proceed step by step. They will be substantial in accordance with the development and the addition of researchers.

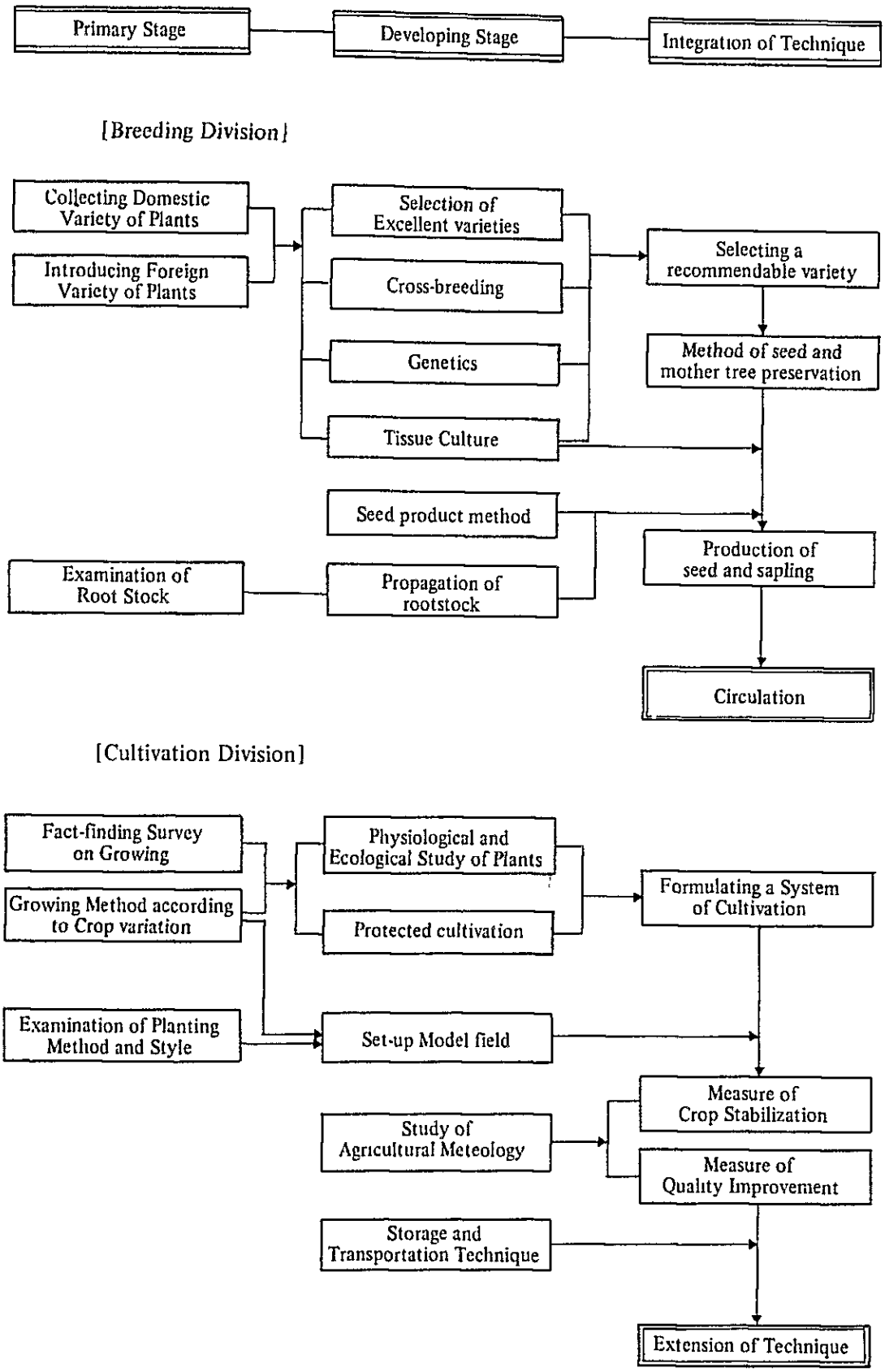


Fig. 21 Flow Chart of Research (No. 1)

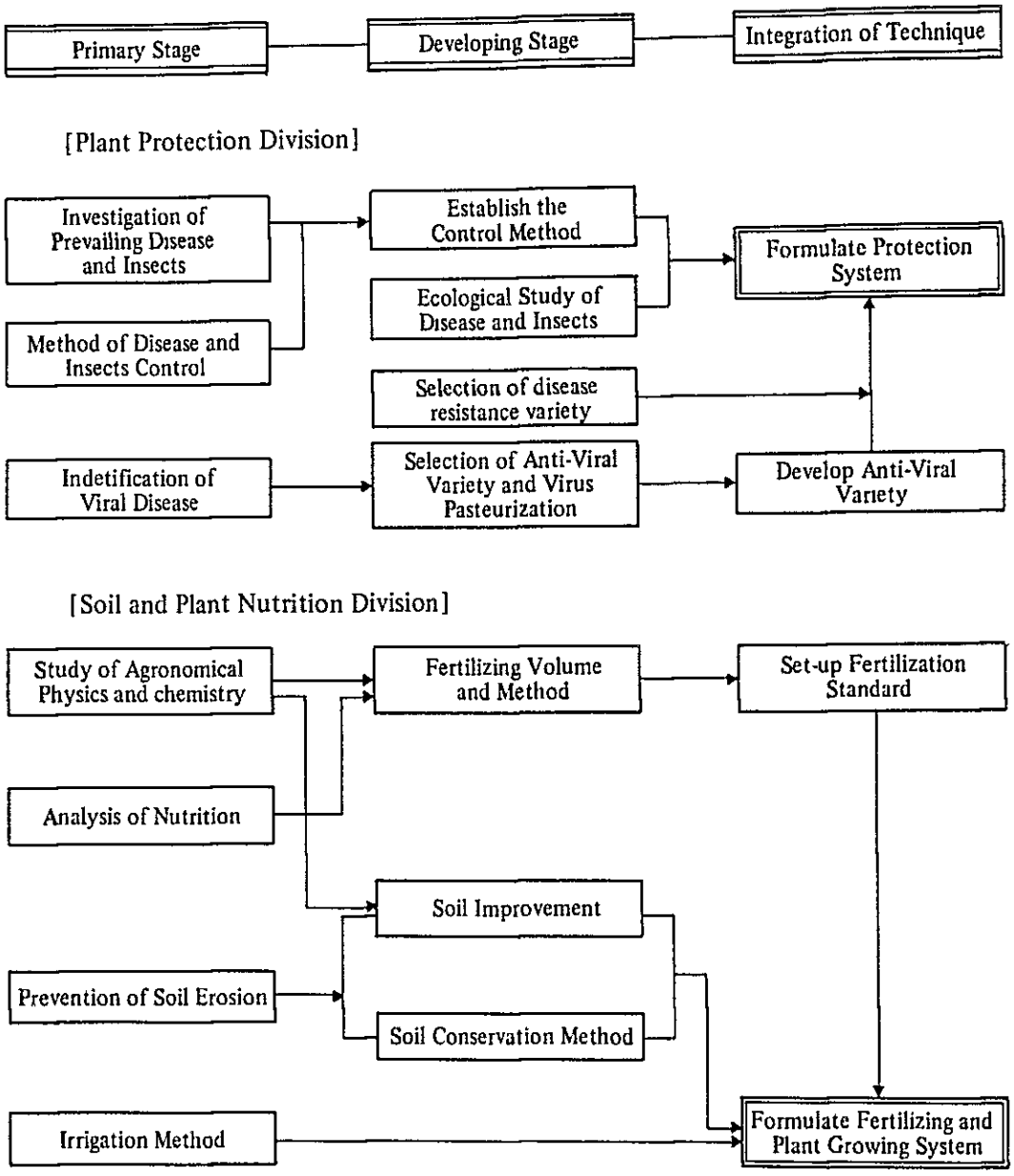


Fig. 21 Flow Chart of Research (No. 2)

3–1–2 Structure of Laboratories

Laboratories shall consist of the following four (4) laboratories for execution of four (4) research objects as previously mentioned.

(1) Vegetable Laboratory

(2) Fruit Laboratory

(3) Soil and Nutrition Laboratory

(4) Plant Protection Laboratory

This composition is different in (1) and (2) from the previous classification of research divisions. Taking into consideration the fact that there are differences in the research methods of breeding and growing between long term fruit arbor and annual vegetable herb. Also, judging from the current situation in Burma, it seems to be more efficient to research the breeding and growing in each vegetable and fruit.

Training of researchers will be performed in the form of "on job training".

3–1–3 Experimental Field

The Government of Burma emphasized the importance of experimental fields in the project.

The governmental agricultural project in Burma shall play a basic role in leading the overall agricultural development. Therefore, the scope of the development from research to practice should be expansive and solid. Also, in Burma, the characteristics of its agricultural education emphasizes practice.

Upon the implementation of this project, research and practice will be considered as a continuous activity. It will then be implemented through demonstration testing, on-job training for researchers and the practice of research results will be parallelled with research activities at each stage of the research. To establish a solid experimental field means to expand the possibility of various activities, thus the importance of experimental fields is especially emphasized at this time.

3–1–4 Sub-Center and Five Regional Experimental Farm

Among the existing experimental farms under the jurisdiction of the Extension Division of the Agriculture Corporation, the Government of Burma appointed six (6) farms applied to this project. The experimental farm located in Maymyo has been appointed as a Sub-Center considering its priority, and other five (5) farms have been appointed as the Regional Experimental Farm. These experimental farms are located in Mandalay, Mon, Irrawaddy, Shan, and Chin, which have the typical characteristics in climate of Burma. Taking into account of the research conducted in the Main Center located in suburban area of Rangoon, the objectives of the Regional Experimental Farms are the actual field research in accordance with the characteristics of each region. Some of the above five regions are not arranged its infrast-

ructure sufficiently. Thus it is necessary to improve the infrastructure conditions smoothly.

3–1–5 Crop Items for Research

Crop items for research indicated by the Government of Burma are as follows:

These are 13 kinds of vegetables including current major vegetables in Burma and 13 kinds of fruits which spread from the tropical zone to the temperature zone. Improvement of these items will be the most urgent objects for research.

Crops	Main Center (Hlegu)	Sub-Center (Maymyo)	Regional Experimental Farms				
			Madaya	Taunggyi	Kyaikhto	Haka	Maubin
Vegetable							
Tomato/Eggplant	○	○					
Chilli	○						
Cabbage	○	○		○		○	
Cauliflower	○	○		○			
Radish	○	○		○			
	○						
Melon	○	○					
Water Melon	○						
Peas	○	○		○			
Beans	○	○		○			
Sweet Pepper		○					
Garlic		○		○			
Kholrabi						○	
Fruit							
Pomelo	○		○		○		○
Durian	○				○		○
Rambutan	○				○		
Mango	○		○		○		○
Orange (Tropical)	○		○				
Orange		○		○			
Lime & Lemon	○						
Apple		○				○	
Pear		○		○			
Stonefruit		○		○			
Grape		○	○				
Nut		○				○	
Pine Apple	○				○		

Fig. 22 Proposed Crop List

3–2 PROJECT IMPLEMENTATION SYSTEM

3–2–1 Organization

a. Relevant Organization

The implementation and management of the project will be controlled under the Agriculture Corporation. The independent division for the project will be situated in parallel with the existing divisions, and supervised by the Managing Director of the Agriculture Corporation. Its structure is shown as follows.

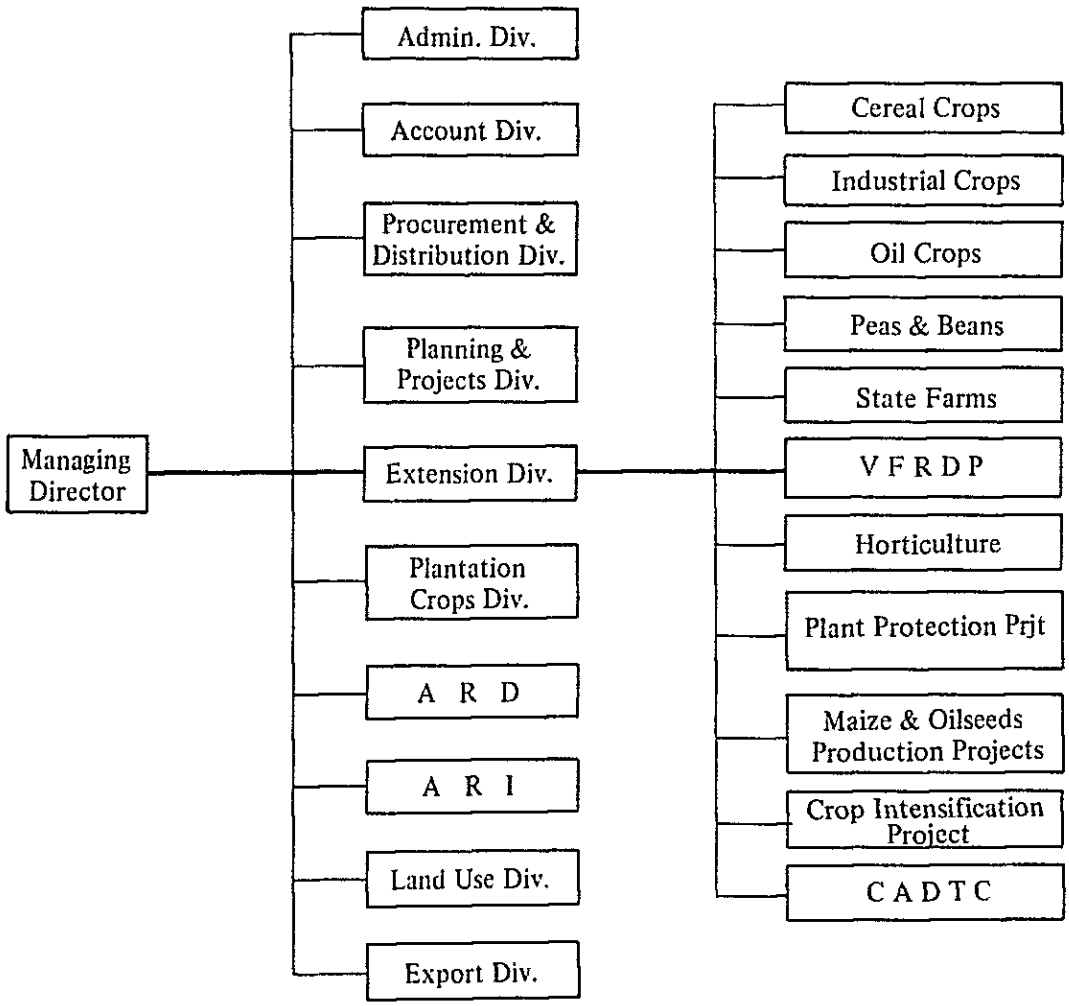


Fig. 23 Positioning of the Center in the Present Organization of Agriculture Corporation

b. Organization of the Project

The organization for the project proposed by the Government of Burma is shown in the following drawing:

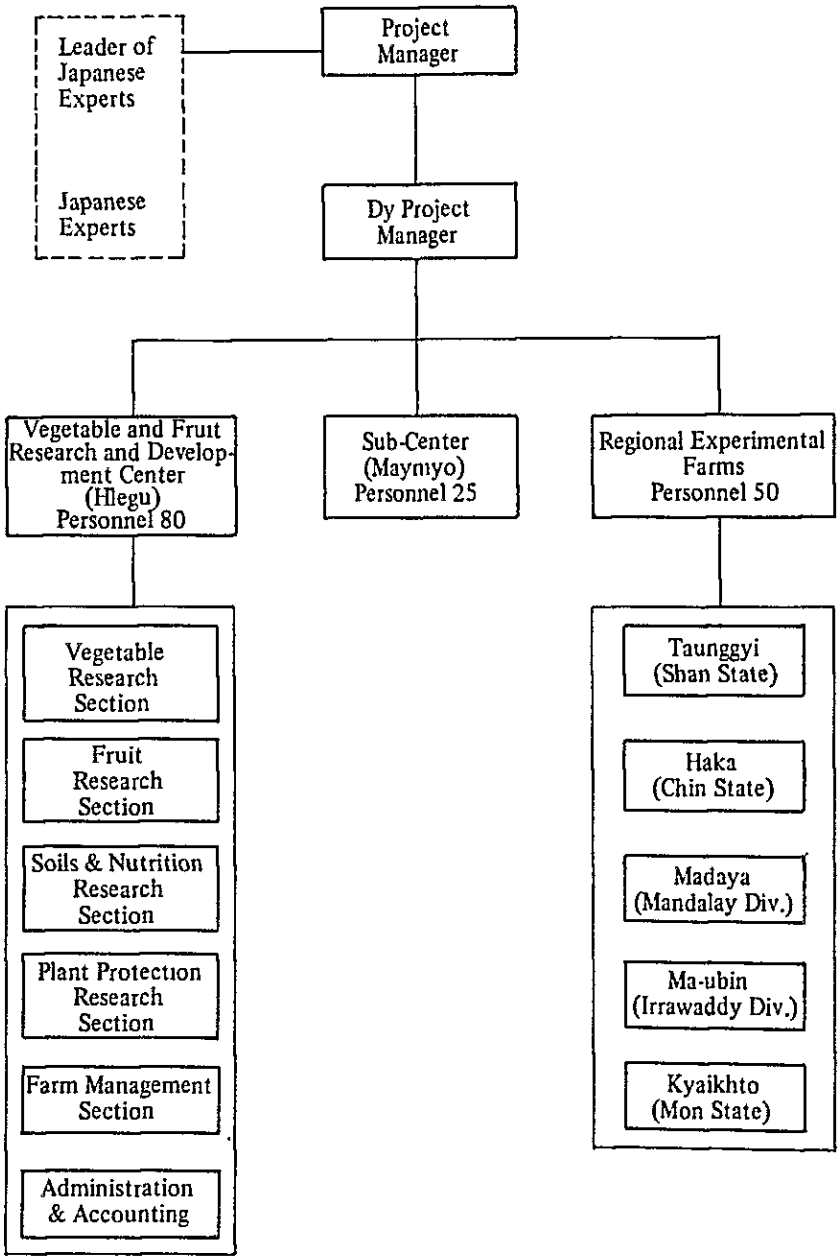


Fig. 24 Proposed Organization Chart of the Project

The Main Center to be established in Hlegu Township, will include 4 laboratories, farm management section, administrative and accounting section. 80 members including the Project Manager are to be posted. The Sub-Center in Maymyo has risen in rank from a regional experimental farm because it is located at an important area for the horticultural crops, 25 staff members will be posted in Sub-Center. Five (5) Regional Experimental Farms specially designated in the project among 37 existing regional experimental farms are likely to cover the typical regions in Burma. 50 staff members in total will be posted there. Main Center, Sub-Center and 5 Regional Experimental Farms will be controlled by the Project Manager.

State & division Township Name of Farm	Potential Area (acre)	Cultivated Area (acre)	Area to be used under project	Temperature (F)		Precipitation (mm)	Elevation (m)
				MIN.	MAX.		
Rangoon Hlegu Main-Center	200	–	100	70.88	81.04	2,993.1	9
Mandalay Maymyo Sub-Center	30	24	30	35.00	98 00	1,238.5	975
Mandalay Madaya Madaya	40	10	30	65.00	104.00	601.7	91
Shan Taunggyi Namlat	260	125	30	45.13	100.80	1,592.6	1,128
Mon Kyaikhto Ingabo	350	226	30	68 00	102 00	1,316.2	91
Chin Haka Cawbuk	50	40	30	32 00	80.00	1,574.8	1,890
Irrawaddy Maubin Maubin New Farms	100	–	30	62.90	98 60	2,497.8	6

Fig. 25 Meteorological Data for Project Area

3–2–2 Staffing

The outline of staffing for the project management is as follows.

To ensure and to prepare 14 research officers and 16 junior research officers who are to be the main body of researchers are the most urgent matter.

Fig. 26 Total Staff Requirement

No.	Description	Number of Staff	Remark
I	Main Center	80	
II	Sub-Center	25	
III	Regional Experimental Farm	50	GRAND TOTAL: 155

Main Center

No.	Description	Number of Staff	Remark
A	PROJECT MANAGER'S OFFICE		
1	Project Manager	1	
2	Dy. Project Manger	1	
3	Junior Officer	1	
4	U.D.C.	1	
5	L.D.C.	2	TOTAL: 6
B	ADMIN. & ACCOUNT SECTION		
1	Admin. Officer	1	
2	Account Officer	1	
3	Suprintendent	1	
4	Junior Officer	1	
5	Auditor	1	
6	Librarian	1	
7	B.C.	1	
8	Store Keeper	1	
9	V.T.M	2	
10	Asst. Auditor	1	
11	Sr. Typist	1	
12	U.D.C.	1	
13	Record Keeper	1	
14	Projectionist	1	
15	Electricien	1	
16	V.M.	1	
17	Jr. Auditor	1	
18	Jr. Typist	1	
19	L.D.C.	1	
20	Driver	2	
21	Watch Man	2	TOTAL: 24

No.	Description	Number of Staff	Remark
C	VEGETABLE SECTION		
1	Research Officer (1)	1	
2	Research Officer (2)	1	
3	Research Officer (3)	2	
4	Junior Research Officer	4	
5	V.T.M.	0	
6	V.M.	0	TOTAL: 8
D	FRUIT SECTION		
1	Research Officer (1)	1	
2	Research Officer (2)	1	
3	Research Officer (3)	2	
4	Junior Research Officer	4	
5	V.T.M.	0	
6	V.M.	0	TOTAL: 8
E	SOIL & NUTRITION SECTION		
1	Research Officer (2)	1	
2	Research Officer (3)	2	
3	Junior Research Officer	4	
4	V.T.M.	0	
5	V.M.	0	
F	PLANT PROTECTION SECTION		
1	Research Officer (2)	1	
2	Research Officer (3)	2	
3	Junior Research Officer	4	
4	V.T.M.	0	
5	V.M.	0	TOTAL: 7
G	FARM SECTION		
1	Farm Manager	1	
2	Dy. Farm Manager (Vege.)	1	
3	Dy. Farm Manager (Fruit)	1	
4	Irrigation Engineer	1	
5	Agri. Machinery Engineer	1	
6	Asst. Farm Manager	2	
7	Asst. Irrigation Engineer	1	
8	Fore Man	1	
9	V.T.M.	3	
10	Mechanic (1)	2	
11	V.M.	3	
12	Mechanic (2)	3	TOTAL: 20

Sub-Center

No.	Description	Number of Staff	Remark
1	Research Officer (1)	1	
2	Research Officer (2)	1	
3	Research Officer (3)	2	
4	Junior Research Officer	4	
5	Dy. Farm Manager	1	
6	V.T.M.	4	
7	U.D.C.	1	
8	V.M.	4	
9	Jr. Typist	2	
10	L.D.C.	2	
11	Driver	1	
12	Watchman	2	TOTAL: 25

Regional Experimental Farm

No.	Description	Number of Staff	Remark
1	Asst. Farm Manager	5	
2	Dy. Farm Manager	5	
3	V.T.M.	10	
4	V.M.	20	
5	Jr. Typist	5	
6	L.D.C.	5	TOTAL: 50

3–3 SCOPE OF PROJECT

Based on the research object and the implementation system mentioned previously, facility and function to be included in the project are as follows:

a. **Main Center** (Hlegu, Rangoon Div.)

(1) Buildings

Management section – management of overall facility
Research section – laboratories
Experimental Farm Supervision section
Storage section

(2) Fields

Vegetable field – about 6 ha
Fruit field – about 35 ha (including future extension)

(3) Equipment

Laboratory equipment – for research and experiment
Field equipment – for field

(4) Others

Glasshouse (including mist-house), net-house, shade-house, etc.

b. **Sub-Center** (Maymyo, Mandalay Div.)

(1) Equipment – for field
for research

c. **Regional Experimental Farms** (Madaya, Mandaley)
(Taungyi, Shan)
(Kyaikhto, Mon)
(Haka, Chin)
(Ma-ubin, Irrawaddy)

(1) Equipment – for field
for research

CHAPTER 4

GENERAL CONDITION OF THE PROJECT SITE

CHAPTER 4 GENERAL CONDITION OF THE PROJECT SITE ECT SITE

The seven (7) areas which are to be covered by this project are the Main Center, the Sub-Center, and the five (5) Regional Experimental Farms. Of the above seven only the Main Center is being planned to be built, while the remaining areas are mainly planned to have equipment supplied. Therefore the major purpose of this chapter is to describe the grneral conditions of the project site of the Main Center.

4–1 SITE LOCATION

The Agriculture Corporation has acquired and maintained approximately 100 ha (240 acres) as the project site for the Main Center. It is located in Yemongle (South) Kwin, Hlegu Township, Rangoon Division approximately 60 kilometers to the northeast of Rangoon City. Because the site is surrounded by paddy fields, rubber plantations, and shruberry, it is impossible, at the present moment, to approach the site by vehicle from the Rangoon-Mandalay Road about two (2) kilometers away from the site. The site is presently a field covered with weeds and bushes, two (2) to three (3) meters tall. The undulating difference of the site is 13 meters, and the average height above sea level is approximately 15 meters, which shows that the site is comparatively flat with gentle undulations.

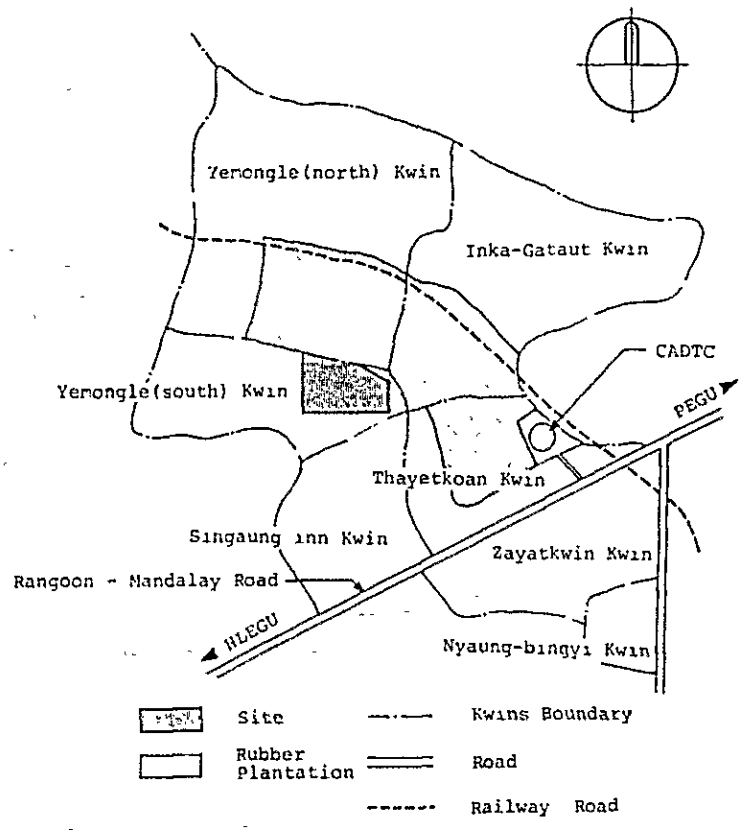


Fig. 27 Site Location

4–2 NATURAL CONDITIONS

4–2–1 Meteorological Conditions

The location of the site is meteorologically classified as a tropical rainforest region. Its climatic conditions are as follows:

(1) Temperature

Average temperature in the hottest month	38 C (April)
Average temperature in the coolest month	18 C (January)

(2) Humidity

Monthly average maximum humidity	87% (August)
Monthly average minimum humidity	62% (January)

(3) Precipitation

Maximum monthly precipitation	600 mm (August)
Average yearly precipitation	2,500 mm

(4) Wind Direction

From February to September	South-southwest
From October to January	North-northeast

4–2–2 Soil

The soil is mainly composed of fine alluvial soil, rich in silt. According to the digging investigation of the soils approximately 1 m deep, the surface soil, 40 – 50 cm deep, is a gray silt layer with reddish brown laterite in the form of fragmental bricks. Therefore, the permeability of the soil is relatively high, although the solidity of the soil will be extremely high when there is no water in the soil. The soil pH (KCl) is 4.5 on the surface and 3.5 at one (1) meter below the surface. It tends to decrease as the depth increases; however, there are some parts where stability exists at pH 4.0.

The soil contains only a low percentage of lime, magnesia, humus, and nitrogen according to the soil analysis by the Land Use Division of the Agriculture Corporation.

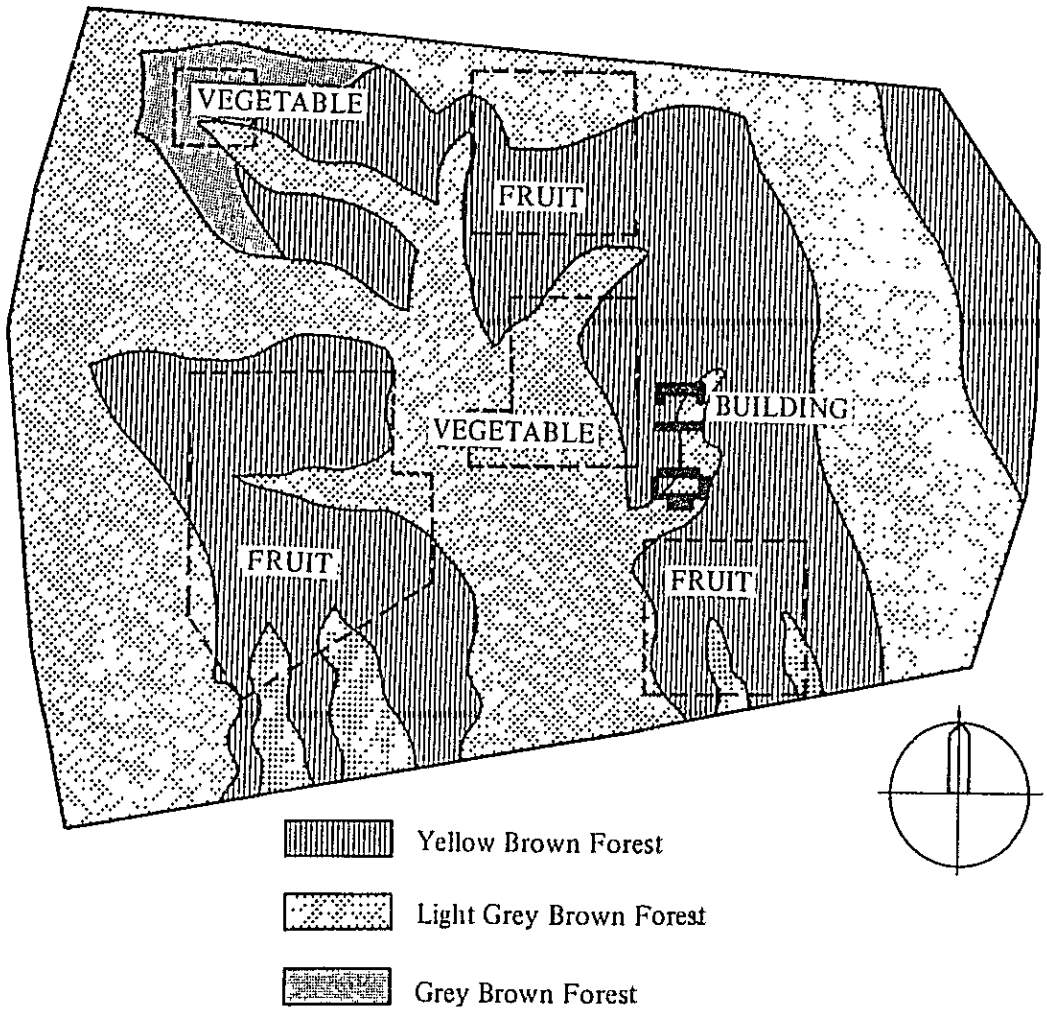


Fig. 28 Soil Map

4–2–3 Earthquake, etc.

The western part of Burma is located in the Europe-Asia Earthquake Zone. A vast default plane runs along the Sittang River from north to south through the center of Burma. Therefore, there have been several great earthquakes in Burma with seismic intensity of 6 to 7, recorded around the site. Hence, there is a need to consider the case of earthquakes when planning the structural design.

In addition, since damage by lightning during the rainy season has often been reported, there is a need to plan measures to meet the situation.

Because hail is very rare, it is assumed that there would be no damage by hail.

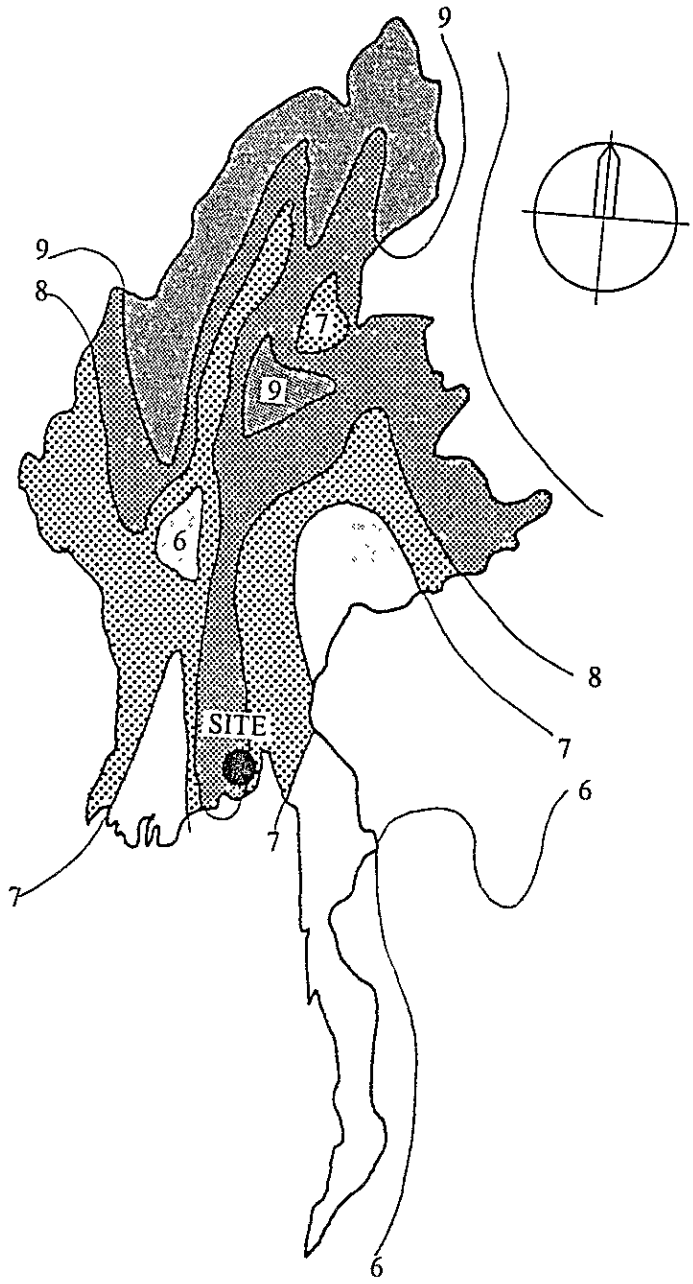


Fig. 29 Seismic Distribution of Burma

4–3 INFRASTRUCTURE

4–3–1 Electricity

A high voltage line of 33 kV, 50 Hz runs along the Rangoon-Mandalay Road, two (2) kilometers away from the site. It may be possible to lead the power to the site by branching out a line of 11 kV, 50 Hz.

The Electric Power Corporation will be responsible for the leading-in of the powerlines. However, since there is a lack of materials such as electric wires and transformers, at present, the completion of the power lead-in works may be said to owe much to the supply of the materials.

It is reported that the voltage fluctuation is ±5.0 – 5.5% at 230 V, and ±12.0 – 12.5% at 400V, and the frequency fluctuation is ±1%.

4–3–2 Telephone

Similarly, the telephone line runs along the Rangoon-Mandalay Road, and it is possible to lead-in the line to the site from the main line. It is assumed that the duration of the lead-in work is about three months.

4–3–3 Water Supply

Although a part of Rangoon City is equipped with water supply facilities, by the Rangoon City Development Committee, there are no such facilities at the project site. Underground water or water from rivers and ponds via elevated tanks is generally being utilized around the site.

4–3–4 Sewerage

There is no sewerage system available in and around the site. Sewerage is usually held by small septic tanks later to be discharged into rivers or to be penetrated into the ground.

4–3–5 Gas

There are no municipal facilities of gas supply or propane gas in Burma. Firewood and charcoal are generally used, and electricity and kerosene are used in limited areas as the energy source.

4–4 CITY PLANNING

The approach road to the site will be mainly the Rangoon-Mandalay Road. It is a major route with heavy traffic of busses and trucks connecting Rangoon and Mandalay via Pegu. According to the city plan, the New-Mandalay Road is to be constructed near the site under the fourth four-year plan. At the same time, the surroundings of the site will be consolidated as an "Educational Area." and also as an "Agriculture Complex Area".

4–5 PRESENT CONDITIONS OF THE SUB-CENTER AND REGIONAL EXPERIMENTAL FARMS

The present conditions of the Sub-Center and Regional Experimental Farms are shown as follows. At present, the farms do not generally have sufficient facilities. Although there is a broad field area, the irrigation system is inadequate and the electricity is unavailable. They are planned to be fully equipped and replenished so as to be the base for diffusing the fruition of the research from the Main Center to the localities.

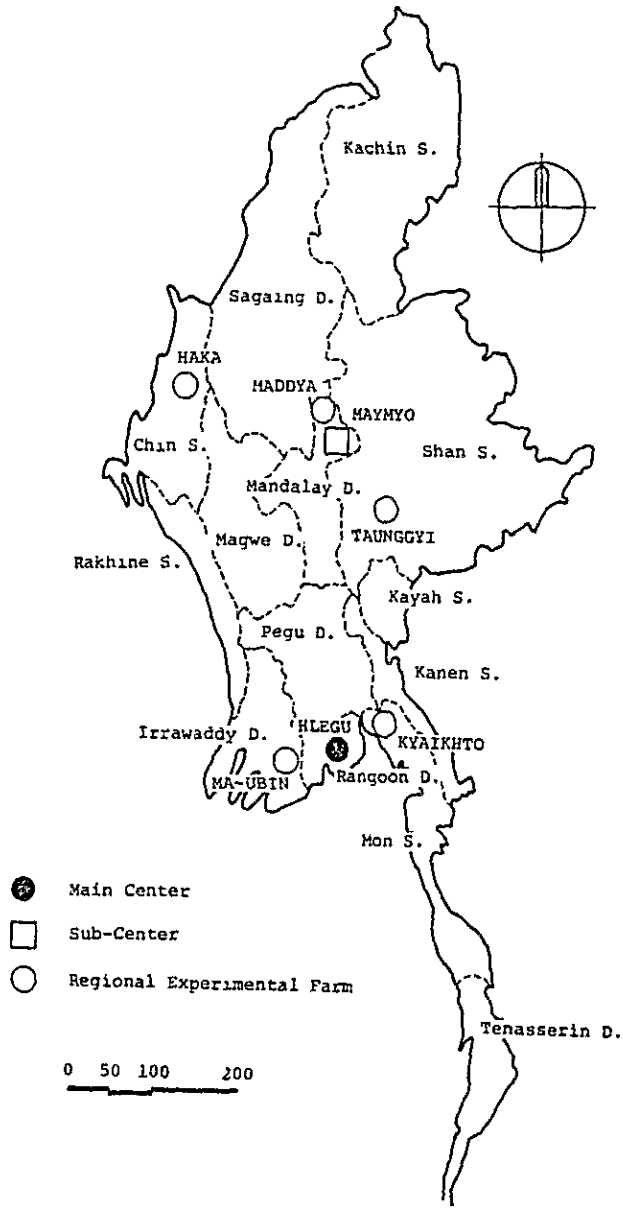


Fig. 30 Location of Sub-Center and Regional Experimental Farms

Fig–31 Outline of the Site Condition

NAME OF FARM	LOCATION	ELEVATION (m)	ANNUAL RAINFALL (mm)	TEMPERATURE		SITE CONDITION			
				MIN. TEMPERATURE (°C)	MAX. TEMPERATURE (°C)	SITE AREA (ha)	CALIVATED AREA (ha)	ELECTRICITY	WATER SOURCE
MAIN–CENTER	Hlequ, Rangoon Division	15	2,993	21.6	27.2	100	0	NO (1985)	TUBE–WELL
SUB–CENTER	Maymyo, Mandalay Division	960	1,239	1.7	36.7	12	9.6	NO (1986)	STREAM
MADAYA	Madaya, Mandalay Division	90	602	18.3	40.0	16	0	NO (1987)	IRRIGATION CANAL
NAMLAT	Tauggyi, Shan State	1,110	1,592	13.1	38.2	104	50.0	NO (1988)	STREAM
INGABO	Kyaikhto Mon State	90	4,316	20.0	28.9	140	90.4	NO (1988)	POND
CAWBUK	Hoka, Chin State	1,860	1,575	0	26.7	20	10.0	YES	STREAM
MAU–BIN	Mau-bin Irrawaddy Division	6	2,498	17.2	37.0	400	0	NO (1988)	–

CHAPTER 5
BASIC DESIGN

CHAPTER 5 BASIC DESIGN

This Basic Design dealing with the Vegetable and Fruit Research and Development Project is based on the Basic Design Study done in April 1984, and the series of discussions that were held between the Government of Burma and the Basic Design Study Team. The Basic Design Study Team has given serious study and analysis to the requests and conditions concerning the project that were presented by the Government of Burma during discussions. They were further considered and are reflected in this Basic Design Report.

This report shows the over all view of the project concerning the initial and eventually the full-scale institution of the Vegetable and Fruit Research Development Center of Burma as well as proposing the scale and the contents of the facilities.

5–1 BASIC DESIGN POLICY

5–1–1 Conditions

The conditions for planning the Basic Design are as follows:

(1) This institution is the Research and Development Center for Vegetable and Fruit, to be established in Burma.

(2) Research facilities, materials and machineries, and the experimental field are the objects of this project.

(3) This project is intended to be carried out as Japanese Grant-Aid Project.

(4) The expenses of the construction will come out of the Japanese 1984 budget, and the construction work of the facilities is planned to be completed by March, 1986 if the project is enforced.

The Basic Design is to be planned according to the conditions mentioned above.

5–1–2 Basic Design Policy

This Basic Design is proposed on the basis of the following foundamental concepts which are the result of the field investigation and the discussion with the Government of Burma.

(1) The institution should be constructed with consideration given to the natural conditions of the area.

The area of the site for the institution, including the experimental field is more than sufficient. For this reason, the natural environment should be taken advantage of by constructing the institution adapting itself to the configuration and the soil conditions of the project site. Upon the design of the buildings, comfortable living conditions should be considered, adaptable to the climatic condition of the site.

(2) The content of the facilities, and the scale of the facilities should be appropriate for the purpose.

A clear view of the future plan is to be gotten from the many-sided investigation and through analysis of the requests presented by Burma. As a result, appropriate content and scale of the facilities should be planned and proposed.

(3) Economy is to be pursued

Short and long term economy should be pursued by making a plan that keeps the construction cost low without depriving the facilities of the required functions, and which also, takes the maintenance and durability of the facilities into consideration.

(4) The project is to be made so that the effects of the cooperation between the two nations will be widespread and continuous.

A technological aid, setting at its basis the concept of utilizing local technology and local materials, and awakening the local technological potential, will be enforced. In case of the transfer of technology, not only the local technology but also the local society and culture should be taken into consideration. Therefore a project in which the effects of technological transfers are further utilized by the local technology and culture, should be proposed.

This project is to be enforced so that it adapts to the climate, economy, and technology of Burma. It is considered that the facilities should be a place where the cultural aspects as well as the functional and economical aspects of the effects of cooperation are brought into full play.

5–2 SITE CONDITIONS

5–2–1 Site

(1) The project site is situated 60 km to the northeast of Rangoon, and administratively, it belongs to the following region:

Yemongle (South) Kwin, Hlegu Fownship, Rangoon Division.

(2) It takes about one hour by car from the suburbs of Rangoon using the Rangoon-Mandalay Road. The site actually stands back 2 km from this main highway and presently, it is impossible to get there by car.

(3) The site is part of the educational area of the future city planning, and the Central Agriculture Development Training Center (CADTC) stands near the site as a related facility.

(4) The site is already under the authority of the Agriculture Corporation.

5–2–2 Configuration and the Surrounding Environment

(1) For the present, the utilization of an area of about 100 ha, running 1.0 km from north to south and 1.2 km from east to west is possible. This is considered as a site configuration, including the experimental field, that does not provide an obstacle for carrying out the project.

(2) There are rubber plantations on the northern and eastern areas, a shrubbery surrounded by a rice paddy on the southern area, and a shrubbery on the western area of the site. Therefore a site clearance, especially of the shrubbery, by Burma will be necessary.

(3) The undulation difference of the site is 13 m. Within the site, there are gentle undulations which should be taken into consideration regarding the layout of the facilities.

(4) It is not necessary to take special considerations of the solar light, noise pollution, air pollution, etc., for only a few small towns are scattered around the area.

5–2–3 Infrastructure

(1) The supply of electricity is possible from the existing high-voltage line which runs along the Rangoon-Mandalay Road. The requested amount of the electricity supply to the facilities is as follows:

Primary Voltage – 11 kV, 3 phase, 3 wire, 50 Hz
Electric Capacity – 500 kVA

(2) The installation of telephones from the telephone cable which runs along the Rangoon-Mandalay Road is also possible.

(3) The water supply to the facilities will come from a deep-tube well, due to the fact that municipal water is not supplied in the area surrounding the project site. The water supply to the experimental field will mainly come from the deep-tube well also, but utilizing rain water impounded in farm ponds as a part of the supply is also considered.

(4) Sewerage is not installed in the area surrounding the project site. Therefore in the project, the sewage will be allowed to penetrate into the ground and the rainwater will be allowed to discharge naturally.

(5) There is no supply of municipal gas or propane gas. Therefore electricity or firewood will be planned as the energy source.

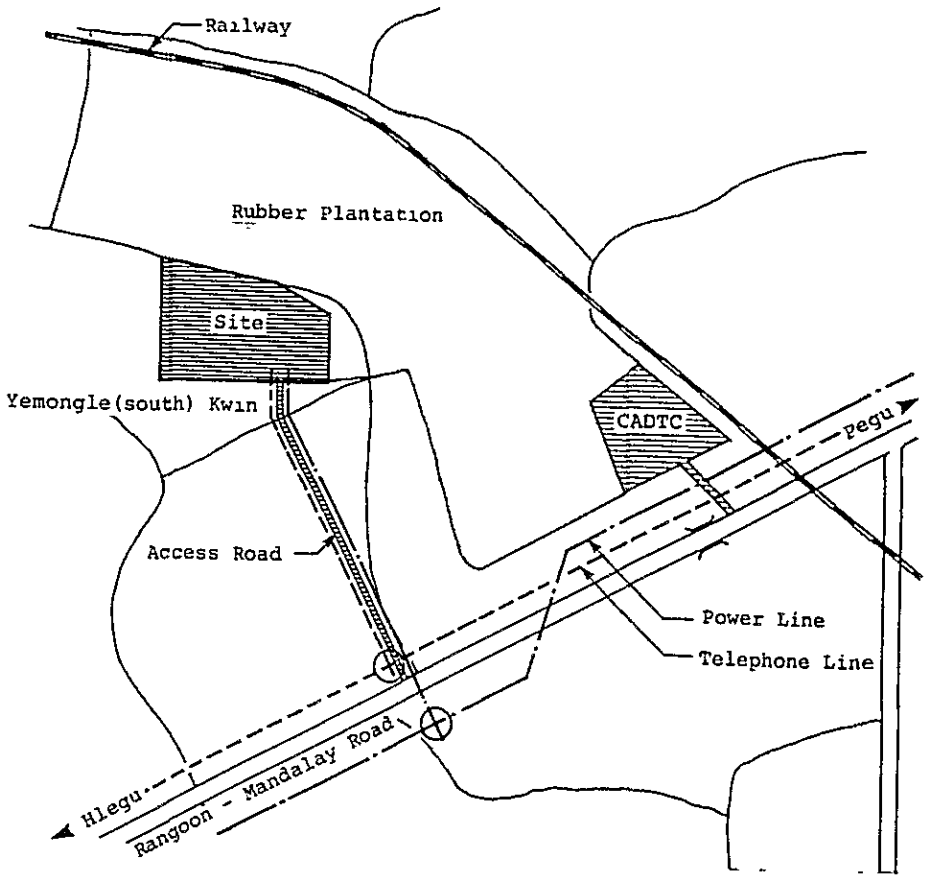


Fig. 32 Infrastructure

5–2–4 Soil Conditions

According to the soil investigation report on the project site, the soil conditions are uniform overall the site composed by the alluvial formation of the clayey silt. The details of the composition of soil are as follows:

Medium stiff reddish brown silt and clay layer with trace of sand and lateric gravel exists down to 3.5 m from the surface. Beneath it, firm reddish brown sandy and clayey silt layer exists down to 12.0 m followed by stiff clayey silt layer.

The underground water-table of the project site is 5.0 m depth from the existing surface. This data was obtained in dry season and the underground water-table varies around 3.0 m during rainy seasons and dry seasons. The project site where building facilities are planned is inclined from north to south by 2.0 m. Since there are no traces of excavation or backfilling, there will be no problem concerning the land settlement.

5–3 SITE PLAN

5–3–1 Components

The facilities are constituted of the following components in the Site Plan:

(1) Buildings

Mainly composed of building for research and experiment.

(2) Experimental Field

Divided into the Vegetable Field and the Fruit Field.

(3) Site for Future Extension

A construction site by the Government of Burma.

5–3–2 Conditions

(1) An access road penetrating into the south-eastern corner of the site will be constructed extending from the main highway.

(2) Considering the rise of water during the rainy reason, buildings should be constructed on the higher spots of the site.

(3) The experimental field should be situated where the soil is suitable for cultivation.

(4) Considering the irrigation and the distance required for conveying the crops, the Vegetable Field should be situated near the Buildings.

(5) The cultivation area of the Vegetable Field should be made level.

(6) Regarding the cultivation area of the Fruit Field, it is not necessary to take into account ground undulations.

(7) Regarding the storage of rain water, the lower spots of the site should be used as a farm pond.

5–3–3 Basic Policies

Followings are the basic policies for the Site Plan:

(1) The amount of soil to be moved during the construction period should be minimized.

(2) Make the site plan taking advantage of the configuration, with special consideration given to the directional flow of rainwater.

(3) Facilities of high artificial degree (i.e., where the natural conditions have been significantly altered to permit construction) such as the buildings, experimental field with a mechanical irrigation system, and so on, should be concentrated in the same area.

(4) The main facilities will be connected by farm roads within the site for the purpose of car transportation.

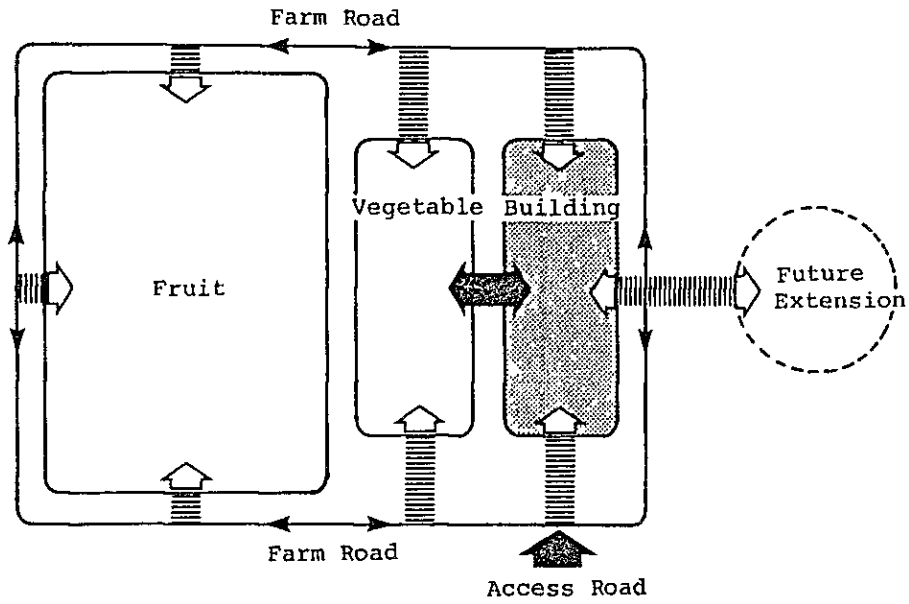


Fig. 33 Basic Policy for Site Plan

5–3–4 Overall Site Planning;

Followings are the outline for the overall site planning:

(1) The connecting point of the access road branching off from the main highway should be located at the south-eastern corner of the site which is the most economical point for the construction of the access road. This area would be considered as the starting point for approaching the facilities.

(2) The buildings should be placed at the higher spots of the site which is the area north of the vertical line extended from the access road. This area would be called "the Building Zone".

(3) The most artificial part of the Fruit and Vegetable Experimental Fields should be concentrated near the Building Zone, with regard to the soil conditions and the configuration of the site.

(4) The Experimental Fields that are less artificial should be layed-out outside of this area of concentration and be connected by farm roads within the site.

(5) The area of land to be planned for the future extension by the Government of Burma will be prepared. This piece of land should be located along the route of the farm roads within the site and near the Building Zone.

(6) Farm ponds for rain water should be constructed by utilizing the existing pond and the low spots of the site as well. The farm ponds would be used as a part of the water supply for irrigation within the Experimental Field.

The concepts mentioned above are as follows:

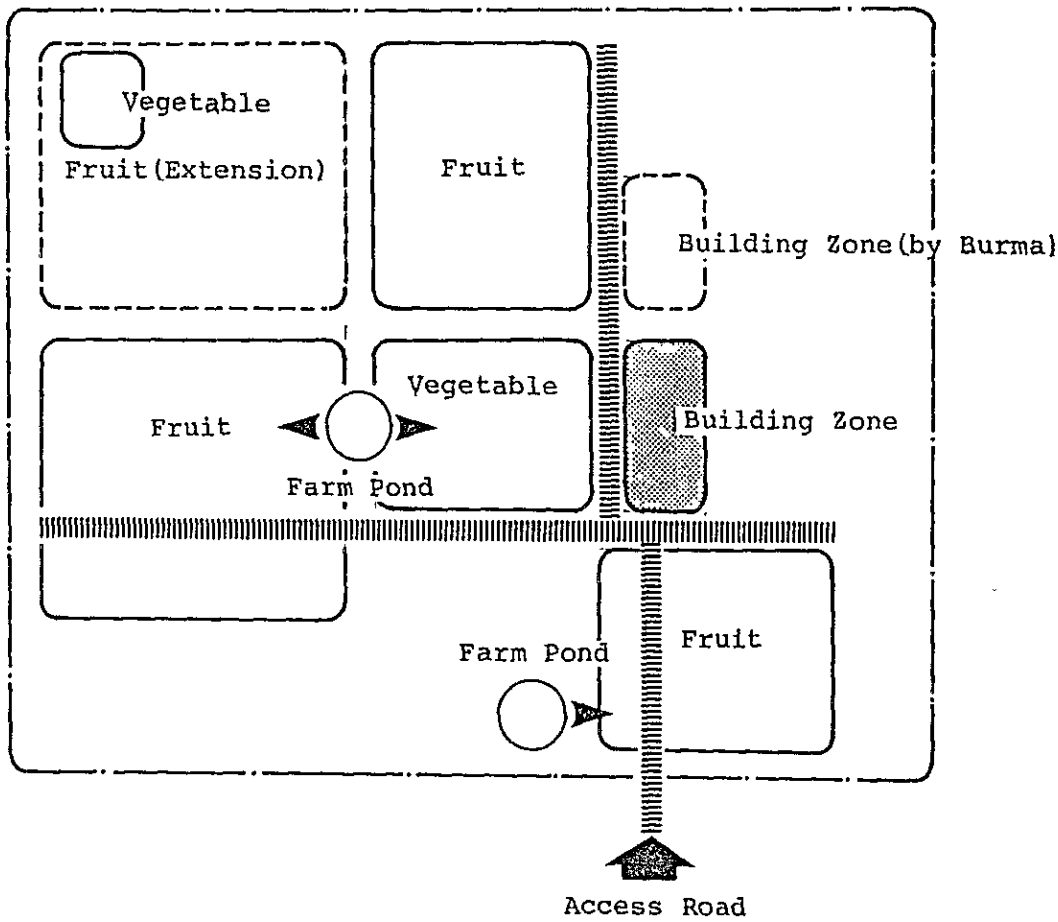


Fig. 34 Concept of Site Plan

5–4 ARCHITECTURAL PLAN

5–4–1 Facilities

The facilities can be divided into different blocks. Followings are the five (5) blocks categorized according to their functions:

(1) Experiment and Research Block

This is a facility for experiment and research purposes, basically composed of following four (4) laboratories. Special laboratories are to be attached to each laboratory.

1. Vegetable Laboratory
2. Fruit Laboratory
3. Soil and Nutrition Laboratory
4. Plant Protection Laboratory

(2) Administrative Block

This is a facility for administration purposes, and is composed of office rooms for the administrative and clerical staff.

(3) Community Block

This is a facility to be shared by the researchers, the clerical staff and so on. The library, the conference room, the dining room, etc. are included here.

(4) Service Block

Sub-Station, Mechanical Room, etc.

(5) Experimental Field Block

Various storages and facilities dealing with the experimental field.

Concerning the layout of the facilities, it is necessary that the Experiment and Research Block be set in the center so as to permit close contact with the rest of the facilities. Furthermore each facility should be allowed to expand independently. The above points should be reflected in the specific planning.

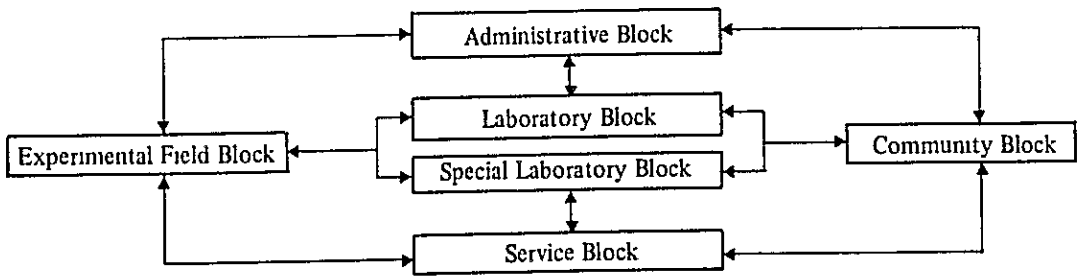


Fig. 35 Building Composition

5–4–2 Building Composition

The experiment and research block, administrative block and community block out of the aforementioned five (5) blocks comprising the entire facility compose the main building in this Project. The other two are planned here as independent buildings. The outlines of each building are as follows:

A. Main Building

The Main Building which will be the major facility of this Center is comprised of the four (4) blocks: the Experiment Laboratory Block, the Special Experiment Laboratory Block, the Administration Block and the Community Block. All the blocks are layed-out in the "one side-corridor" style for better natural ventilation and lighting. Moreover, each block is arranged independently around the courtyard. Formed in the center, the layout also takes into consideration anticipated future expansion. A one-story building is judged to be the best from the viewpoint of minimizing the construction period and by placing importance on the function of each block and their interrelationship.

The outline of each block of the Main Building is as follows:

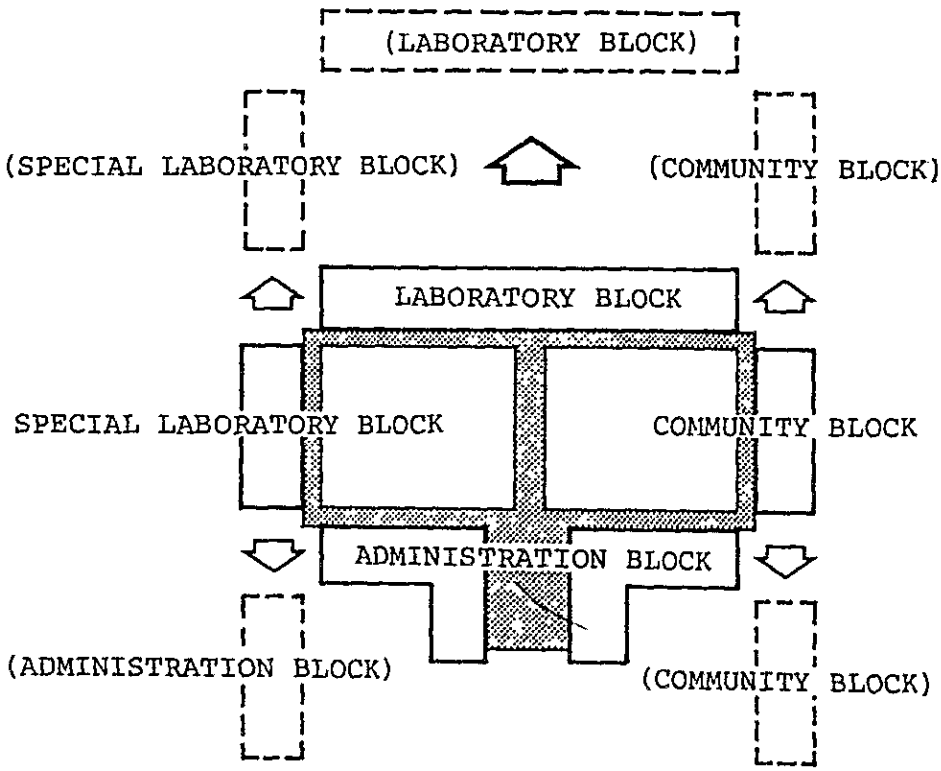


Fig. 36 Concept of Main Building

(1) Experiment and Research Block

a. This block is comprised of the four (4) laboratories of the Vegetable Laboratory, the Fruit Laboratory, the Soil & Nutrition Laboratory, and the Plant Protection Laboratory.

b. Each laboratory takes a form in which the space for experiment (laboratory) and the space for desk-work (office quarter) accompanying the research work are integrated into one area.

c. The number of researchers and assistants for each laboratory is to be 7–8. Space to accommodate at least two laboratory tables should be secured.

d. Considering ventilation and lighting, this block should be situated so that the corridors are on the south side and lighting comes in from the north side, in order to take advantage of the environmental conditions.

(2) Special Laboratory Block

a. This block is comprised of laboratories requiring special facilities such as measuring room, balance room, tissue culture room, and dark room, etc.

b. In arranging the location of the individual laboratories, importance should be placed on their relationship to each other as any one of them could possibly be used communally. (The measuring room should be located adjacent to the Soil & Nutrition Laboratory.)

c. As ventilation and lighting equipment are required functionally, thus creating an artificial environment, this block can be located on the west side despite the existence of the strong sun light.

(3) Administration Block

a. This block is comprised of an administration office, Project Manager's office and entrance hall, etc.

b. The Administration office should be designed so as to accommodate approximately 24 people.

c. It should be situated facing the access road for the purpose of administrative convenience.

(4) Community Block

a. This block is comprised of a library and a conference room.

b. The conference room should be designed so as to possess presentation capabilities and to accommodate 50–80 people.

c. A pantry is to be arranged adjacent to the conference room taking into account the possibility of serving light meals in the conference room.

d. The library should be designed so as to have the capacity for stocking 10,000 books and for six (6) seats for reading.

e. The community block should be situated between the administration block and the laboratory block.

B. Experimental Farm Supervision Building

a. The experimental farm supervision office as well as the worker's anteroom with an accommodation capacity for 20 experimental farm supervisors and 20–30 temporary workers respectively is to be arranged.

b. It will be the central facility for the supervision of the experimental farm, and should be designed so as to be independent from the laboratory and administration quarters.

C. Storehouse

a. This is comprised of storage for the yielded crops, a storeroom for various machinery used for experimental farming, and storage for other equipment.

b. The workshop for the repair of experimental farming machinery is to be deleted from the Project since the workshop of the neighboring Central Agriculture Development Training Center (CADTC) will be used.

c. It should be designed as a single building. A large-scale storehouse should be arranged at the center with smaller storage space attached at both sides.

D. Common Building

a. This is mainly comprised of a dining room and rest room.

b. It should be designed as an independent building so that every worker of the Center can easily use it.

c. The dining room is to be designed to accommodate approximately 50 people by assuming the rate of concentration of people at lunch time as 50 percent.

As described above, this facility is to be composed of four (4) buildings.

5–4–3 Scale of the Facilities

The scale of the facilities of the Project is roughly as follows:

Building	Room Name	Floor Area (m^2)	Note
Main Building	Vegetable Laboratory	120	for 8 researchers
	Fruit Laboratory	120	for 8 researchers
	Soil & Nutrition Laboratory	120	for 7 researchers
	Plant Protection Laboratory	96	for 7 researchers
	Measuring Room	40	
	Tissue Culture Room	48	
	Balance Room	24	
	Chemical Room	24	
	Dark Room	9	
	Storage	40	
	Project Manager's Room	48	
	Leader's Room	48	
	Reception Room	48	
	Administration Office	160	for 24 people
	Dy. Project Manager's Room	48	2 rooms
	Sample Room	48	
	Meeting Room	144	2 rooms
	Pantry	32	
	Library	96	contains 10,000 books approx.
	Locker Room	20	
	Storage	24	
	Hall, Toilet, Corridor, etc.	948	
	Total	2,305	
Farm Super-vision Building	Field Supervision Office	120	for 20 people
	Worker's Anteroom	72	for 30 people
	Storage	16	
	Corridor, Toilet, Shower, etc.	200	
	Total	408	

Building	Room Name	Floor Area (m^2)	Note
Community Building	Dining Room	120	50 seats
	Kitchen	72	
	Sub-Station	96	
	Corridor	120	
	Total	408	
Store-house	Crop Storage	140	
	Large Equipment Storage	280	2 storages
	Small Equipment Storage	140	
	Experimental Farm Equipment Storage	140	
	Low Temperature Storage	98	
	Storage	123	5 storages
	Oven Room	35	
	Fruit Analysis Room	63	
	Survey Room	143	2 rooms
	Corridor	143	
	Total	1,260	
Glass House	Glass House (Vegetable)	216	
	Glass House (Fruit)	216	
	Shade House	57	
	Net House	57	
	Total	546	
Others	Connecting Corridor	240	
	Grand Total	5,166	

NOTE:

Total Floor Area of Buildings	4,620 m^2
Others (Glass House etc.)	546 m^2
Grand Total	5,166 m^2

Each scale will be changed in accordance with the Detail Design.

5—4—4 Material Planning

The selection of the construction method and material of the buildings are essential parts of the design which will not only determine the degree of comfort with regard to environmental conditions, the exterior design, and framing of the construction cost, but will also determine the architectural plan itself. For this project, the construction method and materials are determined based upon the following concepts:

(1) Considering the meteorological conditions of the districts, a comfortable interior environment should be secured by either taking advantage of these conditions or by taking countermeasures in response to these conditions.

(2) The durability of materials should be pursued as much as possible, which giving due consideration to the simplicity of their control and maintenance. In principle, the local construction method and materials will be adopted. A shorter construction period and low construction expenses will be pursued.

The specific construction method and material plan will be as follows:

A. Structure

The most commonly used construction method in Burma will be adopted for the structure; and it will basically be a combination of reinforced concrete structure and brick masonry wall.

(1) Cement

The domestically manufactured normal Portland cement (British Standard BSS-12) is to be utilized. It is manufactured by the Ceramic Industries Corporation, and this cement is supposed to be supplied by the Corporation. However, since it is considered difficult to secure the required amount only from the Corporation, due to the limited construction period, it will be necessary to import for reserve about 1/3 of the total amount of cement. In this way, by having a reserve, the imported cement can be used in case of a shortage of domestic cement.

(2) Reinforced Bar

Imported re-bars are to be used for the following reasons:

a. Only the round steel bars are manufactured in Burma, and moreover their supply is unstable.

b. The domestic reinforced-bar is expensive; and furthermore, considering the fact that they are manufactured only in 1 m lengths from 1 m up to 12 m, there will be a loss when using and thus will be uneconomical.

c. With high sulfar content, there is also a quality problem.

(3) Brick

Domestically manufactured bricks are to be used. Since there are many cases where bricks are used in Burma, their supply is stable.

B. Roof

Corrugated asbestos cement board is used as the roofing material. Underneath there is a light gauge steel or wooden structural frame applied on a reinforced concrete structure. This method has many advantages such as the fact that the air larger in the garret can be used as a heat insulating layer; the fact that the naturally created slope can effectively work against rainfall; and the fact that it is both economical and a domestic construction method.

(1) Corrugated Asbestos Cement Board

The corrugated asbestos cement boards are produced by the Ceramic Industries Corporation and they will be used in the Project. However, in order to have a higher waterproof capability, fitting metals and packing materials should be imported. Presently, since colored cement roof tiles are not manufactured in Burma, only the corrugated galvanized steel sheet can be domestically procured.

(2) Light Guage Steel Roof Frame

Light gauge steel is to be used for the mateiral of the roof frame. Although the wooden roof frame is commonly applied in Burma, due to recent difficulties in obtaining lumber and due to its insufficient condition of seasoning, a light gauge steel roof frame should be adopted from the viewpoint of strict observance of the construction period and of quality guarantee.

C. Exterior Wall

Single-layered brick masonry wall, which is commonly used in Burma, will be adopted; and plastered with cement mortar and finished with paint. As for the design of the exterior wall section, deep eaves should be installed in order to avoid any damage caused by excessive sunlight on the exterior wall. At the same time, an opening mouth should be arranged on the exterior wall with regard to the wind direction so that natural ventilation takes place. In this project, it is decided not to use facing brick masonry wall, since it is inferior in waterproofing and because it will eventually become costly due to difficulty in securing facing bricks for finishing.

D. Interior Wall

Steel trowel mortar plastering with paint finish on top of brick masonry wall will be the main procedure.

(1) Paint

Imported paint will be used for the reason that domestically produced paint is difficult to procure and has a limited color range. In using imported paint, certain considerations will be necessary such as limiting the number of color patterns or avoiding the use of peculiar colors due to considerations of their control and maintenance.

(2) Steel Trowel Mortar Plastering

Although lime plaster can be considered as the wall finishing material, since mortar plaster is superior in shock-resistance and durability, the latter will be adopted in the project.

E. Floor

Terrazzo tiles and concrete steel trowel finish are to be adopted for the floor. Both of them are most commonly used in Burma as the floor materials. They are also superior in durability and can be easy to procure domestically. Plastic tiles which are popular in Japan are not adopted in this project for the reason that their maintenance is troublesome. They get dirty and scratch easily, requiring frequent cleansing and renewal. Moreover, it is necessary to place close attention on determining the floor level so that there will be no worry about flooding caused by rainfall.

(1) Terrazzo Tile

Among the domestic materials, Terazzo tiles are lowpriced and relatively easy to procure, and they also excel in performance. Together with material stones and cement, the domestically manufactured ones will be used, and will be made on the spot or at the plant.

(2) Concrete Steel Trowelling

The method of placing concrete with the finishing thickness of 30–50 mm on top of a concrete floor slab, and then finishing by steel trowel after tapping is generally applied in Burma. This resembles the so-called, "mortar steel trowel finish" in Japan. The method to install glass joints at every distance of 1.5–2.0 m is considered to be the best way to prevent floor cracking.

F. Ceiling

In principle, concrete slab ceiling with paint finish should be applied; and partial application of light gauge steel ceiling frame covered by silicic acid calcium board or mineral acoustic board, of wooden ceiling frame covered by teak board will be considered in case they are needed. The ceiling height should be determined taking into consideration the depth of the room and the window area as well as the meteorogical condition of Burma.

G. Doors & Windows

Considering the airtightness as well as the frequency of usage and durability, aluminum sash is to be used for the window. Steel doors are also to be used for the doors. As this facility is an specialized research center for vegetables and fruits and since there will be many pieces of precision testing equipment, each research office and laboratory should be equipped with a sufficient degree of dust-proof capability. Although wooden doors and windows are mainly applied in Burma, their maintenance has become a problem due to possibility of distortions. As a special emphasis is placed on durability, and also on acquiring long-term economic efficiency, metal doors and windows should be adopted for this project.

(1) Aluminum Sash

As domestically manufactured aluminum sash is not available, wooden or steel sash is mainly used in Burma; however, both have problems in airtightness, durability and maintenance. The imported aluminum sash will be used in the project; however, for the project there is a necessity to consider the possibility of procurement from a third country which is considered to be relatively advantageous cost-wise.

(2) Steel Door

Although wooden doors are mainly applied in Burma, there are many problems in maintenance as there is a need to frequently repair, various distortions. Plywood flush doors are also partially utilized; however, since the binding agent of water-resistant plywood itself is insufficient, separation from the surface has been observed. It has proved to be inappropriate from the viewpoint of maintenance. The design of this project has been planned assuming that ready-made steel door manufactured in Japan will be used.

Thus, as for the entire material plan, it is the adoption planned to suit the climatic condition. In principle, the local construction method and materials should be adopted. However, the selection of the construction method and materials of buildings should also be determined, taking into account the durability of materials, the simplicity of their control and maintenance, the shortening the construction period, and other factors.

5–5 STRUCTURAL PLAN

As Burma is located within the Europe-Asia Earthquake Zone, much damage has been recorded. Consequently, the seismic force should be considered in the structural planning. However, the Government of Burma has not established a decisive Earthquakeproof Standard, therefore case by case decisions are in accordance with the engineer in charge. The general seismic design coefficient used is K = 0.12, depending on the importance of the building. As for this case the coefficient K = 0.12 will be sufficient.

The type of foundation will be decided upon the research data of the soil investigation from the proposed site. The data shows the medium stiff reddish brown silt and clay layer with traces of sand and lateritic gravel having N-value of 20–25 which exists down to 3.5 m form the surface. Beneath that layer lies firm reddish brown sandy and clayey silt layer having a N-value of 10–15 which exists down to 12.0 m, and is then followed by a clayey silt layer having a N-value of more than 30.

Being as the proposed buildings will all be single-storied reinforced concrete structures, a spread footing on the silt and clay layer which is 1.5 m below the present surface will be adequate for a foundation.

Materials

1. Concrete

   Fc = 180 kg/cm²
   (Compression strength at 28 days)

2. Reinforcing bar

   SD 35 (Above D 19)
   SD 30 (Under D 16)

3. Structural steel

   SS 41

Judging from the results of the boring and soil laboratory tests, 10.0 t/m² for the bearing capacity of soil can be expected.

External loads on the structure

1. Earthquake load	
Design seismic coefficient	K = 0.12
2. Wind pressure	q = 150 kg/m²
3. Design bearing capacity of soil	(GL–1.5 m) 10 t/m²

4. Dead load

   Calculation according to structural materials and finished members

5. Live load

   Conforming to Japanese Architectural Standards.

5–6 SERVICE PLAN

5–6–1 Air Conditioning and Ventilation

Taking into consideration of the local climate, air conditioning is not to be installed in all rooms, except the rooms where air conditioning is required from the viewpoint of its functions and research activities.

In principle, ventilation will be natural ventilation. But in case of getting insufficient natural ventilation volume, mechanical ventilation will be applied.

A. Air Conditioning

From the viewpoint of the cost of running and maintenance, the conditioner units will be local system, air-cooled, and window-attached type. The rooms in which they will be installed are Leader's room, Project Manager's room, etc.

B. Ventilation

Ventilation equipment will be installed in lavatories, laboratories, kitchen, sub-station, and storages, etc. Ceiling fans will be installed in each room except, kitchen, sub-station, and storages, etc. And portable fans will be provided for some of the laboratories, because fixed circulation will be interrupted while conducting experiments.

5–6–2 Water Supply & Drainage

Within and around the project site, there is neither a water supply system, like municipal water, well and river, nor a drainage system. Therefore the following plan should be proposed.

A. Water Supply

(1) Source of water supply

A deep-tube well will be drilled at the Site as a source of water supply exclusively for the buildings.

(2) Water supply system

A deep-tube well pump will be put in the deep-tube well to pump up the water to a grit chamber tank. Water stored in the grit chamber tank will be pumped up to an elevated water tank and will be supplied to necessary places of the buildings by gravity.

(3) Drinking water

Water from the well will be unsuitable for drinking, an electric heater for boiling water will be installed in the pantry.

B. Drainage System

Sewage from the buildings, laboratory water, rain water, and other drain water will be discharged through following four different systems.

(1) Sewage

Sewage from toilets will be processed in a septic tank and will be penetrated into the ground through a penetrating tank.

(2) Laboratory water

Laboratory water will be penetrated into the ground through a penetrating tank. Developing solution, heavy metals and organic solvents will be collected in laboratories and will be processed by the authorities.

(3) Rain water

Rain water will be led through gutters constructed around the buildings and colverts and discharged into lowlands.

(4) Other drain water

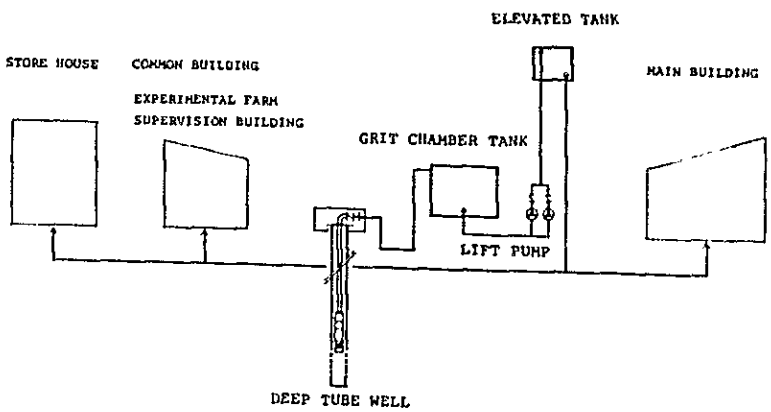
Other drained water and kitchen water will be penetrated into the ground through a penetrating tank. Kitchen water will be discharged through a grease trap.

C. Sanitary Fixtures

Eastern-style toilets will be installed to meet the local custom. A water faucet will be provided in each toilet stall.

D. Kitchen Equipment

A refrigerator, sinks, cooking table and dish cabinets will be provided in the ketchen. As firewood will be used for cooking to meet local fuel condition, gas range will not be provided.



Fgi. 37 Water Supply System

5–6–3 Electrical Facilities Plan

A. Power Receiving and Substation

The 11 kV power will be supplied from the Electric Power Corporation (EPC) of Burma, up to the boundary of the site by overhead line. From the boundary of the site to the substation in the Common Building, underground cables (11 kV) will be installed. The substation equipment will be installed in the cubicle except for the transformer and the automatic voltage regulator. After consideration of the range of voltage regulation in this area, an automatic voltage regulator (induction type) should be provided to prevent damage to the laboratory equipment. The transformer capacity will be approximately 300 kVA.

B. Generator Power

To prevent interruption of experimentation and research by a city power failure the generator power will be supplied to the part of the laboratory equipment which needs continuous power supply. One diesel engine generator unit (approx. capacity 40 kVA) will be provided.

C. Electric Power Distribution

Electric power is to be supplied from the main distribution board (low voltage) of the substation to each distribution board and motor control board.

(1) Supply voltage

Lighting and socket outlet	:	3 phase, 4 wire, 400 V/230 V
Motor	:	3 phase, 3 wire, 400 V

(2) Power distribution

Mainly, power distribution through wiring with piping in the buildings/underground cable for the exterior.

D. Lighting and socket outlet

(1) Lighting

For light source, fluorescent lamps will be mainly used. Lighting fixtures will be principally suspended type.

Average illumination for the rooms will be as folllws:

Laboratory rooms	:	400 lux
Office, Meeting room, etc.	:	300 lux
Dining room, etc.	:	200 lux
Storage, etc.	:	150 lux

External lighting will be provided along the road and around the buildings.

(2) Socket outlet

Socket outlets will be provided at necessary locations as the power source for small electric apparatus.

E. Power Source for Laboratory Equipment

Electric power is to be supplied to the laboratory equipment from the distribution boards as exclusive use which are installed in the laboratory rooms. Some laboratory equipment needs 100 V power. Therefore small capacity transformers are to be installed in the distribution board, and both 100 V and 230 V power will be supplied to the laboratory equipment.

F. Telephone System

A telephone switchboard (push-button system) will be installed in the office (Main Building) and telephone will be provided according to the list shown below. The central telephone office line to the MDF (Main Distributing Frame) in the office (Main Building) should be provided by the Government of Burma.

Room	Number of Telephones
Laboratory	5
Library	1
Meeting Room	1
Project Manager's Room	1
Dy. Project Manager's Room	1
Reception Room	1
Administration Office	2
Field Supervision Office	2
Survey	1
Leader's Room	1
Total	16

G. Lightning Protection System

A lightning protection system will be provided. The lightning rods, conductors and groundings will be installed in accordance with Japanese Standards.

H. Fire Alarm System

A manual fire alarm system will be provided in the building zone. Fire alarm push-buttons, location lamps, and warning bells are to be located in each building, and the receiving panel is to be installed in the office of the Main Building. The system is to be able to indicate the fire signal on the receiving panel and to ring the warning bells after the fire alarm push-button has been manually activated.

5–6–4 Others

A. Fire Extinguishing System

The fire extinguishing system will be provided mainly based on the Japanese Fire Low. Power Source for the fire hydrant pump will be the municipal power supply and emergency generator is not to be provided. The fire hydrant pump will be operated manually.

B. Incinerator

A incinerator will be installed for inflammable wastes among daily disposed garbages.

5–7 EQUIPMENT PLAN

Research subjects on vegetable and fruit requested by the Government of Burma cover a wider range of the field. It is difficult to execute completely the research subjects judging from the activities and facilities of the present research conditions in Burma.

In the project, the most needed research subjects have been selected, after the careful consideration on the present situation in the field of the research and development of vegetable and fruit. These research subjects are to be regarded as a basis of the research and development of vegetable and fruits. It will be the most effective and essential to establish the foundation for the research system. And then, the research system will be improved especially in quality and quantity to deal with a still wider research field. Expansion of the research field should follow foundational improvement of the basic research system.

Based on the abovementioned background, in this project, the necessary research facilities and experimental field will be constructed and improved as the research institution on vegetable and fruit. And also the following research subjects are to be settled as the basic subjects in this institution. Together with the collection of basic data required for research and development of vegetable and fruit, the research system should be improved.

(1) Collection and selection of adequate plants

(2) Cross breeding

(3) Fertilizer control

(4) Methods of culture management like pruning and planting

(5) Harvesting and breeding techniques

(6) Research on actual damages by disease and noxious insects

(7) Preventive techniques of damage by disease and noxious insects.

Based on the above concept the necessary equipment and consumables for executing the project will be supplied. To the Main Center, necessary equipment is supplied to fulfill the role as the central facility of this project. To the Sub-Center which should support the Main Center, necessary equipment to conduct field experiments will be supplied. To the Regional Experimental Farm, necessary equipment will be supplied so as to develop the selection of adequate plants, a method of cultivation and breeding techniques.

Equipment and materials will be prepared in the following seven categories based on the research subjects and number of professional personnels.

(1) Equipment for Common Use

(2) Equipment for Vegetable and Fruit Research

(3) Equipment for Soil and Plant Nutrition Research

(4) Equipment for Plant Protection Research

(5) Equipment for Analysis

(6) Equipment for Farm Operation
(7) Equipment for Meteorological Observation

The necessary consumables of the supplied equipment will be provided with consideration of consumption in a certain period.

5–8 EXPERIMENTAL FIELD DESIGN

5–8–1 Component and Layout Plan

Experimental Field for practicing vegetable and fruit research and development is allocated to 6 ha for Vegetable Field and 35 ha for Fruit Field respectively from the viewpoint of their research items and necessary scale. The site for Experimental Field is to be located at the place where is convenient for the researchers who will usually stay in the building for experiment and research, and also considering terrain and soil condition there. In other words, the site should be the place which slopes slightly and also suitable for reclamation condition of the Field. Location of the site has been decided considering the draining condition as well.

5–8–2 Outline of the Field

The experimental field is to be planned to have 6.0 ha for vegetables and 35 ha for fruits, and is divided as follows based on the component of the facilities.

A. Experimental field for vegetables

(1) Precision Field (4.0 ha)

Farm roads and facilities for waterway and drainage are to be constructed, and the field is to be reclaimed as an adjusted slope field and to get soil dressing. The method for irrigation is the mechanical irrigation method.

(2) Isolation Field (2.0 ha)

This is to be constructed apart from the Precision Field and used primarily as an isolated experimental field of vermins. This field is reclaimed as an adjusted slope field, and farm roads are constructed.

B. Experimental field for fruits

(1) Mechanically Irrigated Field (5 ha)

This field will have irrigation facilities which use sprinklers. In addition, farm roads and drainage are to be constructed to make a experimental activities easy. The field is to get soil dressing and be used as a slope field. 2.0 ha of this, however, is to receive soil improvement.

(2) Local-Irrigation Field (15 ha)

In this field, water for irrigation is conveyed by open channel from the farm pond to the field, and the field is to be irrigated by the local irrigation method. The field is used as a slope field, and the surface of the field is to be arranged to allow for furrow irrigation. Soil dressing is conducted for the whole area and its 5 ha guarantees surface soil of more than 40 cm and the remaining 10 ha guarantees it more than 20 cm.

(3) Field for future extension (15 ha)

Besides the Fruit Field mentioned above, 15 ha of the site of field for future extension is to be guaranteed and its periphery encircled by farm roads. This area does not get construction of reclamation as a field.

5–8–3 Area of the Fields

Experimental Field is devided into following blocks from in terms of the use of Field and its pattern of the facilities.

Use	Block	Area (ha)		
		Field	Ditch & Farm Road	Total
Fruit	A	3.6	1.4	5.0
Vegetable	B	2.8	1.2	4.0
Vegetable	C	1.4	0.6	2.0
Fruit	D	3.8	1.2	5.0
Fruit	E	7.2	2.8	10.0
Fruit	F	–	–	15.0
Total				41.0

5–8–4 Configuration and Area of the Field

Configuration of all of the field is to be rectangle and their periphery is encircled by farm roads. The scale of each field should be suitable for the research activities in the field. In this project, the area of 50 m x 60 m is the standard for the Vegetable Field and 50 m x 100 m is for Fruit field.

5–8–5 Field Reclamation

In the case of field reclamation work, each field is to be developed in accordance with land shape. The main field reclamation works are as follows:

Land Clearance
Top Soil Removal
Field Reclamation
Soil Dressing
Obstacle Removal
Soil Improvement

In field reclamation, each field will also be developed in accordance with its paticular use.

Type I:

This type will be applied for reclamation of vegetable fields and will be appropriate for adjusted slope fields. 50 cm of surface soil will be removed and replaced with 20 cm of soil from outside of the field, mixed with 30 cm of the original surface soil.

Type II:

This type will be applied to making orchard fields, and will be appropriate for adjusted slope field to allow for furrow irrigation. Reclamation of the surface soil will be a depth of 40 cm depth (Type II–1) in one place and to a depth of 20 cm (Type II–2) in another.

Type III:

This type will be applied to orchards on slope fields with mechanical irrigation. In this case, 50 cm of Soil Dressing will be executed. This will be done using only Tillage Mixing for the area with more than 50 cm effective surface soil. In other cases, where surface soil is less than 50 cm, shortage surface soil will be borrowed from the other areas. Soil Improvement will be executed both during this process and in Soil Dressing afterward.

Type IV:

This is for areas where Type III reclamation is applied without Soil Improvement.

Type V:

This type is applied for vegetable fields much as in Type I, with the exception that these fields will not receive Soil Dressing. Nor are irrigation facilities built in this case.

Type VI:

This type is for future site such as orchards. Therefore, no reclamation is executed.

Field	Type	Block	Area	Facilities				
				Farm Road	Irrigation	Field Reclamation	Soil Dressing	Soil Improvement
Vegetable	I	B	4.0	O	O (M.I)	O	O (50 cm)	
	V	C	2.0	O		O		
Fruit	III	A	2.0	O	O (M.I)		O(50 cm)	
	IV	A	3.0	O	O (M.I)		O(50 cm)	
	II – 1	D	5.0	O	O (L.I)	O	O(40 cm)	
	II – 2	E	10.0	O	O (L.I)	O	O(20 cm)	
	VI	F, G	15.0	O				

Note 1) M.I = Mechanical Irrigation 2) L.I = Local Irrigation

5–8–6 Farm Road

Structure and size of the roads are planned considering safety driving for agricultural machines such as tractors, and also trucks for agricultural products and building materials or machines.

Standard for roads is as follows:

	Main Road	Branch Road
Overall Width	5.0 m	4.0 m
Traveled Way (Paving Width)	4.0 m	3.0 m
Road Surface Height (from present level at road center)	0.5 m	0.3 m

Banking of the roads is conducted by drilling soil of drainage and also subsoil of neighboring. Materials for paving are laterite which are available locally. At crossing of roads, corner cut-off of 1.5 m for each side is constructed and this makes automotive traffic easy. Four (4) access gate are constructed for each block to make cultivation easy. Longitudinal slope of roads is less than 18 (1:3).

5–8–7 Necessary Water Capacity and Source

A. Necessary Water Capacity

Water source of the whole area depends on three deep-tube wells. Necessary water capacity which should be dealt with each well is as follows:

No. 1: For area 6.4 ha of irrigation for A.B Block

$$Q = 6.4 \text{ ha} \times 1/3 \times 5.4 \text{ mm} \times 3 \text{ day} \times 10/1440 \div 0.48 = 0.5 \text{ m}^3/\text{min}$$

No. 2: For area 5.2 ha of irrigation for C.D Block

$$Q = 5.2 \text{ ha} \times 1/3 \times 5.4 \text{ mm} \times 3 \text{ day} \times 10/1440 \div 0.48 = 0.406 \text{ m}^3/\text{min}$$

No. 3: For area 6.8 ha of irrigation for E Block

$$Q = 6.8 \text{ ha} \times 1/3 \times 5.4 \text{ mm} \times 3 \text{ day} \times 10/1440 \div 0.48 = 0.523 \text{ m}^3/\text{min}$$

B. Deep-Tube Well

Judging from the pumping record in the site, diameter of the wells are to be 200 mm or 150 mm and depth is 70 m. Details of deep-tube well are as follows:

Well	Diameter	Depth	Aperture of Pump	Power Output	pump Discharge
No. 1	200 mm	70 m	80 mm	15 kW	500 l/min
No. 2	150	70	65	11	400
No. 3	200	70	80	15	500

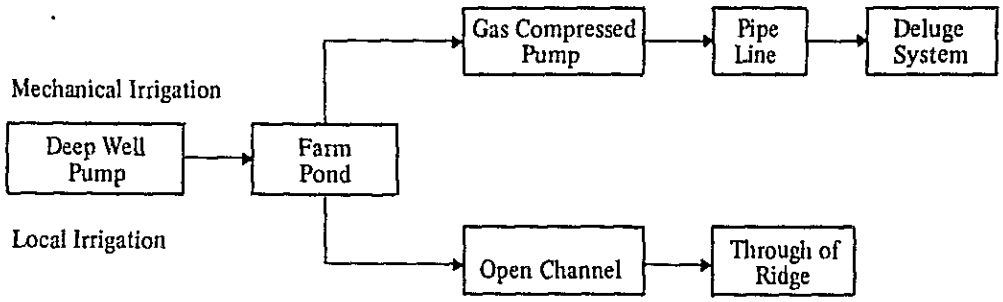
C. Farm Pond

Farm Ponds are equiped of each deep-tube well. Details are as follows:

Well	Storage Capacity	Dimension (a x b x depth)	Side-slope
No. 1	240 m^3	20 x 20 x 0.6	1:1.5
No. 2	180	15 x 15 x 0.7	1:1.5
No. 3	240	20 x 20 x 0.6	1:1.5

5–8–8 Irrigation Facilities

The irrigation facilities from water source to experimental field are as follows:



A. Gas Compressed Pump

Pump	Area	Pump Discharge (l/min)	Aperture of Pump (mm)	Power Output (kW)	Total Life (m)
No. 1	A Block	430	65	7.5	45
No. 2	B Block	300	65	5.5	41

B. Pipe Line

Steel Pipe ϕ100 mm and 75 mm

C. Deluge System

Sprinkling Pressure 0.6 kg/cm^2 – 2.5 kg/cm^2
Sprinkling Method Sprinkler system or drip method

D. Furrow Irrigation

Each field of furrow irrigation will receive water carried from the Farm Pond by open channel. Water which is conveyed to the field is irrigated by furrow irrigation. In this case, making ridges in the field conducted as the maintenance on the cultivation. The side ditch which is situated at the periphery of each field, however, is constructed as a waterway in advance.

An open channel is in principle constructed by excavation without timbering, and its base width is 0.40 m, depth is 0.30 m and side slope of a waterway is a paved section of laterite which prevents from soil erosion.

5–8–9 Drainage Plan

The drainage system installed after the farm reclamation will consist of minor gutters in the site and main gutters where the minor gutters join together. Each minor gutter in the site will cover a small area; generally from 0.4 ha to 2.6 ha. Their cross section can be small because street gutters will be also used to drain the site. On the other hand, the main gutters that discharge water out of the site must be large and strong enough to meet the intensive drainage in heavy rains. The cross section of the small gutters is 0.4 m in bottom width, 0.50 m in depth and 1:1.5 in side-slope.

The cross section of the main gutter will be double-section, which consists of the lining cross section whose bottom is 0.5 m wide and the widening cross section of the part excavated without timbering. The grades of the gutters will be generally less than 1 in 500. Energy killers and protection systems will be installed at the gutters which have a steep slope for configurational reasons, at the outlet parts to discharge water out of the site and at the confluence points of the gutters.

5–8–10 Erosion Control Systems

Four disaster prevention ponds are planned to be provided in the project site. They will be used to temporarily store the debris flows caused by rain during and after the farm reclamation. They also prevent paddy fields and other land along the downstream from suffering damage done by large debris flows.

As for erosion control systems, disaster prevention forests or gully protection areas will be set up along the roads or gutters so as to prevent debris flows caused by rain. And after the adjusted slope fields, the toes of the slopes will be sheathed with stone blocks in order to prevent destruction and sliding of the faces of the slopes right after the construction.