REPORT OF THE JAPANESE IMPLEMENTATION SURVEY MISSION FOR AGRICULTURAL DEVELOPMENT IN LAMPUNG, INDONESIA

SEPTEMBER 1972

OVERSEAS TECHNICAL COOPERATION AGENCY

TOKYO JAPAN

FOREWORD

At the request of Ministry of Foreign Affairs, Overseas Technical Cooperation Agency dispatched the survey team to Indonesia for a period of one month from August 22, 1971 for agricultural development of Lampung province. The first half of the survey team was headed by H. Yoshiwara, Director of the O. T. C. A and the latter half by Mr. T. Shiroshita, Director of Tohoku National Agricultural Experiment Station.

The situation on the Indonesian side which led to the dispatch of the said survey team can be briefed as follows.

As is well known, the Indonesian government is exerting strenous efforts for the development of outer territories in an attempt to cope with the increasing population pressure of Java and tranform these territories into the bases of the country's food supply and production of export crops. Of a number of outer territories, Lampung province which is situated in the southern part of Sumatra and faces Java across Sunda channel is known to be favoured with natural conditions suited for the growth of various crops and at the same embraces a huge unreclaimed land area. The province is geographically situated within the economic zone of Java and its development is believed very promising. The Indonesian government has taken a number of measures to accelerate the development of the province.

In 1970, the Indonesian government requested Japan's assistance in a great diversity of projects which were aimed at the accelerated food production through the modernization of small holders' agriculture and export augmentation of agricultural products through the promotion of estate agriculture. The projects, mapped out for agricultural development of Lampung province, called for both economical and technical cooperation and covered infrastructural improvement, breeding and introduction of improved varieties, extension and establishment of advanced farming techniques using fertilizers and agro-chemicals, rationalization of marketing mechanism, and improvement of farmers' credit system.

It is with such background that the said survey team was dispatched to Indonesia. Since the aid request embraces a multiple of projects, arrangements were made with the Indonesian government for carrying out a series of surveys to grasp the overall agricultural development of Lampung in parallel with surveys to be conducted for high priority projects of the province. The present report contains the fundamental concept and approach to the overall agricultural development of Lampung province.

A number of plans are proposed in this report for implementation in future. For the development of Lampung, it is earnestly hoped that these plans will be taken up and put into practice at an early date.

As manifested by the efforts exhibited by many private concerns in the past for Lampung's development, the growth of this province is drawing the keen attention of many quarters concerned. If this report should prove to be of some use for province's development, it will give me great pleasure.

In take this opportunity to express my deep gratitude to government

and private organizations of Indonesia and Japan for the valuable assistance extended to the survey team and wish to record here my appreciation of the labrious work of all the team members.

December 1971

Keiichi Tatsuke
Director-General
Overseas Technical Cooperation Agency

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CAHPTER I BACKGROUND AND PURPOSE OF SURVEY

1.1 Background of Survey

(1) Survey activities for the development of Lampung Province situated in the southern part of Sumatra have been repetitively undertaken by Japanese private concerns since the beginning of 1965. These activities, intended chiefly for agricultural development of the province, were carried out with the view to implementing various development schemes on a commercial basis.

During this period, surveys were also conducted on a government-to-government basis, but these were made on a rather limited number of occasions with no systematic approach to the province's development.

(2) Japan's past technical and economic cooperation in agricultural development, offered under an agreement reached by the governments of Indonesia and Japan, was extended mostly to Java island.

The Ministry of Agriculture of Indonesia, however, had long hoped that the technical improvement and extension activities for paddy production and the maize production development project, which constituted part of Japan's technical cooperation for Java, would be expanded to cover Lampung province.

(3) The said hope of the Ministry of Agriculture, intensified by the plan of the Central Government of Indonesia to reinforce its immigration and public investment policy, was manifested in IGGI LIST in which request for foreign financial and technical aid was made for fiscal year 1971. In this list, assistance was requested for a number of projects in Lampung.

Noting the need for implementing aid programmes in a manner that ensures balanced development of different regions and considering the desirability of attaining a higher overall effect from them by concentrating their execution in particular areas to an extent, the Japanese government expressed its intention to give priority to Lampung over other provinces of the country while maintaining balance between various programmes.

(4) As described above, Japan's technical cooperation in Indonesia's agricultural development centers on Java and is currently offered for promoting four projects, i.e., the Accelerated Food Crop Production Project (a project incorporating two schemes, one being the training on seed multiplication and farming equipment, and the other the so-called Tani Makmur Project (Project of Prosperous Farmers) which is a regional agricultural development plan implemented in Tjihea), Research Cooperation Project for the Central Agricultural Research Institute at Bogor, Pilot Farm Project at Tadjum in Central Java, and Accelerated Maize Production and Export Project in East Java.

It was recognized, however, that Java is very densely populated and a repressive effect is exerted on its agricultural development by a number of factors such as the prevalence of excessive small scale farm management, traditional habits and practices inherent to rural communities

and Chinese controlled marketing system. These factors closely bear upon the improvement and extension of agricultural techniques and also set limit on the elevation of farmers' economic footing.

Hence, Japanese government found it imperative to extend its cooperation in line with the policy of the Indonesian government for enhancing the development of and settlement in outer territories, and considered it quite meaningful to implement various aid programmes in outer territories where population density is low, scale of farm management is large, much room is left for future development and consequently agriculture is less subjected to traditional practices or Chinese control over the marketing system. This was one of the reasons for which Japanese government had considered Lampung as a suitable future development area.

(5) From the said viewpoint, Japanese government dispatched two survey teams. One of them, dispatched in FY 1970, from the Overseas Technical Cooperation Agency (OTCA), carried out a basic survey for accelerating production and export of maize in South Sulawesi, Central Java and Lampung. The other team, sent from the Ministry of Agriculture and Forestry in FY 1971, was intended for an overall survey on agricultural development schemes.

The former team discovered, as a result of its preliminary survey in the said three areas, that Lampung is most promising for production increase and export of maize and outlined its recommendations for project implementation in a report presented to the Indonesian government.

The latter team, which made an overall survey on agriculture in Lampung, stressed the importance of upland crops in the agricultural development of the province and also pointed out its relationship with improved paddy cultivation.

(6) In the official aid negotiations held in Tokyo in June 1971 for fiscal year 1971/1972, which centered on IGGI LIST, moves gained impetus for systematic implementation of agricultural development schemes in Metro and other related development projects in neighbouring areas. As a result, agreement was reached that Japan's economic cooperation would be extended for implementing two projects in lampung. The two projects, included in the said IGGI LIST, are Pump Irrigation Project (Project No. A-1) and Rice Processing and Storage Project (Project No. A-18). (Numbers indicate project numbers given in the list)

It is to be added that the list also includes the following three projects for which Japan's technical cooperation is requested.

Rice Intensification Project (ATA-9)

Corn Production Centre Development Project (ATA-19)

Grain Legumes Development Project (ATA-20)

1.2 Purpose of Survey

(1) The survey team was dispatched in compliance with the request for financial and technical aid described in Item (6) of the preceding section

which was made in the historical background mentioned in Items (1) to (5).

To be precise, the team was assigned to the task of conducting a feasibility study for the two projects for which Japan agreed to offer its economic cooperation, and carrying out a basic survey for paddy and upland crop cultivation in and around Metro for which technical cooperation had been requested.

As for the irrigation farming scheme in Djepara district, the team made an evaluation of survey data collected in the past and also made a reconnaissance survey.

Metro district was selected as the survey area because it is provided with a number of favourable conditions and is likely to serve as the base for Japan's future cooperation in the province's agricultural development. To cite a few of such conditions, the district is not only close to Tandjung Karang, the capital of Lampung, but also advanced in paddy and upland cultivation, and further, the irrigation scheme of the Central Government is either planned or in progress in the district and the province-operated "Maize Centre" is operated at Tegineneng located near the district.

(2) In dispatching the survey team for the aforementioned purpose, Japanese government considered it of controlling importance that its cooperation in agricultural development of Lampung should be based on a synthesized and systematic approach to the following three goals.

(a) Overall agricultural development covering not only paddy but also upland crops.

(b) Systematic provision of economic cooperation and technical cooperation.

(c) Assurance of closer tie between the government and the people for projects implemented by the joint efforts of both parties.

Some comments on these three goals are given below.

(a) Japan's agricultural cooperation centered on paddy in the past. Though it also covered maize and soybeans, the only project currently implemented with Japanese cooperation for accelerated production and export of primary products is found only in East Java.

The planned overall agricultural development of Lampung envisages concurrent implementation of a paddy production project and a maize production project, providing, for the first time in many years of Japanese agricultural cooperation, an opportunity to undertake two different types of project in an integrated manner.

(b) and (c) This is the first time that Japanese government has brought these two goals to the fore, though stress has long been placed on their importance. During the survey period, however, no adjustment measures nor institutional improvements were made for their attainment, though all parties concerned were fully congnizant of their importance.

Integrated development aiming at the above-mentioned three goals should be constantly borne in mind in the future planning and implementation of various projects in Lampung. Owing to the limit set on the time and scope of survey, the team was unable to provide any concrete recommendations for such integrated development. It is the problem that awaits incessant researches and follow-up investigations by survey teams and experts to be dispatched to Indonesia in future.

(3) The survey team was dispatched to Indonesia for the purpose and against the background described above. Immediately upon its arrival in Djakarta, the team called on Mr. S. Sadikin, Director of General Bureau of Agriculture and other high officials of the Ministry of Agriculture to explain the survey purpose which is described below.

(The following description is the comprehensive explanation made to the Indonesian government and is given here as data though it includes repetition of part of the explanation already given in the foregoing pages)

(a) As a result of the negotiations for economic and technical cooperation for 1970/1971, the governments of Indonesia and Japan reached the agreement, at a meeting held in Tokyo in June 1971, that Japan would provide its economic cooperation for two projects in Lampung, i. e., Pumping Irrigation Project (A-1) and the Rice Processing and Storage Project (A-18).

(b) The survey team was assigned to the task of studying the technical and economic feasibility of these two projects.

(c) The team is informed of the request of the Central Government of Indonesia that Japan's technical cooperation to Rice Intensification Programme (ATA-9) be implemented in Metro and neighbouring area, Lampung. The team therefore considers it possible to expect effective and efficient implementation of all the three projects, i. e., A-1, A-18 and ATA-9, if they are arranged into a single project and carried out in an integrated manner with ATA-9 playing the the primary role in the overall development.

(d) As regards Way Djepara Irrigation Project (BTA-24), the team understands that its feasibility study undertaken by the Indonesian government has shown a substantial progress. The team therefore wishes to review the data collected during the past feasibility survey and collect any additional data required for studying the feasibility of the project.

(e) Projects A-1, A-18, ATA-9 and BTA-24 are all intended for instructural and technical improvement for paddy cultivation and improvement of rice marketing system.

The findings of the two Japanese survey teams, one dispatched in 1970 for maize production development and the other dispatched in the spring of 1971 from Japanese Ministry of Agriculture and Forestry for agricultural development, clearly indicate the pressing need and high probability of improving both the production techniques and marketing system of upland crops in the agricultural development of Lampung.

During its survey, therefore, the team wishes to make studies for planning projects for such improvement. The team believes that the feasibility of the two technical cooperation projects, Corn Production Centre Development Project (ATA-19) and Grain Legumes Development Project (ATA-20), can be clarified by such studies.

(f) On the basis of the findings of the afore-mentioned two Japanese survey teams, the team recommends that the following two measures be taken for future agricultural development.

(i) Establishment of an Agricultural Development Centre

In order to develop advanced cultivation techniques and breed improved varieties for the improvement of upland crop production techniques, systematic applied research activities should be connected at an agricultural development centre with account taken of the conditions in Lampung. Such a centre can extend the scope of its activities to cover not only researches but also training and extension services. It is conceivable that the centre functions as an integrated research organ for both upland crops and paddy.

(ii) Improvement of rice production techniques, strengthening of extension activities of improved rice cultivation and improvement of distribution channel for agricultural materials such as fertilizer, agro-chemicals so on, and improvement of agricultural credit system.

(iii) Improvement of marketing system and processing of upland crops

Since upland crops are mostly cash crops, improvement must be effected to their marketing system and processing techniques so as to elevate the financial footing of farmers. The team believes that such improvement will augment the marketing, make easier the processing and preparing work, and also provide export possibility of maize and other upland crops.

The above two proposals are presented merely as desirable promotional measures and therefore call for a feasibility study in many respects. The team wishes to make a preliminary study on their feasibility.

(g) The team considers that the time alloted for its survey activity is just too short to reach any conclusion that the integration of these projects into a technical cooperation project is both possible and promising. Accordingly, the Japanese government is ready to continuously dispatch survey teams in future if necessary.

It may be added that because experts dispatched to Indonesia are not expected to be given sufficient survey period, Japanese government plans to appoint to two to three experts who will be stationed in Indonesia during the preparatory period of the technical cooperation projects, provided, however, that the team considers these projects promising and the agreement of the Indonesian government is obtained.

(4) On hearing the team's explanation described above, Mr. Sadikin gave the following comment.

(a) He fully agrees to the team's proposal for integrating projects. All of the following projects, for which cooperation is requested by his government through BAPENAS, are intended for food production and may therefore be called Food Crop Development Project in Lampung.

Pumping Irrigation Project (A-1)

Rice Processing and Storage Project (A-18)

Rice Intensification Programme (ATA-9)

Corn Production Centre Development Project (ATA-19)

Grain Legumes Development Project (ATA-20)

With respect to the proposed integration of technical cooperation and economic cooperation, he wishes to express wholehearted support and suggests that the Seed Multiplication Project surveyed by the World Band may be of some use for the such integration.

(b) He agrees to implemeting the integrated development project in Metro and neighbouring areas.

(c) "Tani Makmur Project" a regional agricultural development project currently pushed forward by his ministry, aims at raising farmers' income through improvement of terminal irrigation facilities and extension system and supply of agricultural equipment and materials. Though this project is intended primarily for paddy cultivation development, his government fully recognizes the importance of upland crops as well. The seed multiplication programme being implemented in Tjihea of West Java with Japanese cooperation may be same in project type.

(d) Jpan's cooperation in the development of upland crop production will be wholeheartedly welcomed. Viewed nationa-wise, maize carries the greatest weight in all upland crops, followed by groundnuts, cassava and soybeans. Problems now faced by his government for production development of these crops are the supply of improved seeds of maize and groundnuts, introduction of advanced drying method for cassava, and pest and disease control and supply of good seeds for soybeans.

He hopes that the team will make a technical and economic study on the crops raised in Lampung and indicate crops which are most suited for future development.

(e) As regards Pump Irrigation Project and Rice Processing Storage Project for which economic cooperation is considered by Japanese government, he hopes that the team will find a way to accelerate the use of pumps in consideration of the proposed establishment of an agricultural development centre since many of the existing pumps are not in use, and will also take due account of the fact that the overall capacity of rice mills in Lampung has already come to excess relative to paddy production while their rate of operation is on a very low level as a whole.

It may be added that the Ministry of Public Works expressed the hope that the team will study and confirm the feasibility of Way Djepara Irrigation Project because the Indonesian government considers this project amply feasible from its past survey. The team was informed that the

Indonesian government plans to include this project in the Project Aid List for 1972/1973.

1.3 Member List of Survey Team

Mr. Heijiro Yoshiwara	Leader (The first half)	Executive Director, OTCA
Dr. Tsuyoshi Shiroshita	Leader (The latter half)	Director General, Tohoku National Agricultural Experiment Station, MAF
Mr. Sadao Hatta	Rice Cultivation	Chief, Planning and Coordination Div., Tropical Agriculture Research Center, MAF
Mr. Tetsuo Nakajima	Irrigation	Deputy Chief, Irrigation and Drinage Div., Construction Dept., Agricultural Land Bureau, MAF
Mr. Katsumi Nakae	Farm Mechanization (Rice Milling Facilities)	Chief, Engineering Lab. 1, Farm Mechanization Div., Tohoku National Agricultural Experiment Station, MAF
Dr. Mitsugi Kamiya	Agricultural Economy	Chief, Southeast Asia Section, National Research Institute of Agricultural Economics
Mr. Mikio Abe	Up Land Farming	Chief Researcher, Hokkaido National Agricultural Experiment Station, MAF
Mr. Yukio Ohhata	Farm Management	International Cooperation Div., International Dept., Agriculture and Forestry Economic Bureau, MAF
Mr. Satoshi Hirai	Pump Irrigation	Engineer, Design Division, Japan Irrigation & Reclamation Consultants
Mr. Hiroyoshi Takeishi	Farm Mechanization	Agricultural Machinery Div., Agricultural Administrative Bureau, MAF
Mr. Ryonosuke Goto	Coordination & Liaison	Programming and Coordination Div., Agricultural Dept., OTCA

Remarks: MAF: Ministry of Agriculture & Forestry

OTCA: Overseas Technical Cooperation Agency

CHAPTER II GENERAL DESCRIPTION OF AGRICULTURE IN LAMPUNG

2.1 Recent Development in Lampung

2.1.1 Repelita and Lampung

Repelita (Rentjana Penbangunan Lima Tahun), or Five Year Economic Development Plan worked out for the period from 1968/1970 to 1973/1974, is now in the third year of its execution. As a result of remedies applied to check the astounding inflation ensued from the chaotic state in the country's budget, finance and foreign trade which invited an annual growth rate of commodity price of 650% in 1966 and also with the increased budgetary appropriation to rehabilitation work, Indonesian economy has gradually restored its stability and is about to cut its way to expansion through the implementation of a number of new development projects. Aimed primarily at agricultural development, Repelita has recorded remarkable achievements since 1968 particularly in the expansion of food crop production. [1)]

This has brought about the expansion of domestic market and increased supply of raw materials for industries, whereby the commodity price is now stabilized and industrial development is set afoot.

As Repelita clearly indicates, Indonesia has a vast potential for development. Exploitation of natural resources available in underdeveloped outer islands (islands embraced in Indonesian archipelago excepting Java and Madura) has a direct incentive effect on the increased production of export crops and foodstaffs. Under Repelita, development of rural districts and villages which is given the same great importance as attached to the development of the entire country, is incorporated in the top priority policy of the government. In its development disbursement, the government appropriates a subsidy of Rp 100 thousand to each desa, a minimum of Rp five million to each kabupaten, and Rp 50 to each resident in all kabupatens. The magnitude of the government's development disbursement is considered to be quite effective in inducing inhabitants in rural districts to uphold and participate in Repelita. It may be said, however, that the pace of development in a certain area is determined rather by the amount of development investment and techniques introduced in that area than by such an all-round subsidy disbursement.

Lampung Province, situated in the southern part of Sumatra, covers a land area of 32,821 km^2 which is only 1.7% of the country's total. Its population is likewise small, registering 2,673 thousand persons or slightly over 2% of Indonesia's total population in 1970. Amount of investment appropriated for Lampung's development under Repelita is not known. In the irrigation development sector which covers the largest investment made under Repelita, it is known that an area of 830 thousand ha in Java designated

1) During the 1960~1967 period, food crop production was extremely small and recorded an annual growth rate of -0.2%. During the subsequent three year period (1967~1970), the growth rate is estimated to have reached 6.4% per annum.

for rehabilitation of irrigation facilities occupies the greater part of investment, and that in the remaining irrigation development area of 430 thousand ha, Pungur Utara and Way Seputih irrigation development projects occupy as large an area as about 60 thousand ha. This indicates that Lampung is given equally great importance as Makassar district in Sulawesi and the Barito river basin in Kalimantan for accelerated food crop production planned under Repelita. As a matter of fact, the expansion of paddy harvesting area in Lampung marked an annual growth rate of 4.7% over the past five years, far surpassing the rate of 2.2% recorded in Java and Madura. This upward trend is conspicuous particularly in 1968 and subsequent years. It is to be noted, however, that this remarkable increase in paddy harvesting area, which was naturally accompanied by the expansion of paddy (Sawah) field area, has ensued largely from the implementation of Raman Utara Irrigation Project and Bantanghari Utara Irrigation Project which were nearly completed towards the end of 1960. Other irrigation projects planned in the province include Djapara Irrigation Project which will shortly be put into execution to supply an area of 7,000 ha with irrigation water from Lake Djapara located near the east coast, and Umpu Irrigation Project (3,500 ha) and Pengubuan Irrigation Project (5,000 ha) in Lampung Utara.

The expansion of farmland area, specially that of paddy field area which has a large population supporting capacity, promises increased employment oppotunities for the inhabitants in the province. Further, with the development of estate agriculture recently promoted by Mitsugoro Farm and Singalaga Farm (the former started operation in April 1969 and the latter in November 1969 chiefly for maize production), increased employment opportunities are being offered to the people in the neighbouring area not only for their own estate operation but also for increased trading activities. This trend has produced a promotional effect on the immigation from densely populated areas such as Java, with the result that the province's population increased by 27% over the past five years, recording an annual growth rate of 5.0%. Particularly in Lampung Tengah where the input of development capital is concentrated, the annual growth rate of population in recent years is as high as 8.5%. This deserves attention because during the period from 1961 to 1965, the population of the entire province increased by 26% with no large disparity recorded in the annual growth rate of respective kabupatens (See Table 2-1).

Table 2-1 Population Increase in Lampung

Population Year / Kabupaten	Population 1961	Population 1965	Population 1970	Growth Rate 1965/1961	Growth Rate 1970/1965
				%	%
Tandjung Karang	133,901	169,163	187,718	126.3	111.0
South Lampung	685,392	860,201	1,070,690	125.5	124.5
Central Lampung	514,084	636,723	959,220	123.9	150.6
North Lampung	334,134	432,563	455,503	129.5	105.3
Total	1,667,511	2,098,650	2,673,131	125.9	127.4

The Business News (June 9, 1970) reports that a total of 99,510 households migrated from Java and Bali to outer islands during the 19 year period from 1950 to 1968, and that 53% of them, or 52,323 households, migrated to Lampung and 32% or 31,711 households to other areas of Sumatra, indicating that Sumatra, and particularly Lampung, is favourably conditioned for new settlers. It is to be added that the recent capital input in Lampung Tengah has invited the convergence of migration into Lampung.

As will be clear from the above description, the greater part of settlers from Java and Bali are farmers. It is considered that these farmers are either engaged in subsistence-level agriculture with a small holding or earning their living as farm labourers. Inflow of these farmers, who have neither funds or techniques, hardly contributes to the improvement of agricultural productivity, nor does it bring about any appreciable increase of yield of food crops despite of the continuous expansion of farmland. Nevertheless, the recovery of paddy production ensued from the paddy field expansion since 1968 and increased production of maize and cassava must be assigned to the augmented availability of labour force realized by the said inflow and investment for infrastructural improvement. Increase in labour force also brought about the increase in both production and cultivated land of cash crops such as coconuts, coffee, pepper and tobacco which are raised by small holders. Such upward trend of production prompted the market expansion and commodity distribution in the province which, coupled by the increasing capital input and resultant inflow of capital goods, has resulted in the ever increasing inflow of commodities into the province. According to the import data of Pandjang port, the import value declined to 600 thousand dollars in 1969, but thereafter pursued a rapid upward trend with 1,120 thousand dollars recorded in 1970 and 1,930 thousand dollars in the first half of 1971.

The increase in export value is indicative of the expanding trend of Lampung's economy. With active commodity distribution brought about and active by such trend, economic activities are animated in urban areas such as Tandjung Karang, the province's capital, Telukbetung which adjoins Tandjung Karang, and Pandjang, the province's only seaport. Trucks which play an important role in the intra-province commodity flow are also said to have shown a phenomenal increase in these cities over the past two years. It is believed that the construction of Sumatra Highway and improvement of railways will largely contribute to the expansion and development of the hinterland of these cities.

2.1.2 Indonesian Economy and Lampung

Just as its land area occupies only 1.7% and population 2.2% of the country's total, so is the production of Lampung estimated to account for less than 2% of Indonesia's total. Lack of data makes it impossible to compare the production of Lampung with that of other provinces. However, agriculture of Lampung, which supports the life of more than 70% of the province's population, is known to account for only 2% in the country's total agricultural production. Considered from the viewpoint of economy as a whole, therefore, Lampung's contribution to Indonesia's national economy must be rated at less than 2%. Further, despite of its recent

economic development, the province's position in the national economy shows no sign of improvement. Worse than that, Lampung's economic situation is such that its per capital income level is on the decline relative to its rapid population increase. (See Table 2-2).

Like the whole Indonesia, Lampung's economy depends heavily on agriculture in which food crops occupies a large percentage, and in this context, Indonesia's agriculture appears to be represented in miniature in the province. It is to be noted, however, that decline in importance of food crop production and expansion of export crop production are seen in the province. It is also to be noted that the relation decrease in food crop production was invited by the relative decline of paddy and cassava production, and that maize production is augmented by the recent export demand. (See Table 2-3).

Lampung's agriculture is expanding in scale with increasingly great weight given to export crops. From the existing state of land use,

Table 2-2 Lampung's Position in Indonesia Agriculture

Item \ Year	1965	1967	1969	1970
Food Crops (2)	2.30	1.75	1.83	1.98
Cash Crops (Small Holders)(3)	2.18	2.50	2.67	-
" (Estate Agriculture)(4)	1.51	1.81	1.61	-
Total	2.18	1.94	1.99	-
Population	1.72	1.96	2.27(5)	-
Value of Agricultural Production per Capita	1.27	0.99	0.88	-

Notes 1 (1) Rate of Lampung's agricultural production in value to the nation's total.
(2) Paddy, maize, cassava, sweet potatoes, groundnuts and soybeans.
(3) Rubber, copra, coffee, kapok, tea, tobacco, sugar and pepper.
(4) Sugar, rubber, coffee, tea, palm oil and coconut.
(5) Population in 1970

2 Calculation was worked out on the basis of the national income data of the Central Statistics Office, and the value of Lampung's agricultural production was obtained by multiplying the crop- and year-wise production value expressed in 1969 commodity price by the rate of production amount.

Ref. Biro Rusat Statistik· Pendaratan Nasional Indonesia 1960-1968 Djakarta, 1970.

Table 2-3 Year-and Crop-wise Distribution of Values of Agricultural Production

Item \ Year	Total Indonesia			Lampung			
	1965	1967	1969	1965	1967	1969	1970
Food Crops	65.8	64.8	67.1	69.4	58.4	61.6	60.5
Paddy	37.6	39.5	43.7	41.7	40.6	38.8	38.8
Maize	5.8	5.9	5.3	5.3	4.1	5.4	5.7
Cash Crop (Small Holder)	22.8	24.9	22.3	22.7	32.1	29.8	31.5
" (Estate Agriculture)	11.4	10.3	10.6	7.9	9.5	8.6	8.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: See the footnote to Table 2-2

this trend is expected to be accelerated in future. As shown in Table 2-4, about 40% of entire province is covered by grasslands and swamps. This percentage is very large as compared with the average value in other outer areas, not to speak of Java and Madura. It merits attention that alang-alang fields and shrubbery areas occupy as much as 36.8% of the entire land area of the province. This means that there is much room left for land development and the province is favourably conditioned for future agricultural development relative to other outer areas. Farmland area cultivated by small holders for paddy and upland crop production occupies a rather small portion in the total land area, but it is expected that such farmland area will be expanded in future with the increase of population. It is also expected that the advantage of export crops over other crops which is suggested by the demand-supply trend of foodstaffs will bring about the alteration and diversification of crops. Study of land use and agricultural production reveals that Lampung surpasses, to some extent, Indonesia's average in the production of export crops by small holders. In fact, the yield per ha of coffee, the most important export crop of the province, is 0.64 tons and is therefore slightly larger than the average of 0.55 tons attained by small holders in whole Indonesia. In contrast with this, the production capacity of estate agriculture in the province is substantially lower than in other parts of the country, which suggests that the province's agricultural development must be accompanied by the improvement of management and cultivation techniques of estates.

Though timber export has shown a rapid increase in recent years, coffee and rubber are still the dominant export items of Laumpung. In the total export value for 1970, coffee accounted for 50%, rubber 37%, pepper 4%, timber 3%, and maize 1%. With these agricultural and forest products occupying 6.2% of Indonesia's total export value for 1969 (excluding petroleum), importance and expectation placed on the province is greater for export crop production than for food crop production. (See Table 2-5).

Table 2-4 Land Use in Lampung, Entire Endonesia and Java

Land Use / Item	Lampung		Entire Indonesia		Java and Madura		(A)/(B)
	Land Use(A) Area(Th.ha)	Land use Rate(%)	Land Use(B) Area(Mi.ha)	Land Use Rate (%)	Land Use Area(Mi.ha)	Land Use Rate (%)	(%)
1. Forest Land	1,600	48.7	121.8	63.9	3.0	22.6	1.31
2. Farmland	386	11.7	22.1	11.6	8.8	67.0	1.75
(1) Farmland of Small Holders	221	6.7	20.4	10.7	8.2	62.2	1.08
Paddy	59	1.8	6.1	3.2	3.8	28.8	0.97
Other Crops	162	4.9	14.3	7.5	4.4	33.4	1.13
(2) Farmland of Estate Agriculture	165	5.0	1.7	0.9	0.6	4.8	9.71
3. Others (1)	1,296(2)	39.5	46.5	24.5	1.4	10.4	2.79
Total	3,282	100.0	190.4	100.0	13.2	100.0	1.72

Notes (1) Grasslands, swamps and marshes, canals, village areas included.
(2) Wild field with forest trees, shrubs and alang-alang field included.

Table 2-5: Export Record by Major Item (Pandjang Port)

	Export Volume (ton)						Export Amounts 1970	
	1965	1966	1967	1968	1969	1970	Amounts	Rate %
Rubber	53.1	44.7	44.5	50.5	53.9	42.1	12,970	36.9
Coffee	33.2	28.6	42.7	24.9	40.6	27.0	17,515	49.8
Pepper	11.0	13.3	29.3	20.8	10.9	1.3	1,507	4.3
Maize	4.4	29.9	26.6	29.0	38.5	46.2	389	1.1
Cassava-chips	9.2	2.8	2.7	15.0	45.3	73.5	1,434	4.1
Copra	2.6	4.9	4.3	4.2	3.6	5.8	148	0.4
Rice Bran	-	0.0	1.0	1.0	1.9	3.3	21	0.06
Resin	-	-	0.5	1.6	3.7	3.2	62	0.2
Wood (1000 m^3)	-	0.3	4.5	5.9	24.7	81.6	1,112	3.2
Total Export Amounts(th. $)	-	32,277	38,796	33,581	38,571	35,174	35,174	100.0

Source: Perwakilan Departmen Perdagangan, Propinsi Lampung
(Foreign Trade Department of Lampung Province)

2.2 Agriculture in Lampung Tengah

2.2.1 Characteristics of Agriculture in Lampung

With all its quantitative factors such as population, farmland area and agricultural production maintaining a 2% level in the country's total, Lampung presents the structure of Indonesian agriculture in miniature. The province, however, embraces its own environments and it is possible to point out varying agricultural climate produced by the differences in its natural conditions.

If one looks into the cropping pattern adopted in the three kabupatens of the province, Lampung Uatara, Lampung Tengah and Lampung Selatan, one would readily be able to point out that all the three kabupatens have their own characteristics.

In the cropping ratio of food crops and cash crops, Lampung Selatan tends rather to cash crops than otherwise, whereas Lampung Tengah points mostly to food crop production. Just as half the food crop planted area of the province is found in Lampung Tengah, so is half the cash crop planted area found in Lampung Selatan. Lampung Utara, standing midway between

these two kabupatens, shows a trend more or less resembling Laumpung Selatan. Major crops produced in Lampung Selatan are paddy, upland paddy, coffee and coconuts; and 42% of the kabupaten's planted area is for paddy production and 35% for coffee and coconuts. In Lampung Utara, major crops are upland paddy and pepper, the former occupying 42% of the total planted area and the latter 17%. In Lampung Tengah, on the other hand, upland paddy ranks top with 25%, followed by maize, paddy and cassava, and these four crops combined occupy 79% of the kabupaten's total planted planted area. (See Table 2-6).

Cash crops such as coffee and pepper are mostly produced by indigenous inhabitants of Lampung, whereas paddy cultivation is carried out chiefly by Javanese settlers. The cropping pattern in Lampung can therefore be classified into two types of crop combination, i.e., cash crops + upland crops for one and paddy + ordinary upland crops for the other. Though the food crop production in the province is generally intended for self-sustenance, Lampung Selatan not only places importance on paddy production but is fairly well advanced in the marketing of paddy. Acording to the data of Dinas Pertainan Rakjat, Kabupaten Lampung Selatan, an average of 50% of rice produced in the kabupaten is marketed. Considering the fact that 49% of the province's total paddy field area is found in this kabupaten and the soil productivity is high relative to other kabupatens, it may be said that the market-oriented production centering on paddy and coffee carries a heavy weight in the kabupaten's agriculture. Compared with Lampung Selatan, Lampung Tengah's agriculture may be said to consist chiefly in the self-sustaining production of paddy, maize and cassava, whereas Lampung Utara may be considered an area of pepper marketing and self-sustaining upland crop production.

Not surprisingly, such difference in the cropping pattern results largely from the difference in natural conditions. As shown in Fig. 2-1, the topography of Lampung is such that the mountainous area in the south-western part descends in the eastern and northeastern directions with swamps extending on the east coast. This swamp area spreads as far northwards as the extensive swamp area in the basins of the Ogan and the Komering flowing in the vicinity of Palembang, the capital of Propinsi Sumatra Selatan (South Sumatra Province). The western hilly area is an andosol zone where the soil is very fertile. On the western side of the hills, the surface layer is thick and fertile because it was formed by the volcanic ash deposition brought about by the explosion of Krakatau island in 1983. This is one of the causes of the high soil productivity observed in Lampung Selatan. Cultivation of coffee, the most important export crop, can be most efficiently carried out in a volcanogeneous area where water can be readily drained and soils are fertile and contain much organic matters. Hence, coffee cultivation is concentrated in the hilly area of Lampung Selatan extending to the south of Sumberdjaja in Lampung Utara.

Rivers in Lampung, rising mostly in the western mountainous district, flow eastwards through the central plain and empty into the Sea of Java. Major rivers in the province are the Tulangbawang, the Seputih and the Sekampung. Since all these rivers have a large run-off, irrigated paddy field are formed along their either side.

In the 1920's when the country was under the Dutch colonial rule,

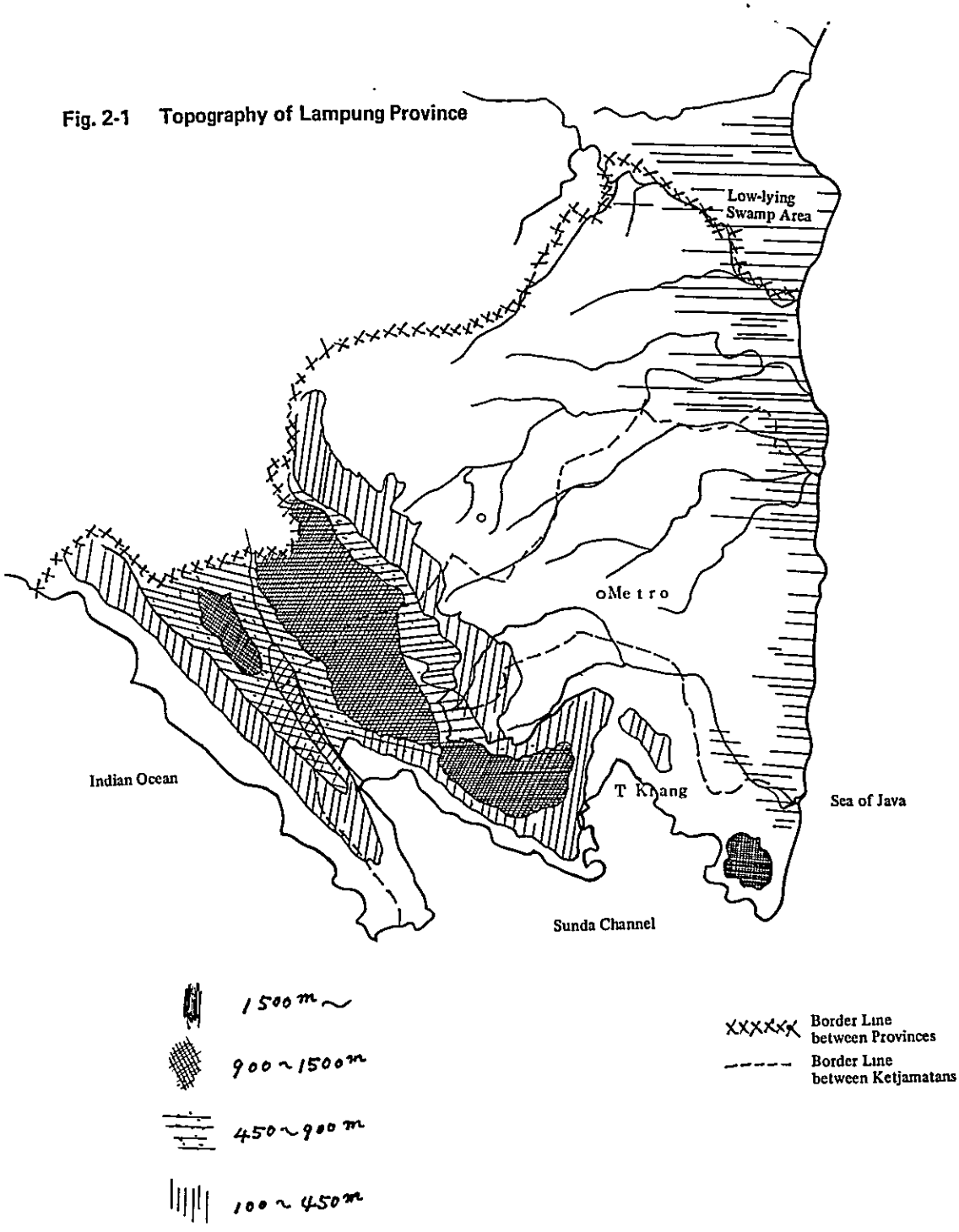
Table 2-6 Cultivated Area by Crop (1970)

- Diversity and Regional Characteristics of Lampung's Agriculture -

	Lampung Selatan			Lampung Tengah			Lampung Utara		
	Caltivated Area	Rate	Rate to Lampung's Total	Caltivated Area	Rate	Rate to Lampung's Total	Cultivated Area	Rate	Rate to Lampung's Total
	ha	%	%	ha	%	%	ha	%	%
Food Crop	100,989	58.3	29.7	159,968	84.7	47.1	78,845	60.8	23.2
Paddy	38,971	22.5	49.4	30,339	16.1	38.4	9,608	7.4	12.2
Uplaned Paddy	34,255	19.8	24.2	53,056	28.1	37.5	54,055	41.7	38.3
Maize	16,199	9.3	25.1	39,617	21.0	61.4	8,751	6.8	13.5
Cassava	4,837	2.8	13.9	25,481	13.5	73.1	4,550	3.5	13.0
Sweet Potatoes	2,620	1.5	61.0	1,028	0.5	24.0	644	0.5	15.0
Ground Nuts	854	0.5	28.6	1,526	0.8	51.0	609	0.5	20.4
Soybeans	3,032	1.8	25.3	8,511	4.5	71.0	441	0.3	3.7
Green Beans	221	0.1	27.0	410	0.2	50.1	187	0.1	22.9
Cash Crop	72,265	41.7	47.6	28,801	15.3	18.9	50,850	39.2	33.5
Coffee	35,615	20.6	66.5	6,356	3.4	11.9	11,585	8.9	21.6
Pepper	2,370	1.4	7.0	9,530	5.0	27.9	22,200	17.1	65.1
Coconuts	25,200	14.5	67.3	5,850	3.1	15.6	6,400	4.9	17.1
Rubber	3,350	1.9	19.7	4,450	2.4	26.2	9,180	7.1	54.1
Clove	4,880	2.8	63.2	1,820	1.0	23.6	1,015	0.8	13.2
Tabacco	850	0.5	42.6	675	0.3	33.8	470	0.4	23.6
Sugar-cane	-	-	-	120	0.1	100.0	-	-	-
Total	173,254	100.0	35.2	188,769	100.0	38.4	129,695	100.0	26.4

Note: Values of Cash crops are for small holders only.

Fig. 2-1 Topography of Lampung Province



weirs were constructed in the upstream section of the Sekampung and irrigation facilities were constructed in the lower basin of the Talangpadang in Lampung Selatan for systematic settlement of Javanese farmers. Paddy fields are also found formed in the low-lying area extending around the mountainous districts in Lampung Selatan, and this is considered ascribable to the short distance to Java, abundant rainfall and excellent soil productivity.

In Lampung Tengah, Argoguruh Dam was constructed in 1935 by damming up the Sekampung, with three main canals constructed at Trimundjo for diversion of the reservoir water. Irrigation water from these cannals is supplied to about 20 thousand ha of farmland in the vicinity of Metro. Though this irrigated paddy field area is about to be expanded by drawing irrigation water from the Seputih, the Sekampung and their tributaries, paddy production in this area is subject to fluctuation because of a number of reasons such as the lower soil productivity than in Lampung Selatan which is incidental to the mixed soil of latosol and podsol, poor water management, and extreme annual fluctu tion of rainfall (See Fig. 2-2 and Table 2-7). The area around Sribhawono (Lampung Tengah) and Tandjungan Kalianda (Lampung Selaten), which extends to the southeast of the said irrigated area, is covered by weathered volcanogenous soils which are quite productive though not so fertile as the soils in the west. This area is inhabited by many indigenous people of Lampung who are engaged in the coffee and pepper cultivation. Production of these two crops is largely affected by soil nature, and coffee is cultivated around Sribhawono and pepper around Kalianda.

In Lampung Utara, latosol soil area extends from the central part where Kotabumi is located towards the western mountainous district, and coffee is cultivated in this area. The plain extending in the northeastern direction from Kotabumi is poor in soil productivity and rather far from Pandjang, the gateway to Java. As a consequence, not many settlers are found in this area and agricultural activity is limited to the self-sustaining upland crop production and rubber cultivation. 54% of the province's total planted area of rubber is found in this kabupaten.

The structure of agricultural production in the three kabupatens is determined by the cropping pattern described above. In lampung Selatan where a substantial portion of farmland area is used for cultivating cash crops which provide higher value productivity than food crops, the two types of crops are approximately the same in production value. In Lampung Tengah, however, agriculture centers on food crops which occupy 75% of production. In Lampung Utara, on the other hand, the production of cash crops slightly exceeds that of food crops. This is because the kabupaten's food crop production centers on upland paddy which is smaller than cash crops in both land productivity and value productivity, though greater weight than in Lampung Tengah is given to cash crops in this kabupaten. If account is taken of the acreage of planted area, comparison of Lampung Selatan and Lampung Tengah will disclose that the former excels the latter in the production of food crops. This is due to the fact Lampung Selatan enjoys a higher soil productivity and produces paddy as its major food crop (See Fig. 2-3).

Table 2-7 Fluctuation of Annual Rainfall (mm)

Kabupaten	Lampung Selatan	Lampung Tengah	Lampung Utara
1961	1,022	1,593	1,845
62	1,385	2,012	1,560
63	1,383	1,617	1,460
64	794	2,472	2,298
65	1,157	1,446	1,625
66	1,509	1,149	2,427
67	1,609	647	2,010
68	974	1,108	3,090
69	1,171	2,327	2,479
70	1,506	2.280	2,550
Average	1,251	1,665	2,134
Coefficient of Fluctuation	20.3	34.3	23.2

Note: Data for Lampung Selatan and Lampung Utara were obtained from Laparan Survey Potensi Pengembangan Pengairan Pedesaan di Propinsi Lampung, Departmen Pertanian, August 1971, and those for Lampung Tengah from Some Data of Ketjamatan Trimurdjo, Kabupaten Lampung Tengah, Propinsi Lampung - The Location for "Tani Makmur Project," Dinas Pertanian Rakjat, Propinsi Lampung.

Fig. 2-2 Rainfall Distribution in Lampung Province

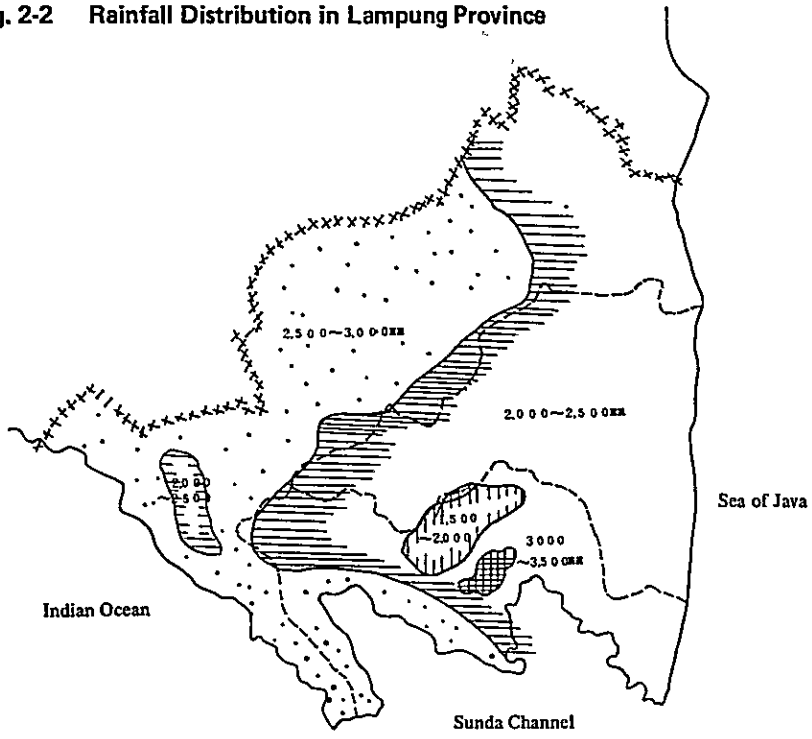
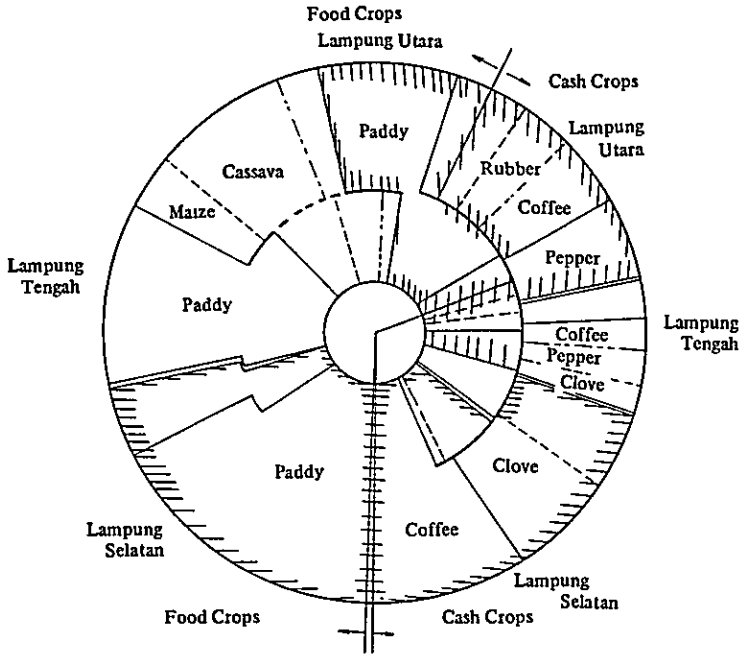


Fig. 2-3 Ketjamatan-wise Agricultural Production and Crop Distribution



2.2.2 Agricultural Production in Lampung Tengah

As is clear in Table 6 and Fig. 3, Lampung Tengah occupies 47% of Lampung's total planted area and 44% of the province's agricultural production. But in the production of paddy, the major food crop of the province, the kabupaten covers only a little less than 31% while Lampung Selatan occupies 44%. While Lampung Tengah accounts for as much as 38% and Lampung Selatan 33% in Lampung's total planted area of both paddy and upland paddy, the latter covers nearly half of the province's paddy production. This is ascribable, for one thing, to the difference in land productivity between the two kabupatens, and for the other, to the concentrated paddy production in Lampung Selatan. Changes that have taken over the past five years in the cropping rate of food crops indicate that in the production of paddy, Lampung Selatan has declined in relation to the other two kabupatens and Lampung Tengah has gained an increasingly important position.

Though Table 2-8 shows that the expansion of planted area of food crops has been larger in Lampung Selatan than in other kabupatens, it is to be noted that the increased cultivation of maize and upland paddy must be cited as the major factor contributing to the said expansion. It may be said that the stronger demand for food crop production arising from population growth ascelerated upland crop cultivation in Lampung Selatan because of its hilly topography, and this trend is believed to have been accompanied by the intensification of maize production occasioned by the rising export demand. In Lampung Utara, on the other hand, population increase brought about the expansion of planted area, cultivation of upland paddy in place of maize and cassava, and transformation of some upland paddy fields into lowland paddy fields. In Lampung Tengah, however, there is a marked trend for expanding the planted area of crops having a relatively high commercial value such as maize and groundnuts and for shifting upland paddy cultivation to paddy cultivation. Needless to say, the intensification of paddy cultivation now in progress in Lampung Tengah is closely related to the concentrated capital input in irrigation facilities described in the foregoing pages.

The existing trends in the three kabupatens of the province may be considered to have ensued from the increased population pressure on unit farmland area. Insofar as Lampung Tengah is concerned, however, it appears that the investment in irrigation facilities developed signs for new development such as the shifting from upland paddy to lowland paddy and increase in paddy production capacity which will be followed by the diversification of crops.

It is to be naturally noted that such trend for development is not yet stabilized because the production scale of maize, groundnuts and other cash crops would be determined by price conditions and also because the population supporting capacity of the kabupaten's paddy production has shown a relative decline in recent years as shown in Table 2-9. It merits attention, however, that as shown in Table 2-10, there has been a remarkable increase in the harvesting area, particularly of paddy, and the yield of paddy per unit area has also been on the gradual upward trend in the kabupaten. Lampung's paddy production, hitherto dependent on natural conditions, has been mostly covered by Lampung Selatan in the past, and since such dependence on nature must eventually give place to capital input, Lampung

Table 2-8 Transition of Planting Ratio of Food Crops

	Lampung Selatan			Lampung Tengah			Lampung Utara		
	1965 A	1970 B	B-A	1965 A	1970 B	B-A	1965 A	1970 B	B-A
Harvesting area (100 ha)									
Food Crops	87.0	99.4	12.4	149.0	158.4	9.4	73.3	75.8	2.5
Paddy	65.3	71.8	6.5	76.1	82.1	6.0	49.6	61.8	12.2
Lowland Paddy	35.5	37.6	2.1	19.6	29.3	9.7	6.5	9.1	2.6
Upland Paddy	29.8	34.2	4.4	56.5	52.8	-3.7	43.1	52.7	9.6
Maize	9.4	16.1	6.7	29.0	39.6	10.6	13.4	8.2	-5.2
Cassava	4.8	4.8	-	23.2	25.4	2.2	5.3	4.2	-1.1
Groundnuts	1.1	0.8	-0.3	0.5	1.5	1.0	1.9	0.6	-1.3
Other Crops	6.4	5.9	-0.5	20.2	9.8	-10.4	3.1	1.0	-2.1
Rate of Planting (%)									
Food Crops	100	100		100	100		100	100	
Paddy	75	72		51	52		68	82	
Lowland Paddy	41	38		13	19		9	12	
Upland Paddy	34	34		38	33		59	70	
Maize	11	16		19	25		18	11	
Cassava	5	5		16	16		7	5	
Groundnuts	1	1	0	0	1		3	1	
Other Crops	8	6		14	6		4	1	

Table 2-9 Demand of Rice - Comparison between 1965 and 1970

	Population	Demand (paddy)				Production (paddy)			(paddy)	
		Consumption (C)	Seeds	Others	Total (A)	Total (B)	Per Capita Production	Production Shortage(B)-(A)	$\frac{B}{C}$	$\frac{B}{A}$
	1000 persons	1000 ton				1000 ton	Kg	1000 ton	%	
1965										
L. Selatan	1,029.4	197.6	3.0	31.4	2,320.0	214.6	208	-17.4	108.6	92.5
L. Tengah	636.7	122.2	4.2	17.3	143.7	111.5	175	-32.2	91.2	77.6
L. Utara	432.6	83.1	2.9	12.7	98.7	85.8	198	-12.9	103.2	86.9
Total Lampung	2,098.7	402.9	10.1	61.4	474.4	411.9	196	-62.5	102.2	86.8
1970										
L. Selatan	1,258.4	241.6	3.4	31.9	276.9	197.9	157	-79.0	81.9	71.6
L. Tengah	959.2	184.2	4.3	22.2	210.7	130.4	136	-80.3	70.8	61.9
L. Utara	455.5	87.5	3.7	14.1	105.3	97.6	214	-7.7	111.5	92.7
Total Lampung	2,673.1	513.3	11.4	68.2	592.9	425.9	159	-167.0	83.0	71.8

Notes: (1) Target per capita consumption is 192 kg, and actual consumption is considered about 70% of the target value.
(2) 32.25 kg/ha for wet paddy and 62.25 kg/ha for upland paddy are taken as the basis of calculation.
(3) 5% of consumption is for buffer stock and 10% of production for weight reduction.

Tabel 2-10 Growth of Population and Paddy Production over 1965 ~ 1970 Period

	Population Growth	Growth of Paddy Production			Growth of Wet Paddy Production		
		Harvested Area	Yield	Production	Harvested Area	Yield	Production
L. Selatan	122	104	83	92	104	96	100
L. Tengah	151	93	104	97	157	104	164
L. Utara	105	132	83	109	122	95	116
Total Lampung	127	106	92	97	120	97	116

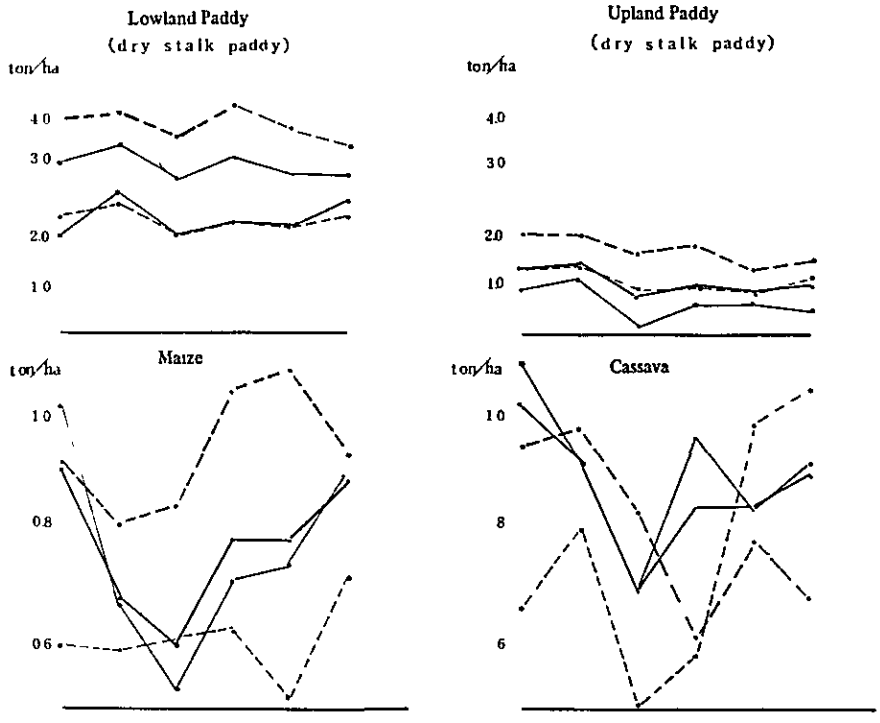
Note: (1) The growth of paddy and upland paddy production was obtained by extrapolating the trend line established by the average values for the 1965~1967 period and the 1968~1970 period.

Tengah is expected to play an important role in the provice's paddy supply. In this connection, note must be taken of the fact that the land productivity in Lampung Selatan is generally on the decline. (See Fig. 2-4).

As is clear from Fig. 2-4, the unit yield of Lampung 'Tengah's major crops such as paddy, upland paddy, maize and groundnuts is on a level lower than the province's average (See Table 2-11). Though the unit yield of maize has improved recently and is about to surpass the province's average level, the improvement is due mainly to factors, i. e., the development of estate agriculture in which maize is cultivated on a scientific line and the resultant diffusion of improved varieties (Metro). Insofar as the land productivity for major crops is concerned, the kabupaten is below the province's average, and considering the recent upward trend in the rate of population to farmand, the kabupaten's labour productivity is also lower than in the other two kabupatens.

Fig. 2-5 shows the comparison of the three kabupatens of Lampung with respect to land productivity and labour productivity as well as the comparison of agricultural productivity between Lampung and Java. The figure indicates that Lampung Tengah's agriculture, in which cash crop production occupies a small portion and the rate of population to farmland

Fig. 2-4 Transition of Yield per ha



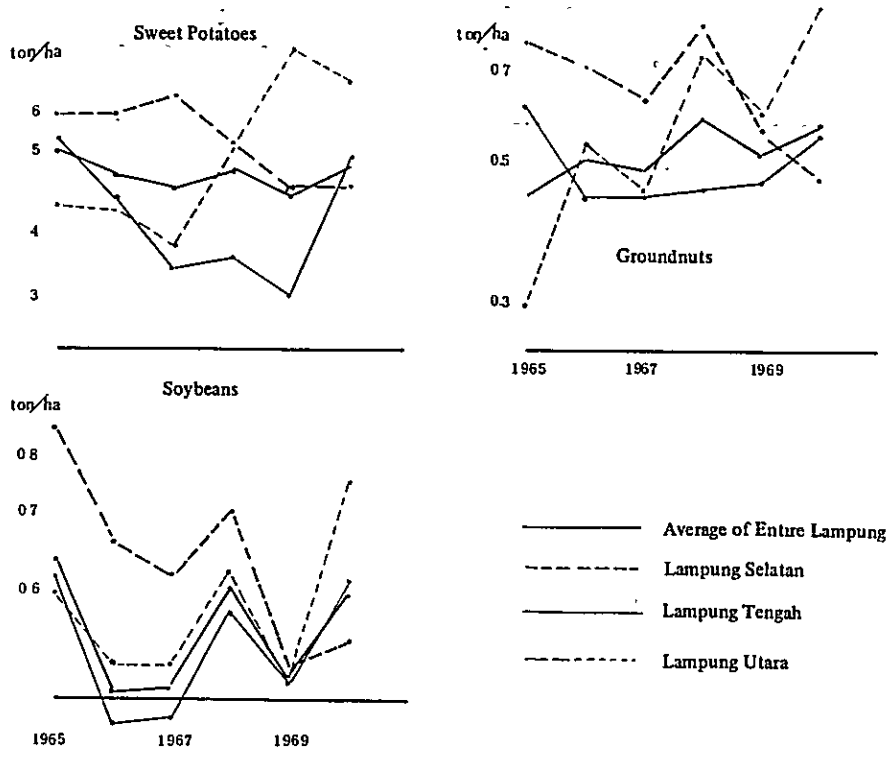


Fig. 2-5 Comparison of Agricultural Productivity between Ketjamatans (Average of Entire Lampung = 100)

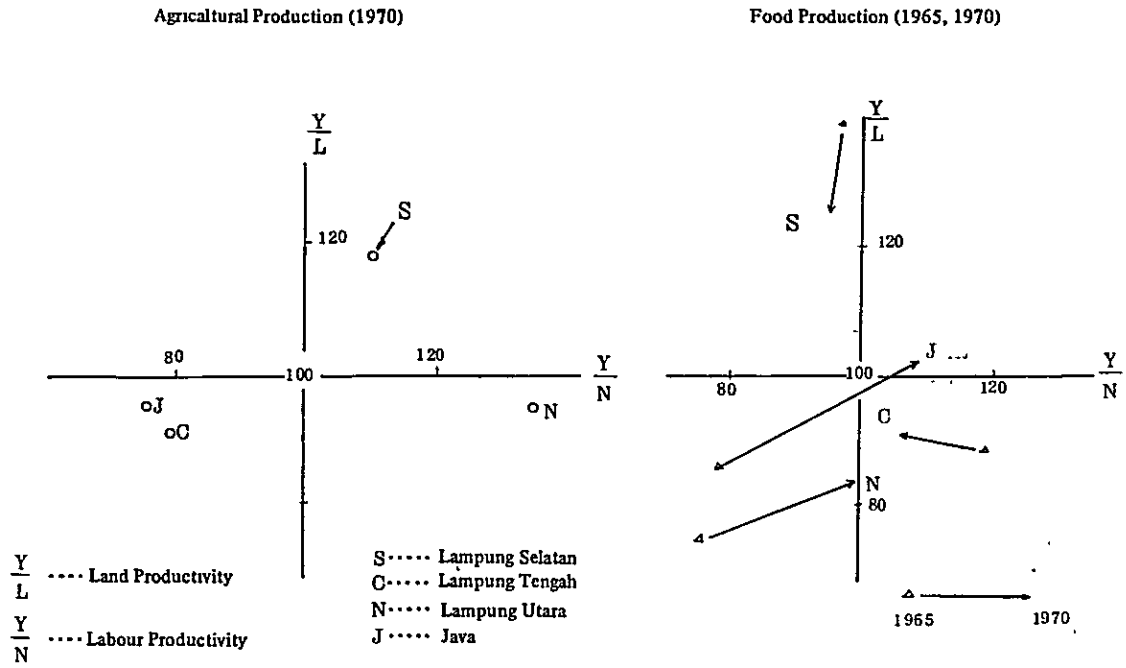


Table 2-11 Yield Lebel of Major Food Crops

	L. Selatan	L. Tengah	L. Utara	All Lampung	All Indonesia	
			ton/ha			
1966						
Lowland Paddy	4.2	2.2	2.5	3.4	2.5	
Upland Paddy	2.2	1.2	1.6	1.6	1.5	
Maize	0.9	1.0	0.6	0.9	1.0	stalk paddy
Cassava	9.5	11.0	6.8	10.3	7.8	
Groundnuts	0.7	0.6	0.3	0.5	0.7	
1970						
Lowland Paddy	3.7	2.8	2.5	3.2	2.8	
Upland Paddy	1.7	0.9	1.4	1.3	1.4	
Maize	0.9	0.9	0.7	0.9	0.9	stalk paddy
Cassava	6.9	9.2	10.5	9.1	-	
Groundnuts	0.5	0.6	0.8	0.6	1.3	

Notes: (1) Average yield of all Indonesia is based on the data of FAO and Indonesian government.
(2) 1968.

is large, creates a noticeable contrast to the general trend in Lampung which points more or less to intensified cash crop production, and presents a pattern similar to Java's agriculture. Insofar as food crop production alone is concerned, however, the figure indicates that the kabupaten's land productivity improved to some extent by the expanded paddy cultivation and increased unit yield of maize, but its labour productivity dropped due to the inflow of new settlers. Thus, the situation in Lampung Tengah is in sharp contrast to that in Java where the recent production increase was not only realized, to a substantial extent, by the improvement of land productivity, but also followed by increased labour productivity.

Judging from the level and trends of agricultural production, it may be said, in a general way, that the province's agriculture is still heavily dependent on natural conditions but has already entered the stage of developing its production capacity through capital input. Unlike the early period of Lampung's development when immigrants settled themselves in areas favoured with soil and water conditions, particularly Lampung Selatan, the capital investment made in the 1930's for irrigation development in Lampung Tengah brought about the expansion of farmland with the increase in labour force ensued from the inflow of settlers, contributing to the expansion of agricultural production. However, even better effects are being produced by the recent implementation of irrigation facilities expansion programmes. These programmes not only allow new immigrants to settle themselves in Lampung but also are paving the way for making modern inputs such as improved varieties and fertilizers, and this makes it justfiable to say that Lampung is, as described above, in the stage of developing its agriculture through capital input.

In the total paddy field area of Lampung Selatan, sawah dengan pengairan tehnis provided with fully technical irrigation facilities occupies only 27%, whereas sawah pengairan desa, created by the efforts of peasants, accounts for more than 41%, and it is considered that rain-fed paddy fields, occupying 24%, are effectively cultivated favoured by relatively abundandant

rainfall which is little subject to annual fluctuation. In Lampung Tengah, practically all irrigated paddy fields are provided with fully technical irrigation facilities which, however, do not seem to be effectively utilized at present due to the poor water management and large annual fluctuation of rainfall. It entails difficulty to say which of the two kabupatens excels in irrigation conditions, but the team is convinced that such irrigation conditions provide the basis for introducing new and advanced techniques along with the increasing modern inputs observed in recent years. In actuality, however, farmers in Lampung show, just as in Java, not much willingness for introducing new techniques. Particularly in Lampung Selatan where agriculture still resorts largely to the abundance of nature, farmers are reluctant to applying fertilizers and planting improved varieties. In this respect, farmers in Lampung Tengah are more progressive. Table 2-12, prepared by a sample survey, indicates that the advanced techniques are employed only by a limited number of farmers. In the report of this survey, it is stated that farmers in Lampung Selatan shy away from the use of fertilizers because the fertilizers they applied proved unsuited for the soil fertility and invited a poor paddy crop. [1] However, as shown in Table 2-13, the level of advanced cultivation techniques as manifested by the degree of fertilizer application, introduction of improved varieties and rate of double corpping is lower in Lampung Selatan, but in Lampung Tengah where the technical level shows an ostensible superiority to that in Lampung Selatan, the production level remains on a lower level. The gap in the production level between the two kabupatens is largely ascribable to the difference in soil fertility which is reflected in the production of upland paddy.

The findings of interviews carried out in 11 ketjamatans in Metro and vicinity clearly indicate, however, that the improvement of irrigation facilities is prompting the inducement of advanced techniques. This suggests that while the recent irrigation development work has resulted in the concentrated settlement in Lampung Tengah, those immigrants who came to this kabupaten in the post-war days settled themselves in the wilderness of land. During the 19 year period from 1952 to 1970, as many as 190 thousand people started new life in a total of 163 thousand ha of settlement area in Lampung Tengah. Irrigation facilities constructed to date in this vast area covers only about 30 thousand ha (less than 20%) which embraces Sekampung, Purbolinggo, Pekalongan, Raman Utara and part of Punggur (See Table 2-14). In other words, 80% of the 170 thousand people who came to Lampung Tengah during the past 20 years reclaimed wild fields into farmland and have been cultivating upland paddy, maize, cassava and other crops for self-sustenance. It is considered that the level of their production capacity is something like or even lower than the average of four ketjamatans (Sekadana, Seputih Raman, Punggur and Gunung Sugih) show in Column C of Table 2-13. It is to be noted that the longer the distance between the settlement area and Metro, the worse the road condition and consequently economic condition.

Table 2-13 also indicates that the farmers who settled in 1950 and subsequent years in areas with fairly well developed irrigation facilities such as Purbolinggo and Raman Utara (Column B) are just as progressive

Table 2-12 - Rate of Farmers Using Fertilizers and Improved Seeds

	Lampung Tengah (Desa Josodadi)		Lampung Selatan (Desa Gunungsari)	
	Rate of Fertilizer Application	Rate of Using Improved Seeds	Rate of Fertilizer Application	Rate of Using Improved Seeds
	%	%	%	%
Prior to 1960	15	11	0	0
1960 - 1964	33	37	0	0
1964 - 1968	52	56	3	0

Source: Survey Agro Ekonomi Departmen Pertanian Aspek[2] Intensifikasi Padi sawah di Dua Kabupaten di Lampung Musim Hudjan 1968/69, 1970, P25

Table 2-13 Comparison of Lebel of Paddy Cultivation Techniques

	Lampung Tengah				L.Selatan
	A (1)	B (2)	C (3)	Ketjamatan's Average	Average
Farmland Area (4)(1000ha)	18.3	7.6	21.1	97.1	69.1
Paddy Field Area(5)(1000ha)	10.3	4.2	1.8	20.4	34.9
Paddy Field Area with Irrigation Facilities(6) (1000 ha)	9.4	3.8	0.7	14.8	9.6
b/a (%)	56.3	55.3	8.5	21.0	50.5
c/b (%)	91.3	89.5	38.9	72.5	27.4
Harvested Area of Food Crops (1000 ha)	25.3	11.0	26.3	158.4	99.4
Wet Season Paddy (%)	43.8	35.5	8.2	14.1	30.5
Dry Season Paddy (%)	26.4	16.7	2.2	4.4	7.4
Upland Paddy(7) (%)	5.0	13.6	22.9	33.3	34.4
Yield per ha (stalk paddy ton/ha)					
Wet Season Paddy	3.4	3.6	1.4	2.8	3.9
Dry Season Paddy	2.4	2.9	1.4		3.1
Upland Paddy	0.9	1.0	0.9	0.9	1.7
Rate of Irrigated(8) (%) Paddy Cultivation	91.2	73.4	14.6	26.4	23.5
Rate of Double Cropping of Paddy (9)(%)	61.8	46.0	34.1	30.9	24.2
Cultivation Rate of Improved Varieties(10) (%)	35.6	45.4	27.1	28.5	8.9
Dosage of Fertilizer Application(11) (kg/ha)					
Urea Fertilizer	128	63	19	113	8
T.S.P.	66	100	13	37	3
Rate of Fertilized Area (12) (%)	30	25	5		

Notes: (1) Resettlement districts prior to 1950 (Metro, Trimurdjo, Bentaghau, Sekampung and Pekalongan)

(2) Resettlement districts after 1950 provided with irrigation facilities (Purbolinggo and Raman Utara).

(3) Resettlement districts after 1950 with poor irrigation facilities (Sekandana, Seputih Raman, Punggur and Gunung Sugih).

(4) Total of paddy fields, ordinary upland fields and perenial crop fields.

(5) Total of irrigated paddy fields, rain-fed paddy fields and marsky paddy fields.

(6) Paddy fields provided with technical irrigation facilities (sawah dengan pengairan technis).

(7) Values for A, B and C are arithmetic means of the ketjamatan's standard values obtained by interviws.

(8) Rate of planted area in irrigated paddy and upland fields to the total paddy planting area. Ketjamatan's average was obtained on the assumption that dry season was all planted in irrigated fields.

(9) Rate of upland paddy cropping area to the double cropping area.

(10) Planting rate of improved varieties (PB-5, 295 and Syntha).

(11) Values for A, B and C are the arithmetic means of the ketjamatan's per ha dossage of fertilizers obtained by interviews. The ketjamatan's average dossage, which is for 1969 and 1970, was obtained by dividing the marketed volume of fertilizers in the kitjamatan by the planted area, and cannot therefore compared with the values for A, B and C.

(12) Arithmetic mean of the ketjamatan's wise rough value obtained by interviews.

Source: Except for those obtained by interviews, values shown were obtained from the data of Dinas Pertamian Rakjat (Lampung Tengah and Lampung Selatan).

in the introduction of improved techniques as the farmers who migrated before 1950 to the paddy field area with relatively good irrigation conditions (Column A). As is clear from the difference in the rate of irrigation development and of double cropping shown in the said table, irrigation conditions in areas B are somewhat poorer than in areas A. Though this is attributable to the poor condition of tertiary ditches and improper water amanagement, account must also be taken of the fact that in area B and neighbouring areas C, shifting from upland paddy to lowland paddy and double cropping of maize whose commercial value is increasing of late, are develping.

Table 2-14 Resettlement Condition in Areas under jurisdiction of Lampung Immigration Control Office (1952 to December 1970)

Name of Resettlement Districts	Period of Resettlement	Area	Number of Settlers	
			Households	People
Lampung Selatan				
Palas	1958~1963	14,300 ha	1,412	6,064
Sidomuljo	1958~1967	15,000 ha	2,628	11,120
Balau Kedaton	1961~1964	12,000 ha	765	3,042
Tandjungan	1968	1,000 ha	302	1,405
Total		42,300 ha	5,107	21,631
Lampung Tengah				
Sekampung	1952~1955	3,000 ha	1,237	5,744
Purbolinggo	1952~1956	10,000 ha	3,613	14,415
Punggur	1953~1957	10,000 ha	2,511	9,703
Pekalongan	1953~1957	1,000 ha	545	2,351
Labuhan Maringgai	1953~1956	142 ha	201	771
Seputih Raman	1954~1959	12,630 ha	5,390	22,172
Raman Utara	1955~1958	9,958 ha	2,904	12,029
Way Seputih	1954~1961	10,537.5 ha	4,298	17,778
Seputih Banjak	1958~1961	19,180 ha	5,000	19,720
Rimbia Barat	1960~1961	4,727 ha	1,003	3,919
Seputih Bm.Nabung	1964~1964	10,000 ha	996	14,619
Seputih Surabaja	1965		2,998	12,408
Way Djepara	195 ~1963	11,689 ha	3,992	16,491
Seputih Mataram	1962~1965	38,000 ha	6,806	28,752
Lempujang	1959~1959	12,000 ha	266	954
Bandjaratu	1959~1967	10,000 ha	551	2,186
Total		162,863.5 ha	42,311	174,012
Lampung Utara				
Baradatu	1959~1963	17,500 ha	1,510	6,496
Negeri Agung	1965~1965	8,500 ha	1,818	7,643
Bandjit	1962~1963		1,084	4,917
Way Abung	1965~1970	20,000 ha	1,77?	7,482
Total		46,000 ha	6,189	26,538
Totals of Three Ketjamatans				
Lampung Selatan	1958~1968	42,300 ha	5,107	21,631
Lampung Tengah	1952~1967	162,863.5 ha	42,311	174.012
Lampung Utara	1959~1970	46,000 ha	6,189	26,538
Grand Total		251,163.5 ha	53,607	222,181

Source: Lampung Immigration Control Office.

2.3 Farm Management in Lampung Tengah

2.3.1 Structure of Agriculture

With the improvement and expansion of irrigation facilities as an incentive factor, agriculture in Lampung Tengah is about to pursue a new course of development aiming at the introduction of advanced techniques and elevation of production capacity. Settlers aspire after the expansion of their small paddy field holding because they know that it assures larger and stabilized production, and promises increased income for them. To put in other words from the sociological viewpoint, they are hoping to be able to cope with the population increase and development of external economies through technical progress, i.e., irrigation development. However, when the expanded production capacity attained by such technical progress eventually comes to fail to catch up with population increase, there will arise the need for more intensive land use. New techniques to be introduced to meet such need will have be ensure higher efficiency of conventional labour intensive techniques since it is evident that non-agricultural sectors in Lampung Tengah have a limited capacity of absorbing agricultural labour force. Hence, the new techniques should comprise the introduction of high yielding varieties and application of fertilizers. However, there will be a number of fundamental problems to be solved before a high production level is attained by the farmers in the kabupaten.

Table 2-15 Frequency of Contact between Farmers and Extension Workers
(Wet Season of 1968/1969)

(Unit %)

	Cases in Lampung Tengah		Cases in Lampung Selatan	
	I	II	I	II
Kabupaten-level Extension Officer	26	3	6	5
Desa-level Extension Worker	-	23	43	14
Desa Chief	17	20	-	14
Desa Leaders	10	14	37	30
Farmers	20	-	7	-
No Contact	27	40	7	20

Source: Survey Agro Ekonomi Department Partanian Aspek[2] Intensifikasi Padi Sawah di Dua Kabupaten di Lampung Musim Hudjan 1968/69, 1970, P35

One of the fundamental problems lies in how the techniques are to be provided and in what technical conditions are required of the recipient side. At present, new techniques are offered chiefly through BIMAS Project on an entirely standardized basis with no adequate consideration given to the inherent and specific conditions of respective areas. The project aims primarily at the supply of capital goods in package deal, but its smooth implementation is hampered and balanced supply of goods impeded by the poor road condition. The fundamental technical condition to be fulfilled on the part of recipient is to effect improvement to the currently practised plot-to-plot irrigation which not only reduces the effect of fertilization but also deprives high yielding varieties of their excellent characteristics by planting them in deep-mud paddy fields. It is to be added that the lack of agricultural extension and guidance activities is one of the factors responsible for the poor technical level. As shown in Table 2-15, farmers obtain technical information mostly within the desa where they live. Whether they seek information from their desa chief or from desa extension worker (P. T. D = Pamang Tani Desa), it can be reasonably assumed that the reliability of information given by either of them is limited. It is also to

be noted that smooth extension service is hindered by the difference in status between these desa-level information diffusers and the ketjamatan-level extension officers (Mastri Pertanian) who may disseminate new techniques among farmers and by the distance between their respective service districts. In Lampung Tengah, the team encountered a rare case where the ketjamatan office is located only 5 km from the service district of desa-level extension workers. In this particular case, the frequency value of contact between the ketjamatan-level extension officer and farmers was reported to be as high as 26%. In Lampung Selatan where the distance is as large as 11 to 15 km, the frequency value of contact is no larger than 5 to 6%.[1)]

Another problem lies in the standard on which the farmers base their selection and decision. Farmers living in the stagnant agricultural climate are generally devoid of the forward-looking attitude which would enable them to make a choice among opportunities offered for the improvement of their economic footing. They seek the standard for making such a choice in their past experience, feel anything new introduced in their life quite risky, and endeavour to diminish what they feel as risky. Therefore, as prerequisite to the input of any new techniques, particularly those which incur a higher cost than the conventional practices, some guarantee must be afforded for alleviating the suspected risk and assurance must also be made that substantially large return can be basically expected from additional input of new techniques. However, since it is already proved that farmers in younger age-groups whose level of education is considered relatively high show a more active response than farmers in higher age-groups towards the introduction of new techniques,[2)] it is considered that accelerated extension and training activity will serve to promote the farmers' decision making capability. Any expectation of increased income cannot be warranted without market stability. If the market condition becomes irregular and shows instability, it will naturally result in dimnished additional input and will also invite rapid outflow of increasing labour force which will seek employment in non-agricultural sectors.

Table 2-16 Demand and Supply of Rice in Lampung

	Rice Purchased by DELOG	Rice Imported by DELOG	Rice Exported by DELOG
	ton	ton	ton
1967	11,924	2,168	4,942
1968	26,710	3,606	9,000
1969	668	735	3,613
1970	1,073	7,250	2,243

Note: (1) DELOG stand for Depot Logistik Lampung (Lampung Food Procurement Office)

Source: Depot Logistik Lampung

In Indonesia, claim has often been put forward that the producer's price of rice should be raised as an incentive to accelerated input of new techniques and increased rice production. At present, the floor price for rice set by BULOG (Food Procurement Agency) is Rp 13.2/kg for stalk paddy (ex-farmyard price) and Rp 33/kg for high quality rice containing 22.5% or less of broken rice (market price). The function of BULOG, however, consists rather in controlling the market price by releasing stock rice when the price exceeds Rp 50/kg than in setting the price (See Table 2-16). Though the release of stock rice has brought about the stability of market price, it also has produced price conditions which are disadvantageous to producers and outweight the benefit of market stability. To put in more detail, prices of daily necessities other than foodstaffs have risen in recent years and the consumption of fertilizers and agro-chemicals is also increasing (the market price of urea fertilizer is Rp 30/kg, but farmers purchase it for Rp 40/kg; and chemicals cost Rp 1,100 ~ 1,200/lit.). In Lampung Tengah, consumption of fertilizers per ha has increased by 3.8 times over the past five years. Further, the activities of middlemen (tengkulak), necessitated by poor road and traffic conditions, invited decreased income of farmers, particularly in those areas which are far from the market, [1] and the annual fluctuation of producer's price caused by the price fall of crop in the harvesting season is an obvious disadvantage to farmers because of the relative stability of market price. All these trends, shown in Table 2-17, are the common problems suffered by subsistence-level agriculture.

Table 2-17 Seasonal Fluctuation of Producer's Price of Coarse Paddy Grains and Market Price of Polished Rice
(Lampung Tengah - 1970)

	Coarse Paddy Grains	Polished Rice
	Rp/kg	Rp/kg
January	15.90	51.50
February	19.40	48.20
March	15.20	41.90
April	13.50	44.21
May	16.20	40.27
June	19.00	42.57
July	19.00	47.50
August	22.30	51.30
September	18.50	52.45
October	21.80	50.00
November	16.00	43.57
December	25.30	43.00
Average	18.51	46.37
Coefficient of Fluctuation(%)	17.6	8.9

Subsistence-level farm management not only produces relative disadvantage to farmers on the market but also exerts a repressive effect on the progress of technical improvement. As described already, the labour productivity is on the decline in Lampung Tengah (See Table 2-5), that is, the upward trend noted in the kabupaten's land productity is seriously retarded by the rapid increase in the rate of population to farmland area. While it can be said that the rise in the rate of population to farmland is generally accompanied by increasing demand for new techniques, the situation in this kabupaten represents a case where the introduction of advanced techniques is impeded by the defect in the dissemination of new techniques, existence of employment opportunities by mutual employment of farmers, and availability of unexploited land. The rate of population to farmland is estimated to be 10.9 in five ketjamatans such as Metro and Trimurdjo which are in the paddy field area of the kabupaten, 8.3 in Purbolinggo and Rama Utara, and 8.2 in Sekadana and four other ketjamatans where settlement was initiated after 1950 and irrigation facilities are fairly well developed.[2] These values are rather close to those observed in rural districts of Java, but they may have to be understood as suggesting the existence of a large population expecting to obtain employment with the expansion of farmland area.

At any rate, it is considered that the increase of population pressure on farmland will accelerate the trend for smaller farm management scale. In the five ketjamatans in the paddy field area, the average operational holding per farmhousehold is composed of 0.30 ha of paddy field, 0.13 ha of upland field, and 0.19 ha of perenial crop field, totalling 0.62 ha plus 0.09 ha of fallowed land. When measured against the yardstick of the initial allotment of land, the above value clearly indicates the shrinkage of farm management scale, because each new settler is usually alloted with 1 ha of paddy field, 0.5 ha of upland field, 0.25 ha of perenial crop field, and 0.25 ha for farmhouse and garden. In Purbollinggo and Raman Utara, idle farm land averages 0.96 ha against cultivated area of 0.82 ha per farm household, and in Sekadana and other four ketjamatans, the former averages 0.58 against 0.84 of the latter per farm household. This is good evidence to show that farmers in these areas, lacking both fund and labour force, are unable to make full use of land, and that the management scale will become smaller as in the vicinity of Metro with the development of irrigation facilities.

It follows, therefore, that unless actions are taken for increasing production capacity through introduction of new techniques and for resettlement through progressive expansion of farmland area, division of farmland and aggravation of farmers' economic condition will be increasingly intensified. Distribution by management scale of farm households in Desa Josodadi in Ketjamatan Metro, shown similarity to that in Java, though the difference in the standard for distribution does not allow to make a linear comparison. (See Table 2-18). It may be added that in a number of desas covered by the survey, the largest operational holding per farm household was 4 ha, and there were a substantially large number of landless farmers. It may also be added thatthe team encountered an extreme case in one of the desas where 60% of the population are landless agricultural labourers. From these facts, it may be reasonably said that the small management scale and poor economic footing of farmers observed in Java are also found in Lampung, only in an aggravated state.

2.3.2 Pattern of Farm Management

According to the survey conducted in 11 ketjamatans in Metro and vicinity, Lampung Tengah, and in the adjoining Metro-Tegineneng district which embraces Ketjamatan Natar and belongs to Lampung Selatan, the paddy field area accounts for approximately 60% of cultivated land area in seven ketjamatans (Metro, Trimurdjo, Batanghari, Sekampung, Pekalongan, Purbolinggo, and Raman Utara) though the rate stands at 40% in Sekampung and Pekalongan, and 90% of the paddy field area is found within the fully technically irrigated area. Thus, the farm management in these areas presents a pattern which is predominantly paddy-oriented, and the acreage of farmland cultivated each year is, as described in the preceding section, 0.32 ha for paddy, 0.15 for ordinary upland crops, and 0.2 ha for perenial crops such as coconuts, coffee and bananas. The rate of double cropping of paddy exceeds the 60% level in Metro, Trimurdjo, Batanghari, Sekampung and Pekalongan, and about 50% in Purbolinggo and Rama Utara. The dry season work is limited to the double cropping of paddy, though about 10% of farmland is used for growing vegetables for farmers' own use. In some of these areas where the water supply is deficient or irrigation facilities are not well developed, upland crop cultivation centering on maize carries a heavy weight in farm management. In Metro and Batanghari, double cropping of maize is carried out. One of the features of these upland field areas is the large planted area of cassava for tapioca production. In the central part of the paddy field area, not much upland paddy is cultivated even by those farmers whose farm management centers on upland crop production. Upland paddy carries heavier weight in the outer areas where it is usually cultivated by mixed cropping with maize. Table 2-19 shows the typical cropping pattern in Trimurdjo where the paddy-based farm management pattern can be most clearly observed. The cropping intensity[1] in the above-mentioned paddy field area is rather high, showing a value of 169%.

Table 2-18 Farm Household Distribution by Operational Holding

	Lampung Tengah (Desa Josodadi)	Java and Madura I	Java and Madura II
ha	%	%	%
0.10~0.49	53.3	52.2	78.0
0.50~0.99	33.3	27.1	11.7
1.00~1.49	10.0	10.8	9.8
1.50~4.99	3.3	9.5	
4.99~	0	0.4	0.5

Notes: (1) Distribution by Wet Season Paddy Field Area in 1968/1969.
Source: Survey Agro Ekonomi, Aspek Intensifikasi Padi Sawa di Dua Kabupaten di Lampung Musim Hudjen, 1968/1969.

(2) Distribution by Farmland Area (Source. 1963 Agricultural Census).

(3) Distribution by Acreage of Paddy Field Area Owned as of 1957.
Source: K. J. Polzer, "Agricultural Foundation," in R. T. Mcvey ed., Indonesia, 1953, P. 127.

Table 2-19 - Typical Cropping Pattern in Paddy and Upland Field Areas (per Farm Household)

	Paddy Trimurdjo		Upland Crops Gunung Sugih	
	ha	%	ha	%
Paddy Field Area	0.50		0.08	
Irrigated Paddy Field Area	0.50		-	
Ordinary Upland Field Area	0.02		0.81	
Harvested Area	0.86	100	1.51	100
Wet Season Paddy	0.50	59	0.08	5
Dry Season Paddy	0.28	33	0.02	1
Upland Paddy	-	-	0.64	43
Wet Season Maize	0.002	0	0.16	11
Dry Season Maize	-	-	-	-
Cassava	0.07	8	0.58	39
Groundnuts	-	-	0.01	1
Soybeans	0.002	0	0.002	0
Green Beans	-	-	0.003	0
Sweet Potatoes	-	-	0.003	0

Note All values obtained by interviews which disclosed that farmland area does not conform to the value shown in the kabupaten's statistics.

Table 2-20 General Cash Balance Sheet Condition of Average Farmers

	Paddy Field Crops				Ordinary Upland Crops				
	Wet Season Paddy	Dry Season Paddy	Maize	Cassava	Upland Paddy	Maize	Cassava	Groundnuts	Soybeans
Harvested Area (ha)	0.50	0.28	0.002	0.07	0.64	0.16	0.58	0.01	0.002
Yield (ton/ha)	3.4	2.4	0.9	10.6	0.9	0.9	10.6	0.6	0.6
Production (ton)	1.7	0.7	0.9	0.7	0.58	0.14	6.15	0.01	0.001
Harvesting Labour Charge in Kind (ton)	0.4	0.2	-	-	-	-	-	-	-
Market Volume (ton)	0.5	0.2	-	0.2	0.12	0.08	592	0.01	0.00
Sales Price (Rp/kg)	18	18	-	3	18	12	3	92	46
Sales Proceeds (Rp)	9,000	3,600	-	600	2,160	960	17,760	920	
Operation Cost (Rp)	4,832	2,300	-	-	-	-	-	-	
Plowing, Harvesting and Transplanting Cgarges (Rp)	2,500	1,500	-	-	-	-	-	-	
Water Charges, Cost of Fertilizers, etc (Rp)	1,332	800	-	-	-	-	-	-	
Income (Rp)	4,165	1,300	-	600	2,160	960	17,760	920	
Total Income (Rp)		6,068					21,800		

Notes (1) See Table 2-19 for harvested area.
(2) Yield per ha is the average in the paddy field area and upland field area.
(3) One sixth of harvested paddy is offered for the harvesting labour offered under the bawon system (commonly called the ani-ani system)
(4) Sales volume and operation cost were obtained by interviews.
(5) Sales price is the average recorded in Lampung Tengah in 1970.

In contrast to the said paddy field area, Sekadana, Sepintih-Raman, Punggur, Gunung Sugil and Natar constitute an upland field area. The average scale of farm management in this area is 0.09 ha for paddy, 0.47 ha for ordinary upland crops and 0.18 ha for perenial crops, and most of paddy fields are either rain-fed fields of swamp though technically irrigated paddy fields are found in a limited area in Punggur and Sekadana. While coffee, coconuts and so forth are cultivated as perenial crops, upland paddy constitutes the most important ordinary upland crop and is planted in the greater part of farmland in the wet season. Upland paddy is cultivated by mixed cropping with maize and cassava, and cassava's cropping season lasts to the dry season. Table 2-19 shows the typical cropping pattern adopted in Ketjamatan Gunung Sugih. The cropping intensity in the upland field area is 141%, which is lower than in the paddy field area.

Table 2-20 shows the rough averages of expenditures and income of farmers whose farm management is based on the cultivation of paddy and ordinary upland crops. Besides the income shown in the table, there are other sources of income such as perenial crops, bricks, roof tiles, poultry, employed labour. In a desa in the upland field area of Punggur, the total income per farm household including income in kind is Rp 113 thousand, of which 67% comes from ordinary upland crops, 11% from perenial crops, and 22% from other sources. Thus the income per person per day in this desa is Rp 51.

CHAPTER III EXISTING STATE AND PROBLEMS OF AGRICULTURE IN LAMPUNG

3.1 Existing State of Irrigation Facilities and Water Management

3.1.1 Introduction

3.1.1-1 Purpose of Survey

Irrigation is primarily intended to maintain proper supply of water so that crops will be provided with water at the right time and their yield will be increased. An irrigation development plan is therefore required to be so worked out that the design volume of water will be supplied with minimum loss to the planned area at a design level and within a design time. Hence, determination of water requirement, planning of cannal network, and improvement of field conditions present themselves as fundamental factors to be studied in the preparation of an irrigation plan. Further, the planners are expected to ensure adequate management and maintenance of irrigation and farm facilities and systematic water management so as to attain highest irrigation efficiency.

The present irrigation survey, constituting part of the Basic Agricultural Development Survey in Lampung, was conducted for the dual purpose of investigating the existing state of irrigation system and water management in the vast area extending in the mid-basin of the Way Sekampung and providing data and information which will be required for studying the irrigation development project of the said area for future improvement of irrigation facilities. To put in more detail, the survey was carried out from the viewpoint of irrigation engineering to investigate the water requirement, water distribution, intake facilities, canals and in-field facilities so as to clear up the causes for the "failure to supply irrigation water to the planned area." However, due to the limited time allowed for the survey, the team was unable to do anything more than to point out the practical and pressing problems which presented themselves to the fore. Analysis of these problems are therefore a matter that awaits future study.

3.1.1-2 Survey Area

The survey was carried out in an extensive paddy field area spreading far out from the left bank of the Sekampung in its mid-stream section. The area lies between the Sekampung flowing in the north and the Way Suputih flowing in the south, and extends from the Way Punggur as far eastwards as the Way Sukadana. Administratively, the area belongs to Kabupaten Lampung Tengah of Lampung Province and embraces 11 ketjamatans, i.e., Trimurdjo, Metro, Batanghair, Sekampung, Pekalongan, Pulbolinggo, Punggur, Raman Utara, Sukadana, Seputih Raman and Gunungsugih.

The area has an elevation ranging from 20 to 55 m, and descends from southeast to northeast with a gradient of approximately 1/2000. Though the gradient is thus rather mild, the area is characterized by many undulations because it extends in the mid-stream basin of the Sekampung. Soils are red yellow podsol, and the entire area is covered with volcanic product of the

Quarternary formation

No large rivers are found in the area excepting the Raman, the Batanghari and Bunut, but there are numerous brooks and natural drainage ditches which flow through depressions and are woven into an intricate network of waterways.

Water utilization in this area has been in progress since 1935 when headworks were constructed at Argoguruh on the Sekampung. Construction of the headworks induced the settlement of Javanese farmers who were the first to undertake paddy field reclamation in Trimurdjo, Metro and neighbouring areas. To date, more than 22,000 ha of paddy field has been opened up, and the completion of the large irrigation development project currently implemented in Punggur Utara district is expected to create a total of 66,000 ha of farmland, the largest granary zone in Lampung.

At present, the greater part of the area is used for paddy cultivation, and the remainder is composed of village areas, upland fields, and alang-alang fields. Fig. 3-2 shows the existing state of land use in the area.

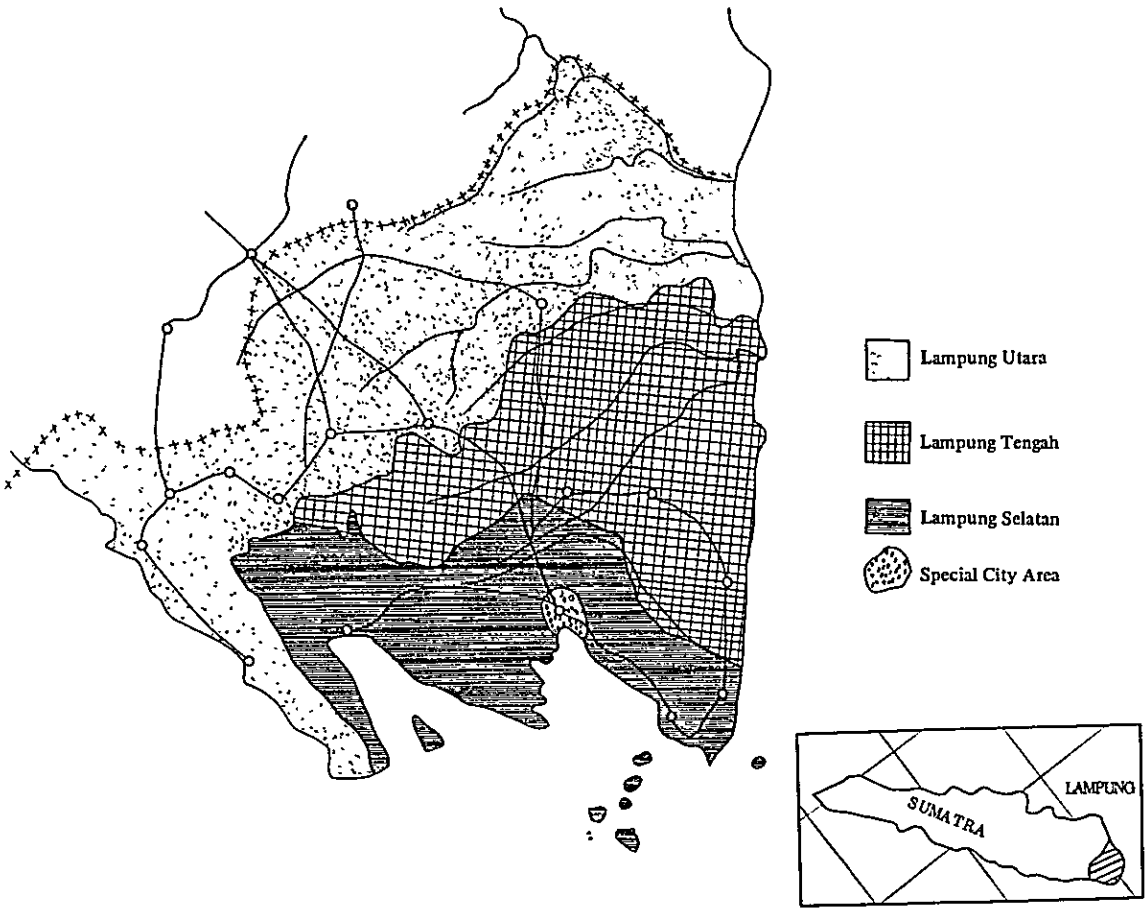


Fig. 3-1 Location Map of Lampung Province

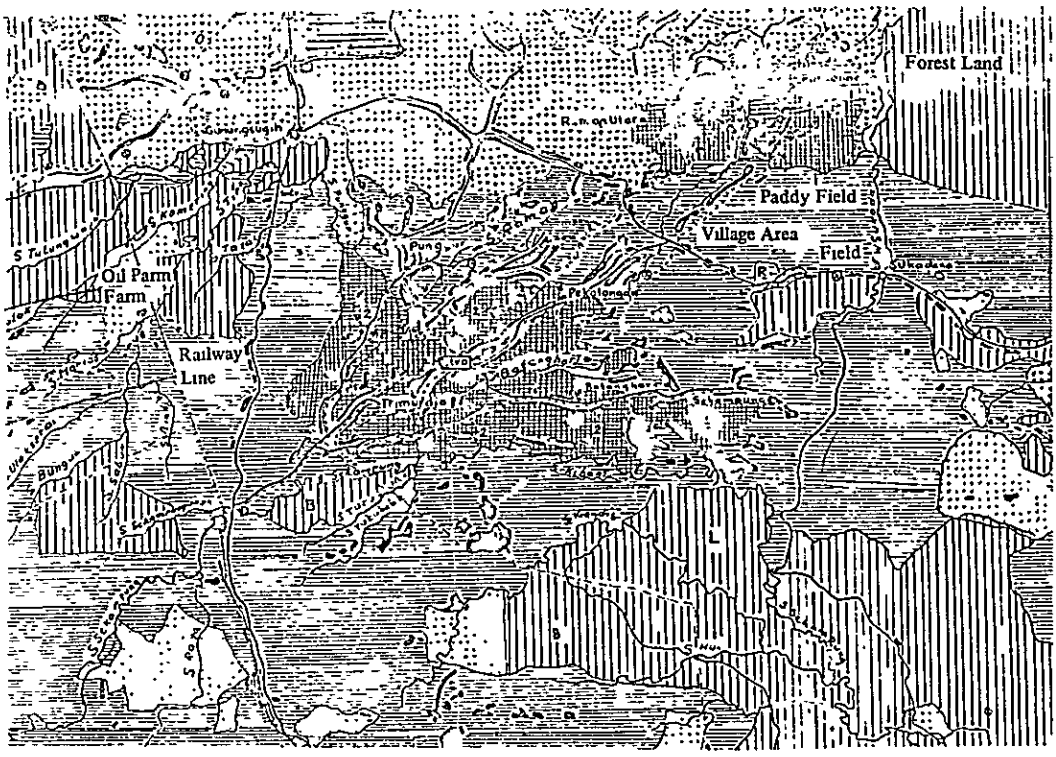


Fig. 3-2 Existing Land Use Condition in Mid-stream Sekampung Basin in Lampung Tengah

Source Land Use Office of Lampung Province

Legend

- Paddy Field
- Upland Field
- Forest Land
- Alan-alang Field
- Estate Farm
- Village Area
- Intake Point
- River or Road
- Railway Line
- Border Line between Ketjamatans

3.1.1-3 Outline of Irrigation Development Project

The project area of the large scale irrigation development work planned for this area can be divided into four districts, i.e., Sekampung, Punggur Utara, Raman Utara and Batanghari Utara.

In Sekampung and Punggur Utara, it is planned that 58.28 m^3/sec of design intake volume will be obtained from the headworks constructed at Argogruh on the Sekampung. Water thus obtained is planned to be led to the diversion gate at Thrmurdjo (Diversion Gate No. KH2) about 9 km apart from the said headworks and to supply 32.19 m^3/sec of water to Sekampung district and 26.09 m^3/sec to Punggur Utara. The planned total of irrigation area is 21,000 ha for the former district and 30,800 ha for the latter.

In Raman Utara, it is planned that Dam Raman (headworks) will be constructed on the Raman, the drainage river in the district, to obtain 5.24 m^3/sec of design intake volume for irrigation of 6,300 ha farmland.

In Batanghari Utara, it is likewise planned that headworks, Dam Galongan, will be constructed on the Batanghari, the drainage river in the district, to obtain 10.00m^3/sec of design intake volume for irrigation of 7,300 ha farmland.

Main and secondary canals are all earth canals showing a trapezoidal section and their total extension in the four irrigation systems is 170 km for main canals and 188 km for secondary canals. Number of diversion weirs totals 262, and that of intakes to be constructed at respective diversion facilities for water supply to fields 414 (excluding those to be constructed in areas farther than Station No. BF 16 in Punggur Utara where the construction work has not yet been initiated). Construction of all these facilities is undertaken by the government under the control of the Ministry of Public Works. Table 3-1 shows basic engineering data specifications of this irrigation development work.

3.1.2 Irrigation Facilities

As a result of active reclamation efforts made by settlers over the past years, the paddy field area in the four irrigation systems in the mid-stream basin of the Sekampung increased from 9,000 ha in 1952 to 13,600 ha in 1962 and further to 21,700 ha in 1971. Paddy field area of both wet season crop and dry season crop has shown a stready increase in recent years.

The fact remains, however, that there is too wide a gap between the planned irrigation area and the actually irrigated area. Table 2 shows the rate of the planned irrigation area to the actual harvesting area in the project area. For convenience's sake, the reciprocal of this rate will be called the "irrigation rate" in this chapter.

Table 3-2 indicates that in Sekampung district where the major irrigation work was completed as early as 1956, the irrigation rate of 1970/1971 wet season crop is as low as 60%. In Raman Utara and Batanghari Utara, the rate declines to 40% and 43% respectively.

Table 3.1 Basic Data of Fully Technical Irrigation Project in Four Districts in Mid-stream Basin of Sekampung River

Item \ District	Sekampung	Raman Utara	Batangaari Utara	Punggur Utara	Remarks
District Area	35,000 ha	9,100 ha	10,000 ha	40,000 ha	(for reference) Seputih I Irrigation Area 25,000 ha Construction period 1958~1974 Water Supply River Way Supitih Intake Point Daw Supitih Design Intake 25,000m^3 Total Length of Main Canal 42km
Design Irrigation Area	21,000 ha	6,300 ha	7,300 ha	30,000 ha	
Construction Period(Commencement to Target Completion Year)	1935~1956	1956~1967	1953~1967	1969~1972	
Irrigation Water Supply River	Way Sekampung	Way Raman	Way Batanghari	Way Sekampung	
Intake Point	Dam Argoguruh	Dam Raman	Dam Garongan	Dam Argoguruh	
Design Intake	32.19m^3/sec (58.28m^3/sec in total)	5.24m^3/sec	10.00m^3/sec	26.09m^3/sec (58.28m^3/sec in total)	
Irrigations Structures					
(1) Intake Dam					
Design Water Intake Lebel	+58.90m	+42.40m	+28.20m	+58.90m	
Dam Length	80.8m	15.0m	+15.0m	80.8m	
Dam Height	Crest elevation +59.00m Crest(height 7.70m structually and 5.20m hydraulically)	Crest elevation +40.60m Crest(height 7.70m structually and 3.90m hydraulically)	Crest elevation + Crest(height 2.80m structually and 1.60m hydraulically)	Crest elevation +5900m Crest(height 7.70m structually and 5.20m hydraulically)	
Dam Structure	Gravity type wet stone pitched concrete structure	Gravity type wet stone pitched conclete structure	Gravity type wet stone pitched concrete structure	Gravity type wet stone pitched conclete structure	
Sand Waste	Width 6.00mxHeightx Set	W. 2.00m x H.1.70m x S.2	W.2.00m x H.2.60m x S.1	W.6.00m x H. x Set	
Intake Conduit	Installed on the left bank width 2.55m x Height 2.50m x Set 5	Installed on the right bank width 1.60m x Height 1.70m x Set 2	Installed on the right bank width 1.50m x H. 1.50m x S.3	Installed on the left bank width 2.55m x Height 2.50m x Set 5	
(2) Irrigation Canal					
Main Irrigation Canal Length	70.9 km	27.7 km	35.1 km	36.3km	Intake in Punggur Utara district cover only these down to Turnout Nos. BG15 and BG16. Number of intakes downstream of these turnouts is not known.
Structure and Section	Trapezoidal earth canal	Trapezoidal earth canal	Trapezoidal earth canal	Trapezoidal earth canal	
Secondary Irrigation Canal Length	42.9 km	22.6 km	24.0 km	98.2 km	
Structure and Section	Trapezoidal earth canal	Trapezoidal earth canal	Trapezoidal earth canal	Trapezoidal earth canal	
Structure Appurtenant to canals	54 turnouts and 133 intakes	41 turnouts and 88 intakes	41 turnouts and 74 intakes	134 turnouts and 119 intakes	

Table 3-2 Planned and Actual Irrigation Areas in Four Districts in Mid-stream Basin of Sekampung River

(Unit: ha)

Destrict	Design Irrigation Area	Wet Season Cropping				Dry Season Cropping			
		Harvested Paddy Field Area		Rate of Irrigation		Harvested Paddy Field Area		Rate of Irrigation	
		1968/69	1970/71	1968/69	1970/71	1968	1970	1968	1970
SEKAMPUNG	21,909	11,702	13,061	54 %	60 %	5,297	8,385	24 %	38 %
RAMAN OTARA	6,279	2,340	2,524	37	40	706	1,005	11	16
BATANGHARI UTARA	7,342	2,630	3,124	36	43	1,062	1,457	15	20
PUNGGUR UTARA	30,843	2,124	3,000	7	10	0	989	0	3
Total	66,373	18,796	21,709	28	33	7,065	11,836	11	18

A number of different reasons can be conceived as causal factors of such low irrigation rates. If it is due to the deficient supply of water, then it should have resulted from 1) the design intake volume which is too small to cover the entire area, or 2) loss in the main and secondary canals which is too large to ensure sufficient supply of water to lower reaches, or 3) poor conditions of tertiary and in-field ditches that hamper equal water supply to all fields. These possible causes will be reviewed in the following subsections.

3.1.2-1 Intake Facilities

In the project area extending around Lat. 5° S and Long. 105°20' E, the monthly average temperature stands at 26°C with virtually no fluctuations throughout the year. The temperature difference between days and nights is approximately 10°, and this is the only factor that gives some variation of temperature. The duration of sunshine also maintains a stabilized level throughout the year. If water supply is sufficient, therefore, paddy cultivation can be carried out in any period of the year, but it appears that the peak period of transplanting and harvesting is determined by whether irrigation water can be obtained with ease or not.

The change of season in Indonesia is most clearly shown by the rainfall which distributes itself into two seasons, the dry and the wet. The wet season usually lasts from November to April and the dry season from May to October. During the wet season, the monthly rainfall generally exceeds 200 mm and the monthly number of rainy days is usually more than 10 days. Hence, three-thirds of annual rainfall is recorded in the wet season. However, even in the dry season, a monthly average rainfall of about 70 mm can be expected, which makes it possible to conduct paddy cultivation only with rain water. The dry season rainfall, however, is subject to a large annual fluctuation and it is often the case that no rain at all falls on 20 and odd days in succession, and this makes the dry season cropping extremely unstable.

As a result of the large scale irrigation development work, practically

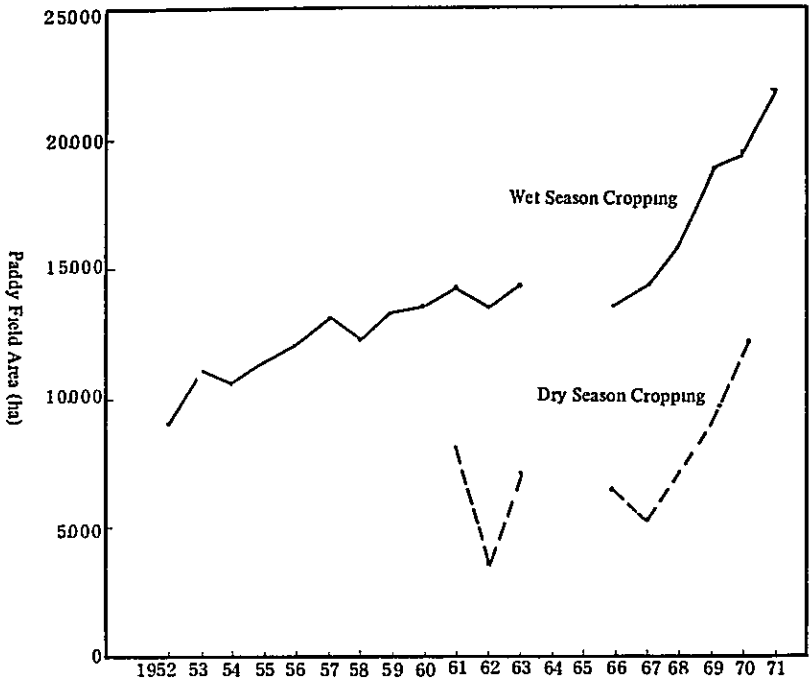


Fig. 3-3 Transition of Harrested Paddy Field Area in Four Districts in Mid-stream Basin of Sekampung River (Data for 1964 and 1965 not available due to political change)

Table 3-3 Planting Period of Lowland Paddy and Upland Paddy in Southen Sumatra (1960)

(Unit: %)

Month	Lowland Paddy		Upland Paddy	
	Transplant	Harvest	Transplant	Harvest
Jan.	14.7	1.0	4.4	2.9
Feb.	6.0	9.4	0.3	15.2
Mar.	2.3	19.3	-	26.7
Apr.	0.8	18.6	0.6	46.3
May	0.5	31.3	-	8.1
Jun.	3.5	9.5	-	0.5
Jul.	1.1	2.3	-	0.1
Aug.	0.1	2.5	1.7	-
Sep.	5.6	0.7	14.6	-
Oct.	12.8	2.4	24.8	-
Nov.	17.0	0.7	37.9	0.2
Dec.	35.6	0.3	15.7	-

all paddy fields in the project area are fully irrigated. The typical cropping season observed in the area is therefore as described below.

In case of double cropping, preparations last from January to February, growth period from March to May, and harvesting is conducted in June for wet season crop; and preparations last from July to August, growth period from September to November, and harvesting is conducted in December for dry season crop. In case of rain-fed cultivation, preparations are made in July-August period, growing lasts from September to November and harvesting is carried out in March.

The monthly average discharge of the Sekampung shows changes which respond to the monthly average rainfall with a time lag of one month. Consequently, the discharge is large in the December-May period and small or medium during the June-November period. The July-October period is the droughty season during which the discharge at Dam Argoguruh drops to less than 40 m^3/sec or smaller than half the annual average discharge. It follows, therefore, that though the design intake volume of 58 m^3/sec can be assured in the wet season, full-scale introduction of the double cropping covering the dry season will necessitate the construction of another dam in the upper reaches for augmenting the average discharge.

Attention must be directed, however, to the fact that in districts where the main irrigation work has already been completed, the irrigation rate is extremely low, and in Punggur Utara district where the irrigation development work is still in progress, construction of main facilities is advanced but the paddy field reclamation work is hardly set afoot yet. Considering the unbalance noted in the irrigation development in the area, the team considers it imperative that stabilized and increased unit yield of wet season crop should be given prime consideration for existing paddy fields, while development efforts should be directed to the systematic construction of irrigation and drainage canals, farm roads, well-divisioned paddy fields and so forth in the new reclamation areas so as to increase the acreage of cultivated field. For effective utilization of both water sources and land, it is also to be borne in mind that the cultivation of dry season paddy should be introduced within the range allowable by the available water quantity and that introduction of upland crops should be considered as secondary crops in paddy fields not useable for dry season paddy cultivation.

3.1.2-2 Irrigation Canals

Water taken in at the headworks is conducted through several tens of kilometers of main and secondary canals before it is distributed to fields from the diversion facilities installed at certain intervals on the way. These diversion facilities are composed of flashboard weirs intended to attain a specified intake level and intakes through which water is distributed into tertiary ditches. Both their structure and type being standardized, a uniform kind of weirs and intakes are found on the canals. Typical of such diversion facilities, installed in Trimurdjo, are shown in Figs. 3-4 and 3-5.

As intake facilities, broad-crested weirs called the Romjn gate are

Table 3-4 Monthly Rainfall and Discharge in Mid-stream Basin of Sekampung River

Month / Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Ful.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total	Remarks
Rainfall (mm)	349	234	243	167	115	95	91	73	76	98	199	229	1,973	Average values in Metro over 18 years period(1950~1967)
Rainfall (%) in Percentage	17.7	11.7	12.3	8.5	5.9	4.7	3.7	4.7	3.9	5.0	10.1	11.6	100.0	
No. of Rainy Days (days)	16.6	13.6	14.8	10.9	9.3	6.2	5.6	5.0	5.1	6.9	13.3	14.3	121.6	Average values in Metro over 18 years period(1950~1967)
Average Monthly Discharge (m/sec)	148	130	115	149	85	7	39	30	38	34	43	86	80	Average values at Dam Argoguruh over 8 years period (1966~1971)
Season	←Wet Season→				←Dry Season→						←Wet Season→			

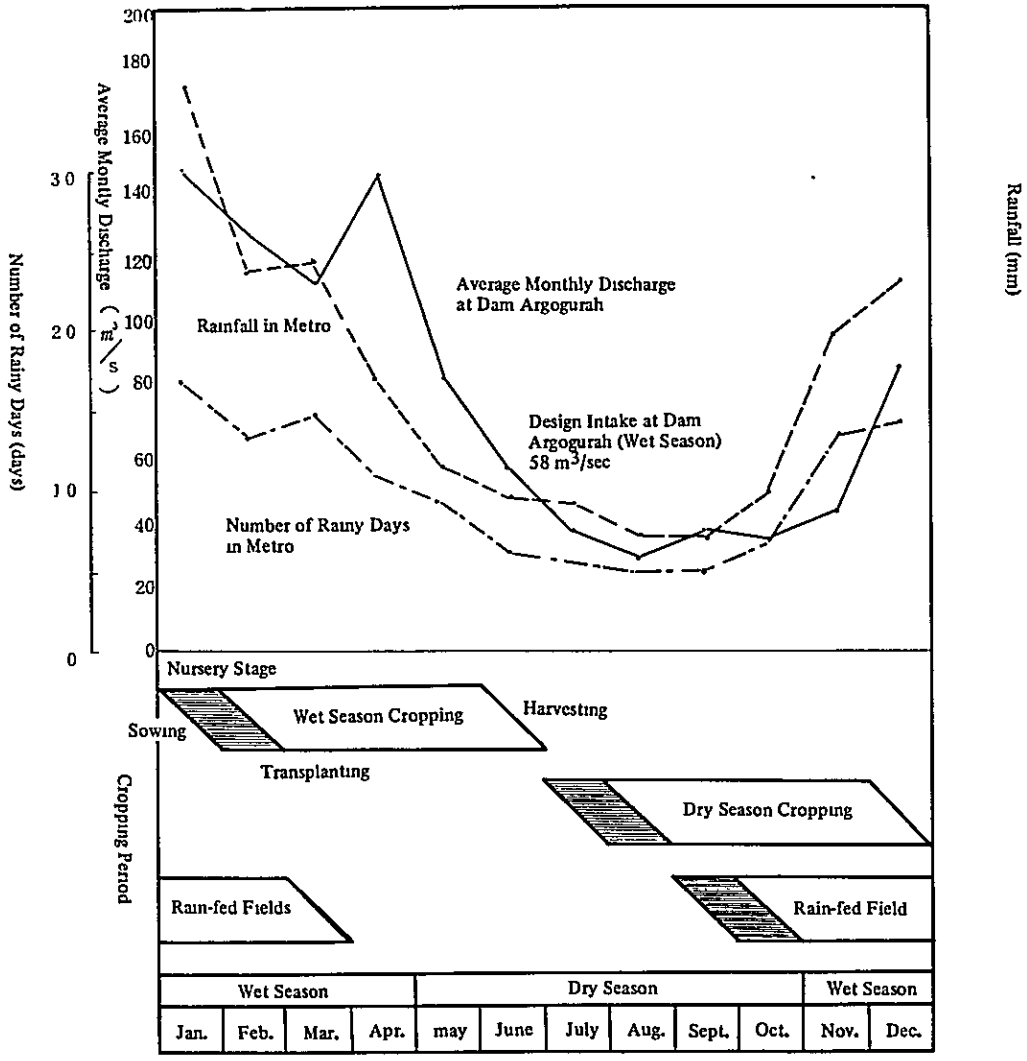


Fig. 3-4 Monthly Fluctuation of Rainfall and Discharge and Typical Paddy Cropping Pattern in Mid-stream Basin of Sekampung River

installed, which are so designed that the intake volume may be measured and diverted by raising or lowering the gate according to the upstream water level and controlling the nappe depth by so doing. The broad-crested weir is known to exhibit a very accurate diversion capacity unless it is thrown into the state of a submerged weir. Calculation discloses that the said weir provides an intake volume of $Q = 1.71\ BH^{3/2}$ (where B is the width of the overflow section and H is the nappe depth).

However, since the installation of this type of weir demands that headworks be so constructed that the water level can be raised without causing the weir to be submerged by the downstream condition of canals, diversion facilities must be constructed at long intervals in areas where the canal gradient is small. This results in a longer distance of tertiary canals leading out from the diversion gate and a lower distribution efficiency.

The team noted that most of level gauges for measuring the nappe depth are not in servicing condition. These gauges should be restored to working condition to ensure adequate management of water.

3.1.2-3 In-Field Facilities

The tertiary canal connects to the secondary canal in the neighbourhood of the intake of diversion facilities to form a network of canals for supplying irrigation water to fields. For construction of this network, carried out by farmers organized into a mutual assistance association called Gotong Rojong, technical guidance is given by PMD established in each kabupaten by the Ministry of Home Affair. However, since no subsidies are provided by the Central or provincial government for its construction, earth canals with an extremely poor structure and cross-section are arranged in a meandering way along the contour lines of depressions in mountainous areas. Distance of such earth canals is made longer by the fact that construction of cross-river irrigation facilities such as inverted siphons, culverts and aqueducts is rather limited in Indonesia. Water taken from these canals is applied to paddy field by plot-to-plot irrigation, and depressions in the paddy field are constantly submerged and water is not drained therefrom.

Figs. 3-7 and 3-9 show the layout of roads, canals and village areas in Trimurdjo and Metro. The broken line with an arrow mark shown in these figures is the tertiary canal. Comparing the two figures with the topography of Sekampung distruct, one would note the following.

Villages cluster in relatively flat and hilly areas. There are branch roads running between all village areas and between villages and main roads. Since maintenance roads are constructed along all main and secondary canals, farm roads have a high road density. Since irrigation water is distributed by gravity flow, main canals flow in the higher parts of the area. In other words, they run in the vicinity of village areas and provide drinking water for villagers.

As a consequence, paddy fields tend to be reclaimed in other areas than mentioned above, i. e., in areas with severe undulations and a heavy gradient. In the early period of development, farmers settled in this area

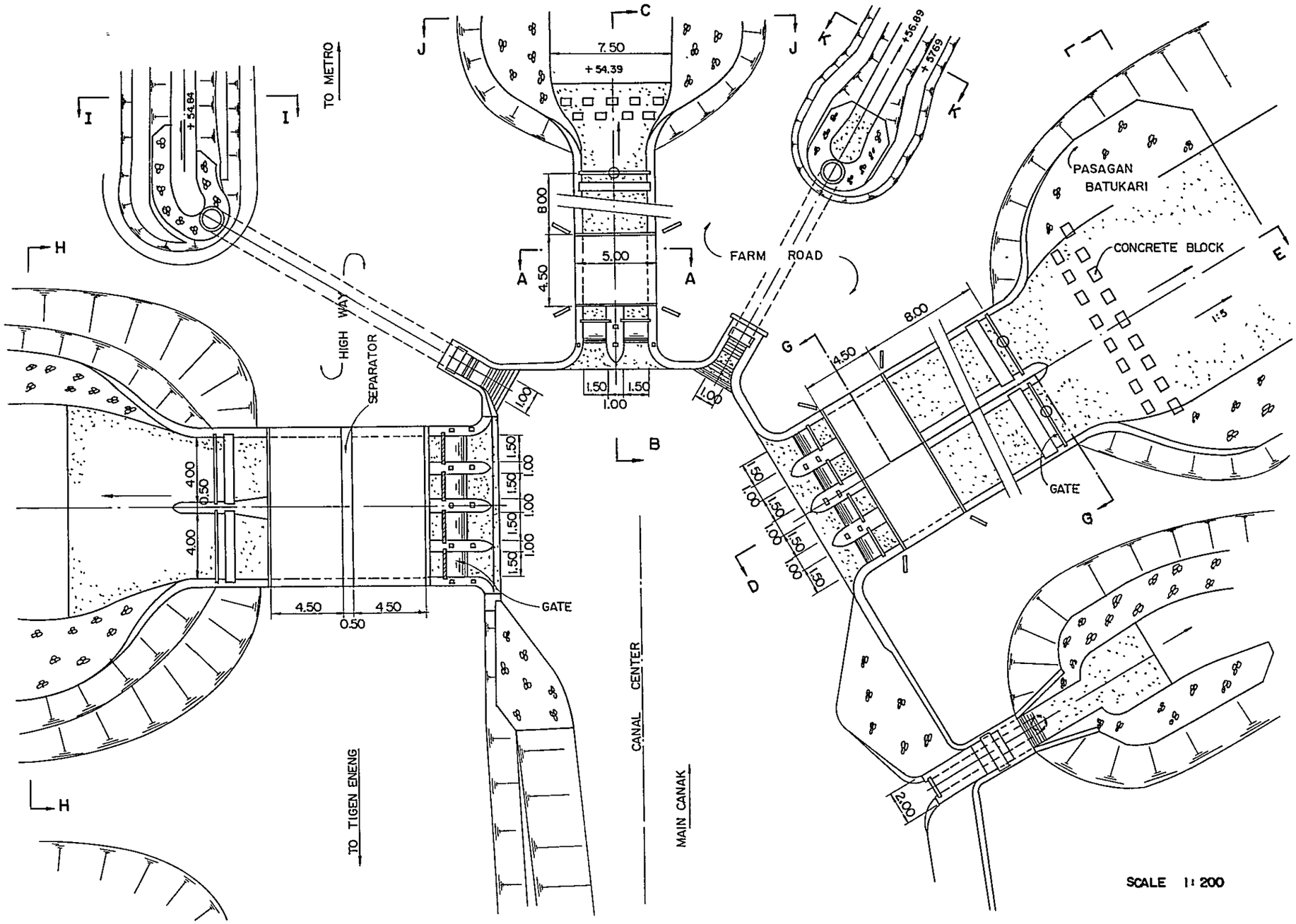
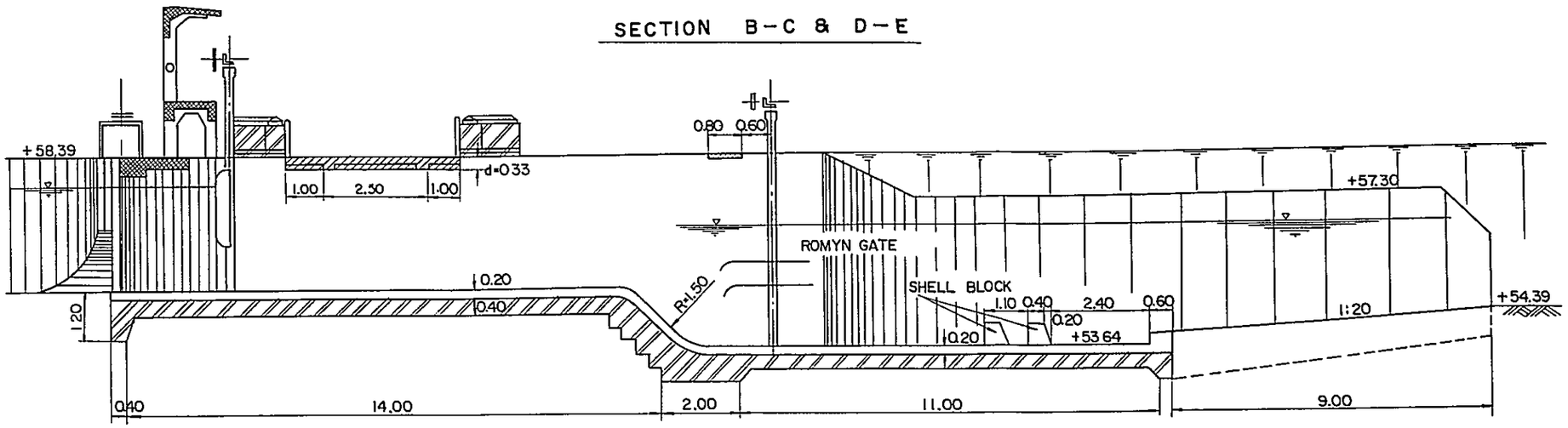
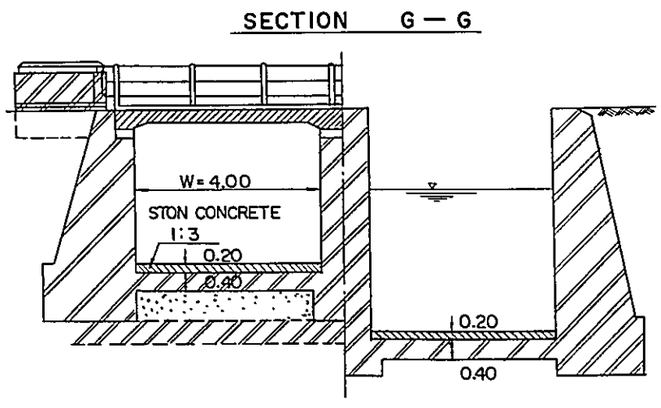
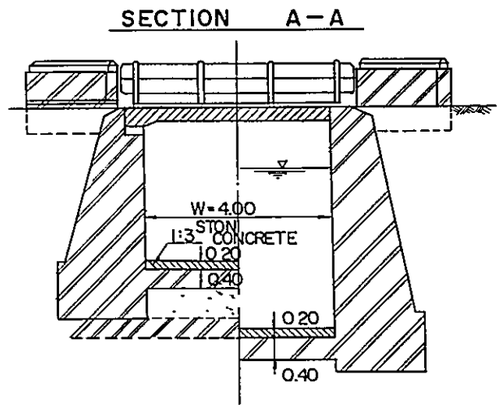
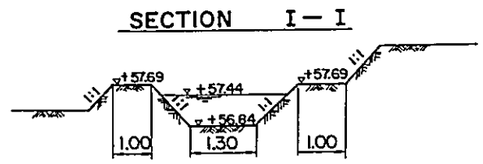


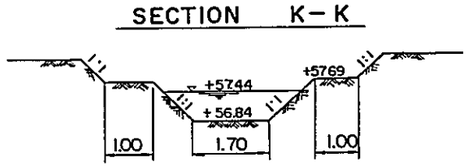
Fig. 3-5 Plan of Turnout Facilities in Trimurdjo

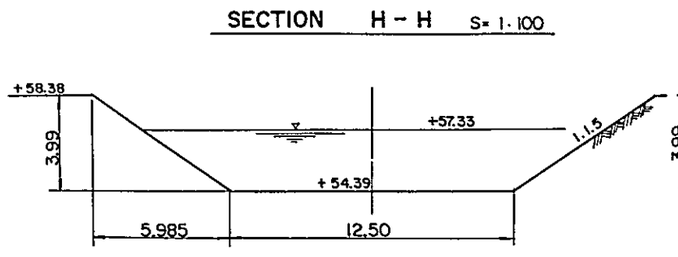


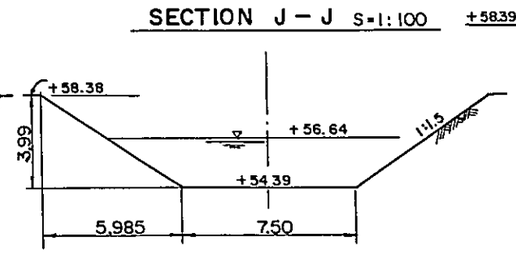












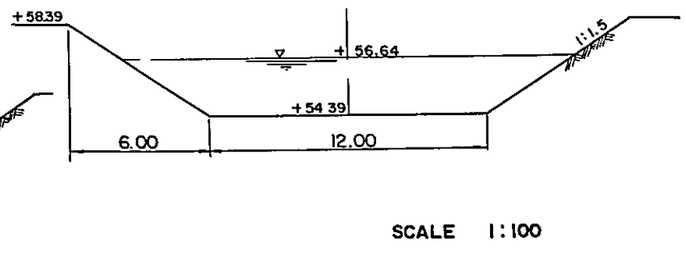
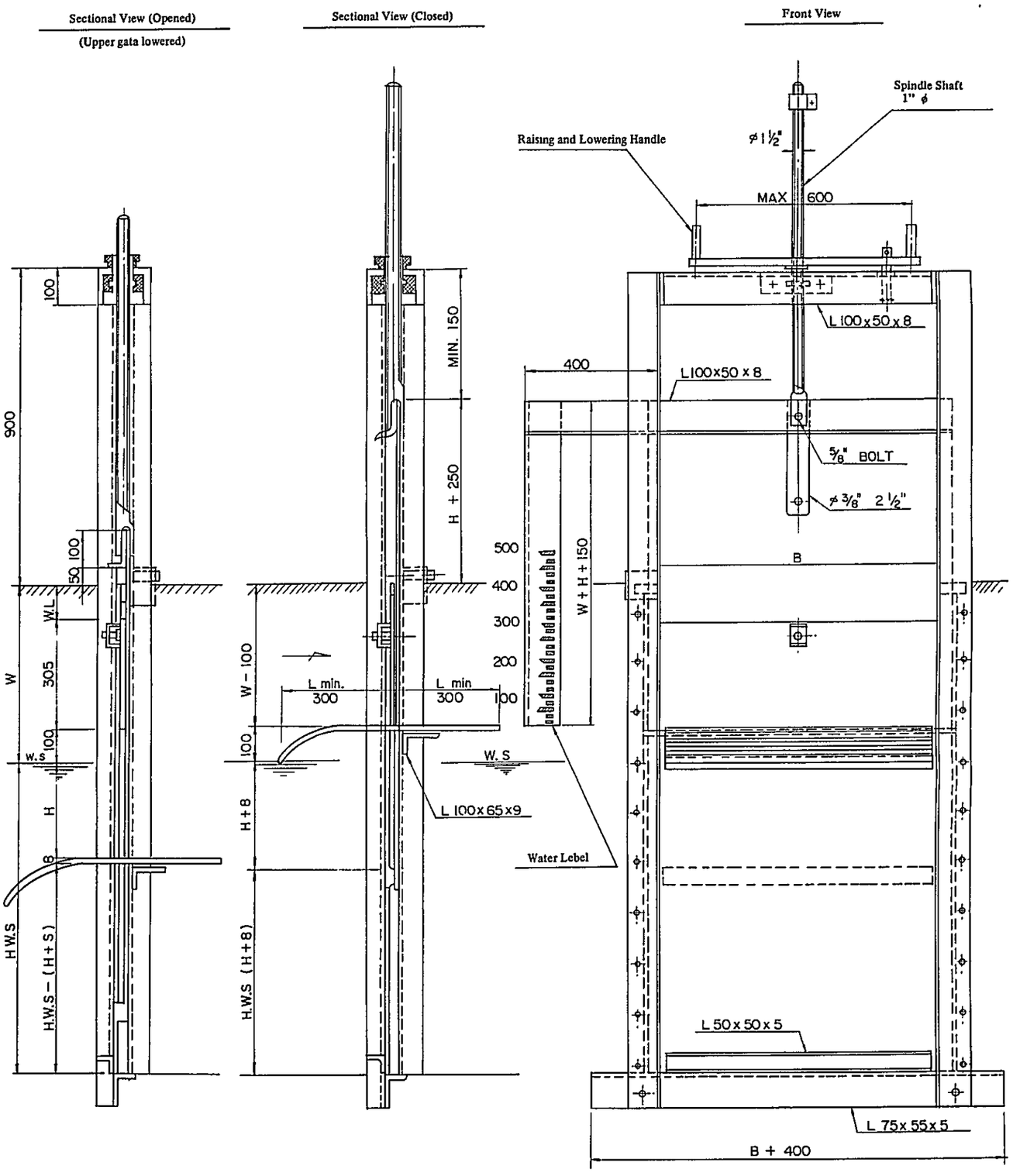


Fig. 3-6 Section of Turnout Facilities in Trimurdjo



Note : H.W.S., H, Band L vary by the intake.

Unit : mm or inches

Fig. 3-7 Detail Drawing of Romjin Gate

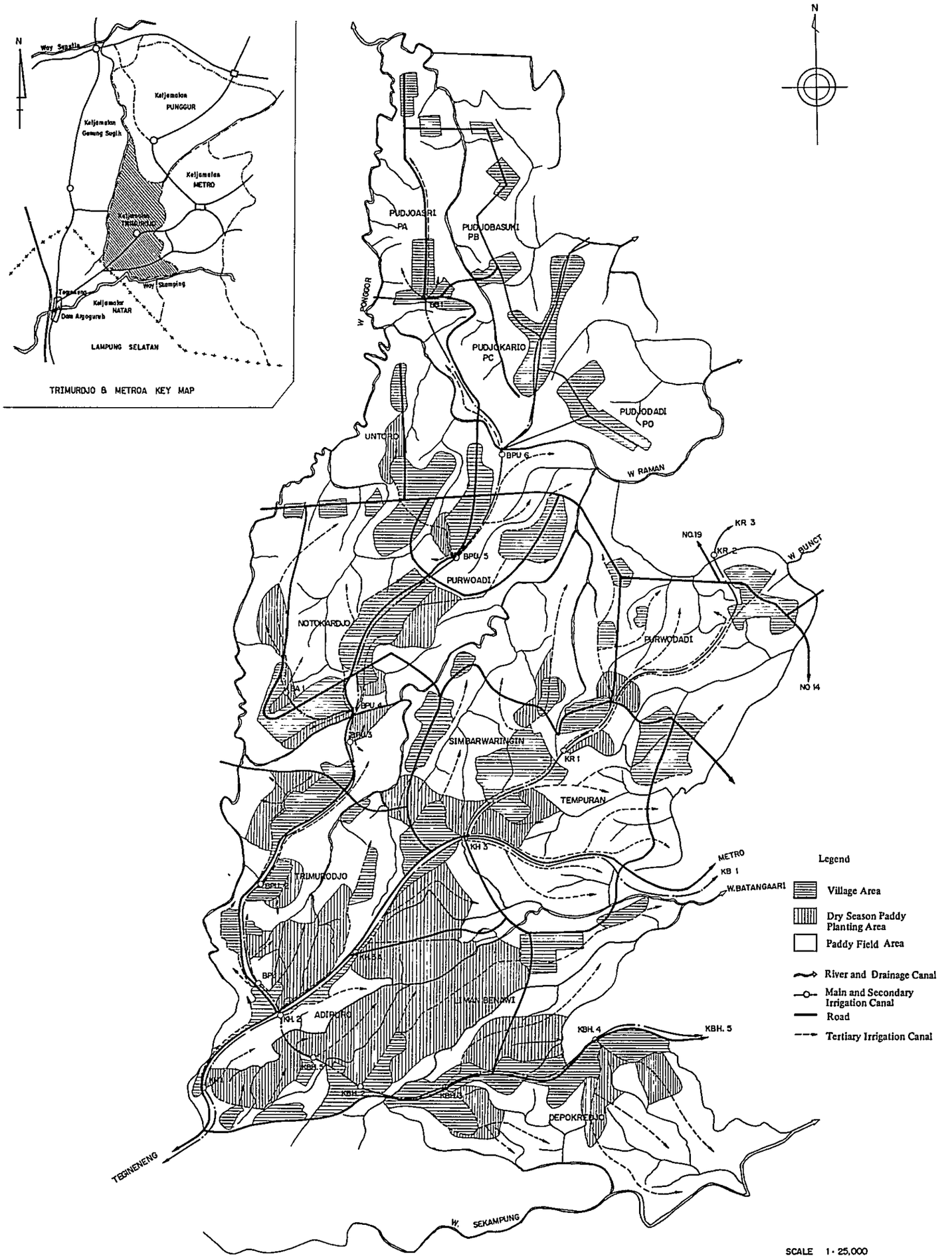


Fig. 3-8 Roads, Canals and Village Areas in Trimurdjo

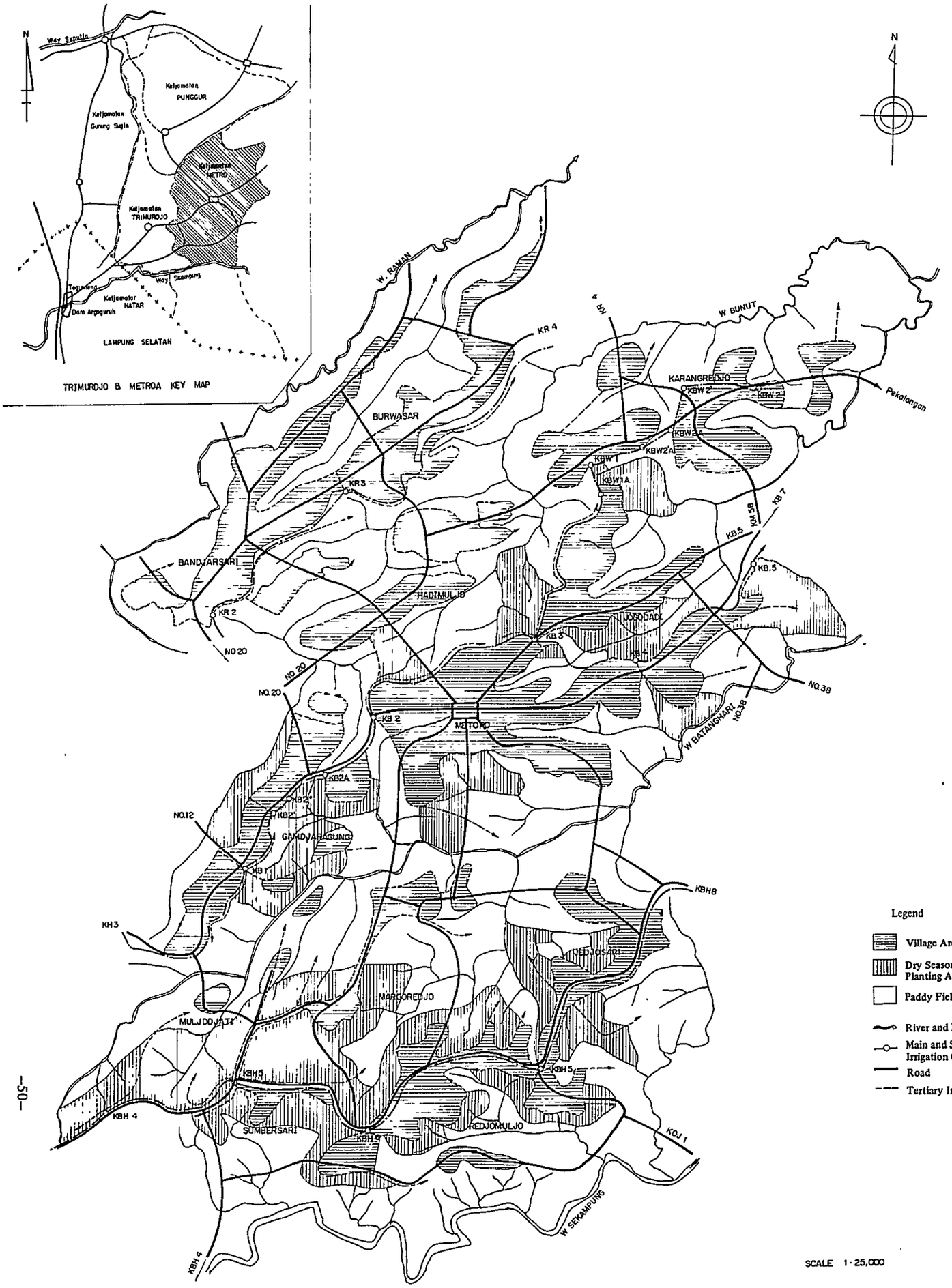


Fig. 3-9 Roads, Canals and Village Areas in Metro

endeavoured to create paddy fields with a minimum of fund, labour and levelling work, with the result that paddy fields reclaimed by them are small in area, not systematically laid out, and have the same large undulations as observed before levelling. In areas embracing such paddy fields, there is no doubt that any surplus water will flow into the low-lying swampy fields if plot-to-plot irrigation is practised and if water is drawn to excess in upstream areas as a result of poor water management and the consequent competition for water. With tertiary drainage ditches not in the least developed in such depressions, water once carried in there can never be repetedly used for irrigation of the whole area.

In such paddy field area, farm roads for cultivation can hardly be observed. Buffaloes employed for plowing and preparing work must necessarily driven along the terminal irrigation ditches or through paddy fields of other farmers.

If any paddy field is desired to be improved to the extent that modern production techniques can be fully made use of for the purpose of saving labour and attaining a stable and high unit yield, the following conditions will have to be satisfied.

1) One end of the field adjoins a farm road which allows free passage to and from the field of farming machines and equipment, cattle-driven farming implement, farm produce, etc. without going through other farmer's fields.

2) The area and demarcation line of each field are such that efficient utilization of machines and animal power can be ensured.

3) The field is drained to the extent that mechanized cultivation can be carried out with ease.

4) Each paddy field is connected to an irrigation as well as drainage canal so that both irrigation and drainage can be controlled independently of other fields.

5) Soil condition is suited for the production of crops.

Conditions 1) to 3) relate to the demarcation, area and bearing capacity of a field in which highly efficient mechanized cultivation can be carried out, and conditions 3) to 5) must be fulfilled for adequate water and soil control which is a must for increasing yield. It is believed that soon or later, fulfilment of these conditions will be required for accelerating the spill out effect of advanced production techniques which involve the improvement of water management, improvement of fertilizer application, rationalization of pest and disease control, rationalization of weeding work, improvement of paddy quality and so on.

Considered from the viewpoint of above-mentioned conditions which are a prerequisite to modern paddy field cultivation, paddy fields in the project area are far from satisfactory. However, since the existing characteristics of paddy fields fit very well into the natural conditions and production level of the area and there exists no pressing demand for mechanization at present, there of course is no need to take any hasty measures to materialize the above-mentioned improvements. Rather, it

is advisable that the improvement of land infrastructure be promoted by stages in parallel with the progress of technical improvement while giving due regard to the current pattern of farm management. Surveys and studies should precede such improvement for the dual purpose of confirming, on the one hand, that its implementation entails no difficulties with the existing level of techniques and is also economically justifiable, and presenting, on the other, a field improvement plan that can best cope with the changes in farm management in the coming ten years.

In the 6,600 ha land covered by four irrigation systems in the mid-basin of the Sekampung, only about one-third is planted with paddy at present. It is to be noted that the large scale irrigation development work now in progress in Punggur Utara aims at the creation of new paddy fields in alang-alang fields and transformation of cassava and upland paddy fields into more than 25,000 ha of paddy field. It is obvious that if the irrigation development is carried out according to the conventional system and method, what it can bring about for the farmers will be a paddy field area which is just as disorderly and poor in productivity as that in Sekampung. The team therefore considers it the pressing need of the hour to study the development method and design criteria of reclamation area in time with the surveys for redevelopment of existing paddy fields.

3.1.3 Water Requirement and Distribution

3.1.3-1 Water Distribution for Extensive Coverage

In irrigated agriculture, determination of water requirement and water distribution is the most fundamental problem to be solved in irrigation planning.

Water requirement in a project area varies by meteorological conditions such as rainfall and evaporation, topographic conditions, hydrogeological conditions involving groundwater level, size of the project area, etc. In Indonesia, water requirement of any one farmland area is obtained not by studying various factors on the basis of the water requirement in depth in each plot. Rather, the prevailing practice in this country is to resort to the curve showing the relationship between the planned irrigation area and the gross water requirement per unit area shown in Fig. 3-11. A number of standard water requirement curves are prepared according to the difference in land conditions such as topography, soil, and groundwater level, and the design water requirement is determined on the basis of such curves with account taken of the past records of water requirement. These curves, however, appear to be rather irrational since they are prepared from calculations whose basis is not clear. For example, Fig. 3-11 shows that the standard unit gross water requirement is set at 1.0 lit/sec/ha for an area of 141 ha (100 bau). This value dereases with the expansion of area, dro ing to 0.8 lit/sec/ha for an area of 700 ha (1,000 bau).

The unit gross water requirement in the area covered by the four irrigation system of the Sekampung mid-basin is as shown in Table 5. The table indicates that the values vary largely by districts, but the team was unable to clarify through its interviews whether these values were determined

on the basis of characteristics of respective districts. The technical staffs of the provincinal government explained that a gross water requirement of 0.9 lit/sec is not sufficient and about 1.2 lit/sec/ha is needed. Considering the fact that the project area lies in a mid-stream basin unlike deltaic areas in Southeast Asia and that its topography inhibits circulation of irrigation water throughout the area, it appears that the water requirement of 1.11 lit/sec/ha shown in the said table is somewhat small for the total project area of 66,000 ha. However, since a unit gross water requirement is determined in relation to the loss incurred by inadequate water management and the assessment of effective rainfall in paddy fields, suitability of this value should be judged in a comprehensive manner based on the result of actual observations and measurements.

Fig. 3-11 shows the design water flow to be employed in determing the cross-section of tertiary ditches in this area. A diagram is also prepared in which a farmer, having obtained the design water flow in a certain block of area from Fig. 3-11, can readily see the execution section of the tertiary ditch from the soil nature and canal gradient. The design water flow in the project area is approximately the twice the standard water requirement mentioned above, and this is considered to have been determined to meet the peak water load ocurring in the puddling and rotative irrigation seasons. It is likely that in determing the said design water flow, consideration was given to the large water requirement in depth in newly reclaimed fields and the consequent poor efficientcy of irrigation, but this consideration could produce undersirable effects such as improper water management, impartial water distribution and deficient supply of water that make farmers in some areas unable to plant paddy or suffer a poorer yield than in other areas.

Table 3-5 Gross Water Requirement for Four Irrigation System in Mid-basin of the Sekampung

District	Planned Irrigation Area	Design Intake Volume	Unit Gross Water Requirement
Sekampung	20,090 ha	32.19 m^3/sec	1.54 lit/sec/ha
Raman Utara	6,279	5.24	0.82
Batanghari Utara	7,342	10.00	1.36
Punggur Utara	30,843	26.09	0.85
Sekampung + Punggur Utara*	51,752	58.28	1.12

Note: * indicates the area to which water from Dam Argoguruh is to be supplied.

3.1.3-2 Water Distribution and Irrigation Rate

Figs. 3-10 to 3-12 shows the findings of a survey conducted at the locations of respective diversion facilities in Sekampung, Raman Utara and Batanghari Utara to investigate "whether water is actually and sufficiently supplied to the planned irrigation area."

Fig. 3-10 Relationship between Unit Gross Water Requirement and Irrigation Area

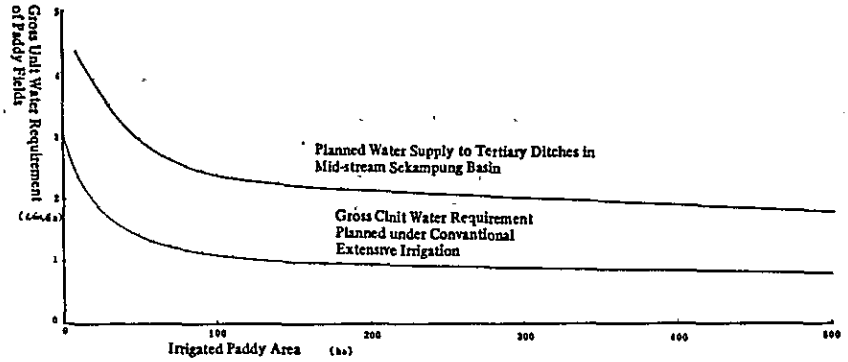


Fig. 3-11 Relationship between Irrigation Rate and Cumulative Total of Distance from Water Source at Respective Turnouts of Canal Route

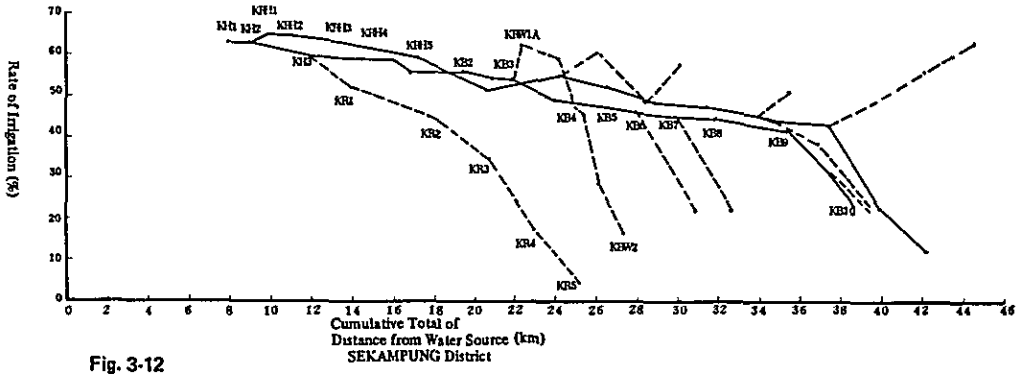


Fig. 3-12

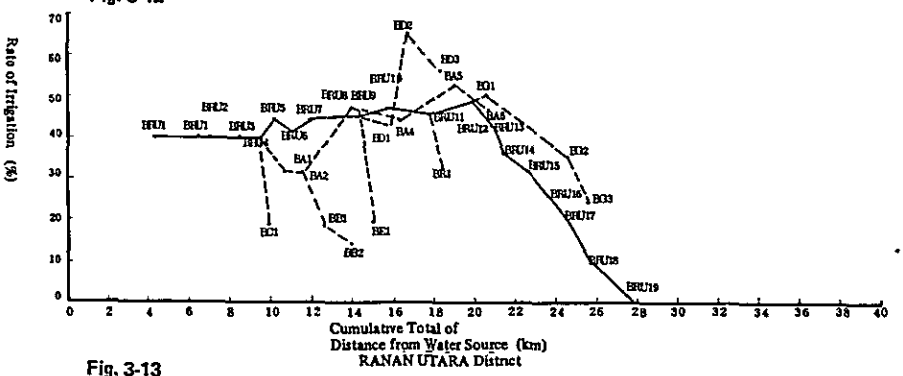
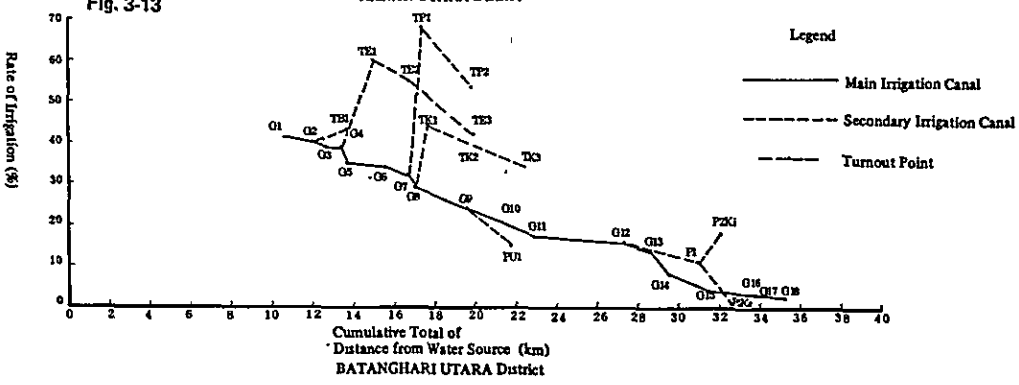


Fig. 3-13



In the case of Sekampung which embraces a planned irrigation area of about 21,000 ha, diversion facilities are constructed at 54 places and there are 133 intakes installed on canals leading out therefrom. Irrigation water is drawn from these intakes and supplied to each field through tertiary ditches. Each intake covers an area of 155 ha. Each of secondary canals constructed by the Ministry of Public Works reportedly covers a total of 150 to 200 ha of area, but in areas where many slopes and valleys are found, the area covered by one diversion facility is smaller, so that one intake covers an area of 71 ha in Raman Utara and 105 ha in Batanghari Utara.

Based on the values shown in Fig. 3-10 to 3-12, the team prepared Annex tables 6 to 8 in an attempt to obtain the irrigation rate between respective locations of diversion facilities and the cumulative total of irrigation rate in the downstream section from a selected point of diversion. Fig. 3- shows the relationship between the cumulative total of distance from the intake point (headworks) and that of irrigation rate, and Table 3-5 shows the relationship between the irrigation area and the irrigation rate of tertiary ditches. From these data, the irrigation rate may be briefed as follows to indicate its general trend.

1) In the main canal, the irrigation rate decreases with the distance from the intake point (headworks) to the downstream section.

2) The decline in the irrigation rate becomes larger as water is diverted and led into the secondary canal.

3) The irrigation rate appears to drop with the increase in the length of each tertiary irrigation ditch.

4) But the relationship between the irrigation rate and the area covered by the tertiary irrigation ditch is not clear.

5) In areas where water diverted from the main canal is directly supplied, the irrigation rate is relatively high.

6) As shown in Figs. 3-9 and 3-10, the irrigation rate for dry season crop presents the same trend as briefed above, showing higher values in areas irrigated with water diverted at points closer to the intakes. It appears that in an area covered by a tertiary irrigation ditch, cultivation of dry season crops is introduced more intensively in the vicinity of the intake gate and along the ditch than in other parts of the area.

The above description is intended to show the general trend that involves many exceptions, and it is probable that a fairly high irrigation rate can be maintained if water management is satisfactory and irrigation facilities are operated and managed in an adequate manner. With the present approach to project planning and existing field conditions, however, 65% would be the maximum rate of irrigation attainable for the project area as a whole. In view of the fact that the large scale irrigation development demands a huge amount of capital input and accelerated paddy production is now an urgent need for the country, the team considers that every means should be used to raise the irrigation rate so as to cover 90% or more of the project area. From this viewpoint, it is recommended that the project be

subjected to a rigid analysis to review its implementation system once again and to reap economic benefit from it as early as possible.

3.1.4 Water Management and Its Organization

3.1.4-1 Irrigation Organization

By the scale of their construction, management and administration, irrigation facilities in Indonesia can be considered under three categories, i.e., fully technical irrigation, semi-technical irrigation and non-technical irrigation.

In the fully technical irrigation work, which is intended to cover an area of several thousand ha, the Ministry of Public Works undertakes the construction and management of principal facilities and further control water distribution to each tertiary ditch, whereas the village community is responsible for the construction and management of its tertiary irrigation ditches and water distribution to respective fields.

In the semi-technical irrigation work which covers a relatively small area embracing a number of desas, the Ministry of Public Works carries out the construction of intake facilities, but the construction and management of canals are a task left to respective village communities.

In the non-technical irrigation, on the other, the construction work is rather simple since it covers one or two desas and is generally intended to draw water from a brook. In this type of irrigation, all facilities including intake facilities and canals are constructed and managed by the village community which also takes care of water distribution.

Fig. 3-13 shows the irrigation organization in Indonesia and Annex Table 10 gives totals by the type of organization.

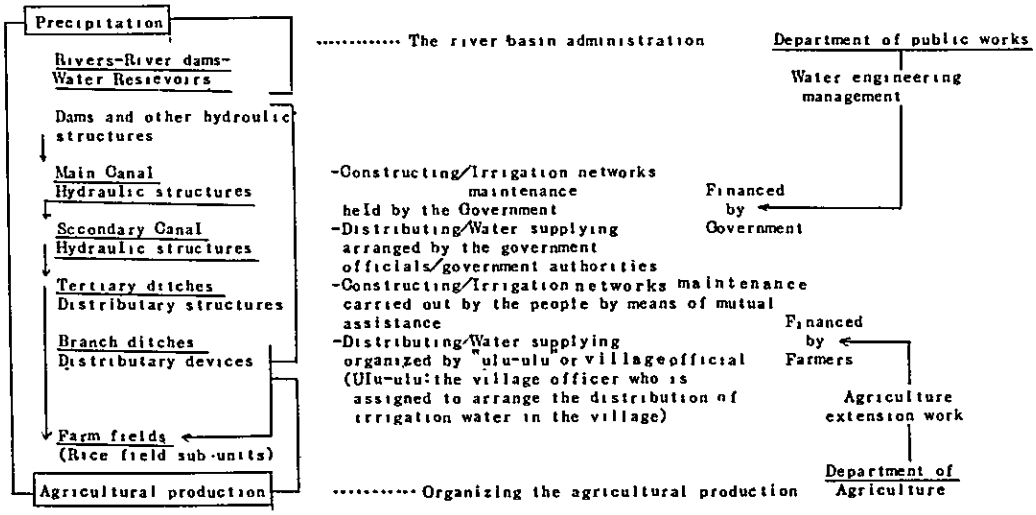


Fig. 3-14 Irrigation System in Indonesia

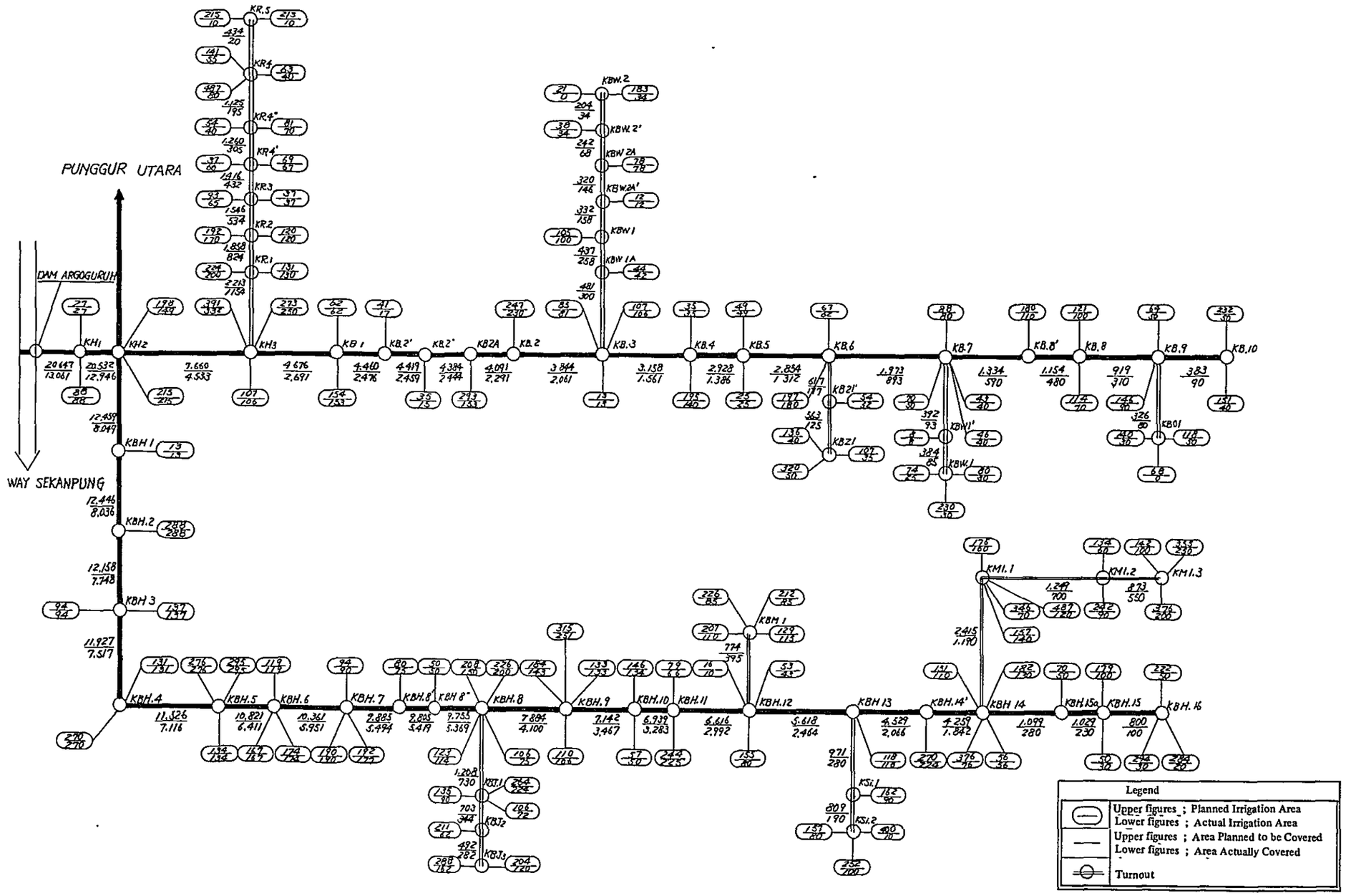


Fig. 3-15 Irrigation Water Distribution System in Sekampung District

Note : The planned irrigation area in this district (21,908 ha) does not show conformity to the total of planned irrigation areas shown in this figures.

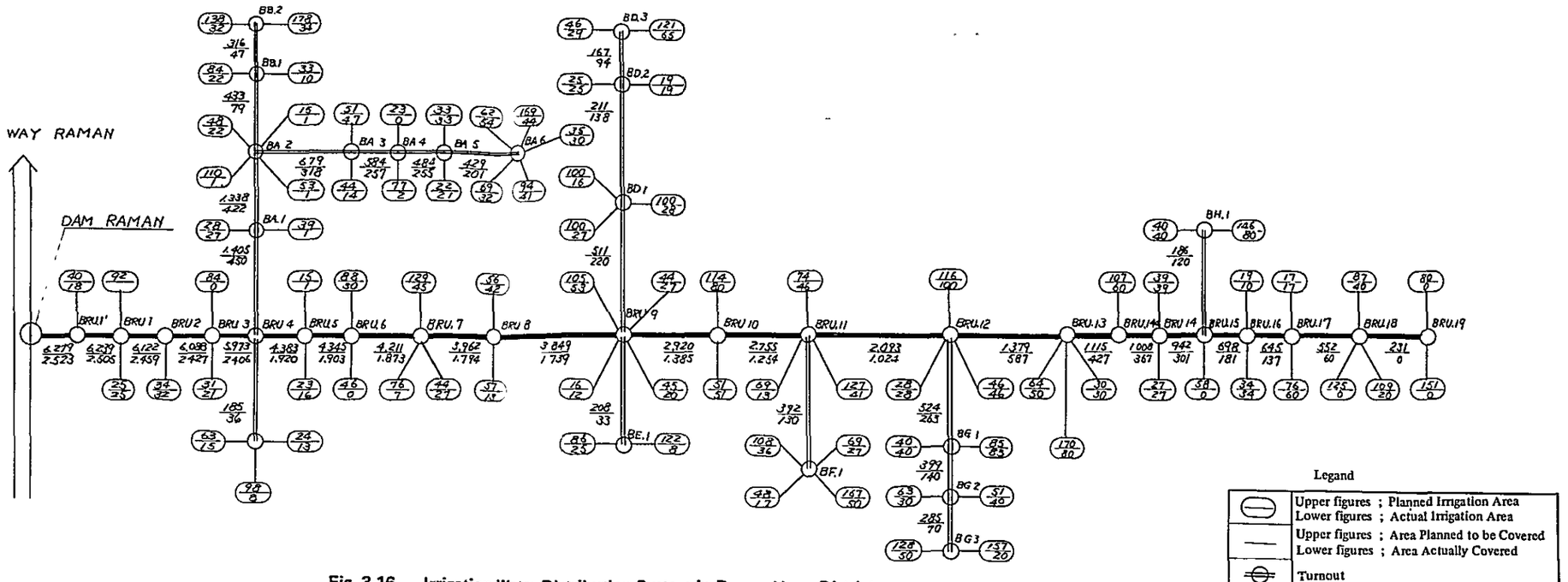


Fig. 3-16 Irrigation Water Distribution System in Raman Utara District

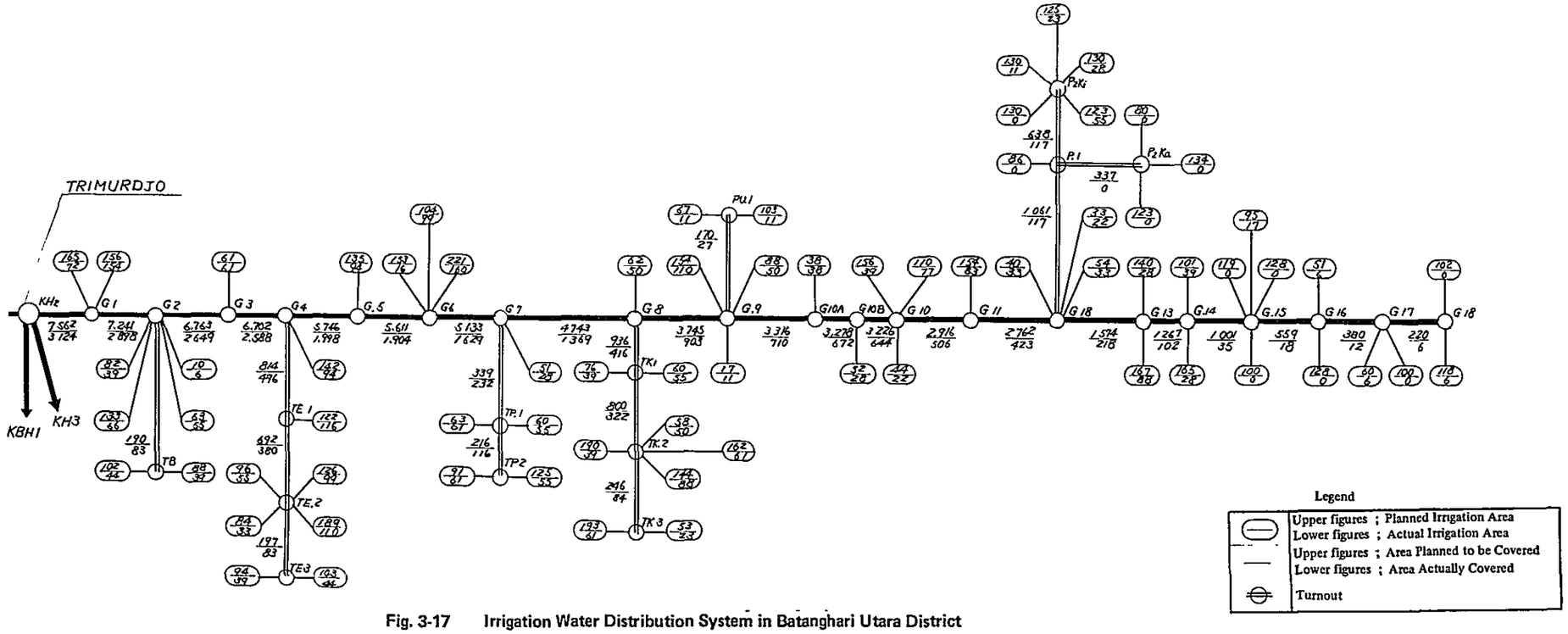


Fig. 3-17 Irrigation Water Distribution System in Batanghari Utara District

3.1.4-2 Water Management System

Since all the four irrigation systems in the mid-stream basin of the Sekampung are planned to cover districts where fully technical irrigation is required, the design, construction and management of all facilities including major structures such as headworks as well as diversion facilities at the end of secondary canals are undertaken by the provincial or kabupaten-level branches of the Ministry of Public Works. Apart from the administrative division, the project area is divided, for the purpose of water management, into 11 resorts (irrigation districts) which are subdivided into a number of districts with a mandor (chief water distribution officer) stationed in each of them. The mandor has under his control a number of wakkers who are engaged in the operation of sluices and intakes and in the maintenance and administration of irrigation facilities under the supervision and order of the mandor. In certain districts, the wakker has assistants called pekerdja.

Besides the above-mentioned system which is under the control of the Ministry of Public Works, there also is another water management system which is controlled by the Ministry of Home Affair Under the latter system, the kabupaten-level PMD provides technical assistance to village communities for the maintenance of smaller rural roads, bridges, buildings and tertiary irrigation ditches, and under his guidance are established farmers' irrigation organizations of which the smallest unit is called ili-ili (In Java, the unit is called ulu-ulu). Members of the ili-ili are appointed by the desa chief from among the staffs of desa office and farmers for water distribution and control of water supply in each desa.

The Ministry of Agriculture also plays its own part in the water management in addition to the aforementioned two government offices, and it appears that there exists no smooth coordination between these government offices. The team also noted that no smooth and integrated water management can be assured for any single irrigation system under the existing system, nor is satisfactory cooperation made with the Ministry of Agriculture which is responsible for the extension of production techniques and improvement of distribution mechanism of agricultural products.

In Lampung Tengah, Irrigation Committee was established in May 1971 as an organ for securing close coordination now lacking between the government offices. However, the committee, headed by the governor of the kabupaten, is not considered capable of making any important contribution to the desired betterment of coordination because it is composed of members belonging to the three different ministries. The urgent need at the present stage is therefore to bring remedy to the interwoven intricacy invited by the noncooperative particiation of different ministries in the irrigation development scheme, and thereby establish a system under which qualified and capable staffs are enabled to carry out the implementation of the project.

As regards ili-ili, the team is of the opinion that an organization of this sort should be established by the farmers themselves and that the irrigation improvement be pushed forward by the voluntary efforts of farmers. To incite farmers' willingness for accelerated production, it is not necessarily justifiable that the government takes care of everything for them.

At present, it is often the case that a single tertiary ditch is controlled not by one but a number of ili-ilis while the control of the intake is in the hands of a third party. As things stand now, therefore, an ili-ili controls too small an area to perform the function of adequate water management. In Trimurdjo, for instance, there are as many as 28 ili-ilis for 14 desas embraced in the ketjamatan. Since this ketjamatan has a paddy field area of 2,930 ha, each desa has an average of 212 ha, and this means that each ili-ili controls an average of 106 ha only. It may as well be added that in Sekampung district, each ili-ili covers an average of 155 ha for each intake.

Nothing that the mutual aid system called Gotong Rojong has a deep-rooted controlling effect on the social life in Indonesian rural districts the team felt that re-examination of the ili-ili system would have to be given top priority in planning the reorganization and fostering of the water management system.

3.1.5 Problems to be Solved

Problems entailed in the irrigation facilities and water management in the mid-stream basin of the Sekampung, which are described in the foregoing pages of this chapter, may be summarized the following four items.

1) Problem relating to rational determination of water requirement in paddy field.

   Besides the water consumption of crops, water requirement in depth in paddy fields, rate of repeated use of irrigation water and effective rainfall on paddy fields, water loss such as canal loss, diversion loss and management loss in the fields should also be considered in planning the water requirement and water distribution. These factors are to be studied together with the hydrological, meteorological and topographical data of the basin to obtain the available intake volume for the dry as well as the wet season, to determine the total water requirement by season, and to delineate the benefited area. To make such a study, it is essential that highly reliable basic data are well consolidated in both quantity and quality, and this in turn demands that a system should be established which serves to determine the method of survey to be conducted for selection of observation points, observation method, selection of measuring and recording equipment and apparatus, as well as the method of analysis of recorded data.

2) Problem of establishing design criteria for redevelopment of existing paddy fields for the purpose of rationalizing the terminal irrigation organization.

3) Problem of implementing the new paddy field reclamation work under a new and reinforced system of legislation, financial measures and technical improvement.

4) Problem of reorganizing and strengthening the water management system and paving the way to securing close relations and coordination with organs which are controlling, on different levels, the production, processing and distribution of agricultural products.

To bring about a solution for problem 2), it is required that irrigation and drainage canals running through fields be either newly constructed or repaired, network of farm roads be improved, and block reformation be effected in cultivated area. The team wishes to emphasize that drainage canals, if improved in a certain district, will be connected with the irrigation canals in the adjoining downstream side district, thereby making it possible to use irrigation water repeatedly. The team further wishes to stress the need for improving farm roads for smooth field management and free passage of animal-driven farming equipment and agricultural products.

For problem 3), it is recommended that mechanized reclamation work will be promoted in forests and waste lands to acclerate the pace of land development and relieve the settlers of the heavy labour involved in it. It is believed that employment of machines will not only enable the reclamation work to catch up with the rapid progress of the irrigation scheme but also assure that newly created paddy fields are delineated into blocks of suitable size.

As for problems 2) to 4), it is to be noted that improvements should be made with consideration given to the fact that the land conditions and level of production techniques vary by districts. Improvements should therefore be implemented according as the results of actual surveys and with the understanding and cooperation of farmers as well. As for better management and operation of irrigation facilities, in which the training of farmers carries a heavy weight, the team wishes to point out that no successful result can be expected from a limited period of survey. It is therefore hoped that a long-range improvement policy will be drafted and carried out by such a suitable organization as, for example, an agricultural development centre, which will perform the function of working out and implementing a comprehensive technical assistance scheme.

3.2 Existing State and Problems of Paddy Cultivation

3.2.1 Patterns of Paddy Cultivation

In Indonesia, there are various patterns of paddy cultivation as enumerated below. [1)]

(1) Padi Sawah rendengan: Wet season paddy

(2) Padi gadu: Dry season paddy

(3) Padi gogorantja: Direct sowing of paddy in the wet season. It is conducted in case the shortage of irrigation water in the beginning of the wet season makes transplanting impracticable, or the poor drainage condition makes the field water depth excessively large soon after the advent of the wet season. Seedling is conducted in direct sowing, either by broadcasting or dibbing, in the dry paddy field. This may be considered a combination of the upland paddy cropping and wet paddy cropping.

(4) Padi gogo: Upland paddy cultivated in the wet season. Seeds are sown mostly by dibbing.

(5) Padi ladang: Upland paddy cultivation by shifting cultivation.

(6) Padi lebak: Conducted from around the end of the wet season in retarding basins or other submerged areas with a high water depth. A non-irrigated nursery or a tapping nursery is used, with transplantation conducted twice (once for temporary transplanting) according to water level sinking. sinking.

During the present survey, the team was unable to confirm Items (3) and (6). It is reported, however, the latter type of paddy cultivation is practised in the basin of the Musi flowing near Palemband

3.2.2 Manpower to be required for Paddy Cultivation

Paddy cultivation in Lampung is characterized, just as in Java, by the extremely large manpower requirement. Though the following table was prepared on the basis of interviews conducted chiefly in Lampung Tengah and does not therefore present accurate values, it indicates that the manpower requirement per ha is as large as 200 to 300 man-days. The table also shows that the labour force needed for weeding varies largely by ketjamatan. If the weeding labour is excluded, all the ketjamatans are in need of approximately same manpower. According to the aforementioned data (See footnote 1) of the preceding page), the manpower requirement per ha is about 200 man-days in Java, and this suggests that the paddy cultivation techniques of Java island were introduced into Lampung by settlers.

Table 3-6 Manpower Requirement for Paddy Cultivation in Lampunt (per ha) Unit: man-days

	Trimurdjo	Purbolinggo	Sekampung	Pringsewu	Kabupaten Office of Lampung T.
Plowing and Puddling	2 ($_{\text{buffaloes}}$) 10	2 ($_{\text{buffaloes}}$) 7	2 ($_{\text{buffaloes}}$) 17	2 ($_{\text{buffaloes}}$) 12	2 ($_{\text{buffaloes}}$) 18
Transplanting	36	24	26	20	21
Weeding	180	80	171	100	80
Spraying of Chemicals	1	2	2	2	2
Harvesting	70	50	40	50	50
Threshing	20	20	20	20	20
Total	317	183	276	204	191

Notes: 1) It is assumed that one labourer is required for threshing 100 kg of paddy and the yield per ha is 2 tons.
2) Plowing, if carried out by a labour, requires a period of about 70 days.
3) Pringsewu is administratively included in Lampung Selatan.

3.2.3 Paddy Cultivation Techniques

The standard cultivation method encouranged in Lampung Tengah calls for the application of 100 kg/ha of nitrogen fertilizer (to be applied twice, half for each time) and 50 kg/ha of phosphorous fertilizer as a planting density of 25 cm x 25 cm. Farmers are encouraged to cultivate improved

varieties such as PB-5 (IR-5) and C_4-63 which are reported to produce a yield of 6 ton/ha and 4 ~ 5 tons/ha respectively in unhusked grains if conditions are favourable. The highest yield of improved varieties is 8 tons/ha which was attained by BIMAS Project, but the team learned that the attempt to extend the cultivation of these varieties entails many difficulties.[2)]

As a result of survey on farm households in Trimurdjo where the improvement of irrigation conditions is most advanced in the kabupaten, the team learned that 75% of paddy field area is planted with Gembira, a local variety which has a growth period of six months and good tastes and also sells at a higher price than PB-5. The team was informed that PB-5 cultivated under the BIMAS project provided a yield which is smaller than that of Gembira grown by the conventional farming practices. This poor yield is considered assignable to deficient dosage of fertilizer application and deep planting; and in short, the cause lies in the direct application of the conventional farming practices to the new variety.

Deep planting has long been practised in Indonesia because the soil in the paddy field is made very soft by thorough puddling work. Partly for this reason, and partly to prevent the rising and falling down of paddy plants, it has been encouranged since old to drain water from the field when transplanting is over. Further, the standard for fertilizer application is set without regard to the soil nature. The prevailing farming practices must therefore improved largely if full advantage is taken of improved varieties.

The table given below shows the achievement of BIMAS Project in Lampung Tengah. The yield per ha shown in this table is considered higher than the actual value since it was obtained by sampling method.

3.2.4 Agricultural Extension System

Lampung province embraces three kabupatens (Lampung Utara, Lampung Tengah and Lampung Selatan) under which are a total of 60 ketjamatans. In these ketjamatans, there are a total of 76 extension workers, each serving an average of three thousand farm households. Though they receive one-week training each year at the Seed Centre of respective kabupatens, they can hardly be expected to satisfactorily play the role of extending new techniques among farmers since they have no texts or data for their service excepting an agricultural calendar. A key farmer is appointed in each desa to promoto the extension of advanced techniques, but this can never be considered sufficient. The pressing need of the hour is therefore to improve and foster the extension organization. The team learned that 30 additional extension workers are planned to be appointed in Lampung Tengah from 1972.

3.2.5 Measures for Future Improvement

In Trimurdjo which is currently covered by Tani Makmur Project, Javanese settlers started paddy field reclamation in areas with a mild slope. The ketjamatan, now turned into a paddy field area, is favoured with

Table 3-7 Results of BIMAS in Lampung Tengah

Source: Implimentation Report of Mitsubishi BIMAS PROJECT in Indonesia (No. 1), 1971

	Recommended Variety			Local Variety			Total		
	Harvested Area	Production	Yield per ha	Harvested Area	Production	Yield per ha	Harvested Area	Production	Yield per ha
	ha	t	kg	ha	t	kg	ha	t	kg
Metro	59	372	6,300	1,024	3,379	3,300	1,083	3,751	3,463
Trimurdjo	793	4,332	5,460	771	2,335	3.030	1,564	6,667	4,262
Batanhari	255	1,782	6,998	1,638	6,472	3,950	1,893	8,253	4,360
Lebomtusung	41	220	5,349	440	1,130	2,572	481	1,350	2,889
Pekalongan	159	1,157	7,255	377	1,397	3,710	536	2,553	4,751
Purbolingo	1,860	8,652	4,652	159	511	3,220	2,019	9,163	4,539
Raman Utara	612	2,742	4,481	271	668	2,460	883	3,410	3,858
Total	3,779	19,256	5,725	4,679	15,891	3,398	8,458	35,148	4,153

Notes: (1) Production and Yield per ha are obtained by unhusked rice with spike. (finishing ratio is 7.5%)

(2) Standard Fertilizer (per ha)

Fertilizer (composition %)	Recommended Variety	Local Variety
Urea (46 %)	200 kg	100 kg
Double sceperphosphorate of line (46%)	75 kg	45 kg

In the case of Recommended Variety, Diazinon 2 /ha are applied as pesticide.

a mild slope. The ketjamatan, now turned into a paddy field area, is favoured with relatively abundant supply of irrigation water, but paddy is cultivated by plot-to-plot irrigation and paddy fields are delineated irregularly and have no farm roads either.

Immediate introduction of modern cultivation techniques into such an area is next to inpossible. Steps should therefore be taken for gradual improvement and extension of techniques which should include the preparation of the fertilization standard by soil nature, examination of the currently followed puddling method, encourangement of shallow planting, improvement of water management required for fertilizer application, and so forth. The team believes that efforts at such simple but fundamental improvements will create a climate for introducing advanced techniques.

3.3 Existing State and Development Plan of Upland Crop Cultivation

In Lampung province, upland crops are cultivated by four types of producers, i.e., the state-operated farm (PNP), small holders, large estates, and ordinary farmers. Among these, PNP and estates excel the other two in production scale and are on a relatively high technical level, carrying out the cultivation, shipment, processing or even export on their own in a systematic manner and producing good spill out effect on the farmers in the neighbouring areas. It is therefore believed that these two types of producers enjoy a stabilized level of production. As compared with them, small holders who are mostly indigenous people of Lampung are far smaller in production scale, but they nevertheless enjoy a high living standard since they are engaged chiefly in the production of special crops that bring about a good income.

Quite contrary to the above-mentioned three types of producers, ordinary farmers who play the major role in the upland crop production in the province are still very low in productivity though they are Javanese and Balinese settlers. The reason for the low productivity is that their settlement history is short (less than 20 years), they still remain in the stage of shifting agriculture, and they mostly cultivate upland paddy by mixed cropping with other crops without using fertilizers or controlling pests and diseases. To turn the situation for the worse, they resort solely to manpower in their farming work, so that they are able to cultivate only half the 2 ha holding per household and as a consequence, they can expect a correspondingly smaller income.

In the planned development of upland crop cultivation, therefore, top priority should be given, for the present, to the improvement of productivity and income level of ordinary upland crop producing farmers.

3.3.1 Outline of Upland Crop Cultivation in Tegineneng District

3.3.1-1 Climatic Conditions

This district is situated in the central part of Lampung and administratively belongs to both Lampung Tengah and Lampung Selatan. It is an extensive and highly promising upland crop area embracing two ketjamatans, Natar and Gunung Sugih, which form a plateatu of an elevation of 50 m, as

well as three other kethamatans spreading to the west of them (Bangunradjo, Kaliradjo and Padangratu). On the east, it adjoins the wide low-lying paddy field area spreading around Metro.

Land currently cultivated for upland crop production covers a total of about 15,000 ha in Natar and Gunugn Sugih and about 30,000 ha in the other three ketjamatans. Considering the development potential of the vast alang-alang fields, however, it is quite possible that the present acreage of farmland will be more than doubled in future.

The district is generally covered with the mixed soil of latosol and podsol which presents a colour ranging from yellowish gray to reddish brown. The soil shows fairly good physical properties, but since it appears to be a loam-soil having a small content of humic soil and basic matters and subjected to the development of eluviation, its chemical properties will have to enriched by fertilizer application and introduction of green manure crops.

As the district is situated very near the equator (around Lat. 5° S), its climate is characterized by an extremely small annual fluctuation of temperature and a large temperature difference between days and nights. The temperature stands at about 26°C on the average, with the highest daytime temperature ranging from 32 to 34°C and the lowest from 22 to 24°C, thus creating a difference of about 10°C between days and nights. The annual fluctuation of sunshine duration is likewise very small, and does not exceed 30 minutes or so. These climatic factors alone considered, it would seem feasible to carry out the year-round and stabilized production of agricultural crops. In actuality, however, the rainfall and its distribution in the dry and wet seasons exert a controlling effect on the cropping system.

The wet season, whose advent can be told by the north-north-westerly wind, brings about lots of rain to the northern part and then to the southern part of Sumatra. In Lampung, the wet season generally coincides with the November-April period. During the dry season lasting from May to October, the wind blows from south-south-east and rainfall is rather small. The rainfall, however, shows some fluctuations by place and year. In general, the western mountainous area has a larger annual rainfall (3,000 m) than the central plain (approx. 2,500 mm). It is said that not a drop of rain falls in the central plain throughout the July-August in some years.

For the sake of reference, values of rainfall observation conducted in 1970 in Tegineneng district are shown in the following graph.

During the transitional period from one season to the other, it occasionally happens that rain falls all day long. In general, however, the shower-type rain falls either in the afternoon or in the nighttime, so that weather is usually fair in the morning. The humidity is as low as about 50% when it is fair, but increases if it is cloudy or rains, occasionally rising beyond the 95% level at night when the temperature declines. The seasonal wind is mild, and very seldom does it blow at a velocity of 1 m/sec or more.

The relatively favourable climatic condition described above promises good growth for crops, but on the other hand, it certainly gives rise to the growth of weeds and development of pests and diseases,, and further necessitates measures for offsetting its adverse effect on the drying, winnowing,

preparing and storage of products. To ensure efficient production of corps, it is essential to study the changes in production factors caused by the shifting of one season to the other as well as the micro-meteorologic elements involved in such changes.

Fig. 3-16 Rainfall and No. of Rainy Days by Month in Tegineneng (1970)

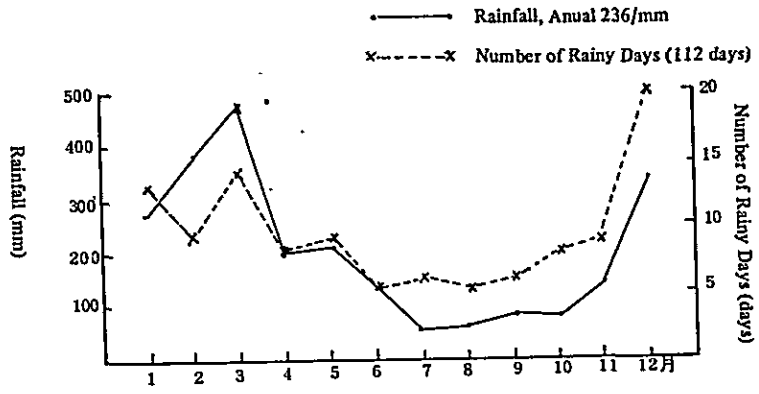


Fig. 3-18 Monthly Rainfall and Number of Rainy Days at Tegineneng (1970)

3. 3. 1-2 Existing State of Upland Crop Cultivation

In Tegineneng district, ordinary upland crops produced in the entire Lampung are also cultivated. Major crops are upland paddy, maize, cassava, sweet potatoes, groundnuts, soybeans and green beans. The cropping season usually coincides with the wet season, and double cropping is carried out for production of maize and pulses alone. The rate of double cropping to single cropping is estimated to be about 40%. Average operational holding per farm household is 0. 8 ha, and the harvesting area including that of double cropping is 1. 1 ha per farm household. In the greater part of farmland, mixed cropping of two or three different products is carried out as one of the farming practices in this district.

The following description deals with the soil preparation preceding sowing as well as with the cultivation techniques of respective upland crops and existing state of harvesting and preparing work. Farmers in this district do not make it a habit to apply fertilizers, nor do they take sufficient care of the fields except that weeding is carried out a few times. Further, they pay no particular attention to the pest and disease control.

Soil Preparation:

Animal power being employed by a very limited number of farm households to say nothing of farming machines, most farmers use hand hoes in plowing and soil preparation work. The team learned that with as many as 10 men working five to six hours a day, a period of 30 days is required before soil preparation of 1 ha of farmland progresses to the extent that seeds can be sown. When creating a new farm in the alang-alang field, it is the common practice to start cutting the grasses in or around July when rainfall is small, burn the grasses and carry out the harrowing and levelling work in August and September, and then sow seeds in October or November. Thus, a period

of as long as three to four months is spent for soil preparation in alang-alang fields. This manpower and time consuming soil preparation is belived to have hampered full utilization of the 2 ha operation holding, of which more than half is left idle in this district.

Upland Paddy: Upland paddy is cultivated only once in the wet season. Seeds sown in the October-November period grow to maturity in 125 to 145 days.

Most farmers cultivate local varieties of Lampung though Gundilbatu and few other improved varieties are also planted in a limited area. Two to three grains of seeds are sown in holes dibbled with a stick at intervals of 20 x 20 cm in newly opened fields and 25 x 25 cm in existing fields where the land productivity is lower. Holes in which seeds are sown are covered with soil and stepped on. Harvesting is conducted in the same manner as adopted for wet paddy, i.e., the spike is reaped with part of stalk using a hand knife called "ani-ani" and husked after drying either by stumping on the stalk paddy or by squeezing it with hands. The husked paddy is consumed by farmers themselves after milled by farmers' own wooden mortar and pounder or at a rice mill at a charge.

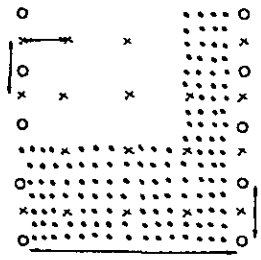
Upland paddy in Lampung, cultivated by the above-mentioned method, has a harvesting area of about 150 thousand ha which is approximately 2.5 times as large as that of paddy. Though upland paddy has been playing an important role in the self-sustenance of food in the province, its productivity is extremely low as compared with paddy. With the increasing rate of self-sustenance of foodstaffs and rapid progress of paddy field reclamation, it is now considered an unstable crop and shows a dwindling production trend. It is therefore hoped that upland paddy will be shifted to some promising cash crops in future.

Maize: Maize used to be grown as supplementary crop of paddy, the staple food in the province. With the large scale production initiated by Mitsugoro Farm and other farms by the recent growth of export demand, its planted area now shows a trend for rapid expansion.

As a rule, maize is planted twice a year. Sowing is carried out in October and harvesting in the January-February period for the first crop, whereas sowing is conducted in the March-April period and harvesting in the July-August period for the second crop. Local Metro varieties having a growth period of 100 to 110 days prevail in the province and their planting density is standardized at 40 x 40 cm or 40 x 50 cm for monoculture depending on the land productivity of respective districts. The planting density actually adopted varies by farmers and shows some departure from the standard densities. In case of mixed cropping, maize is cultivated with upland paddy, cassava or both. Planting patterns adopted in these three types of mixed cropping are as illustrated below.

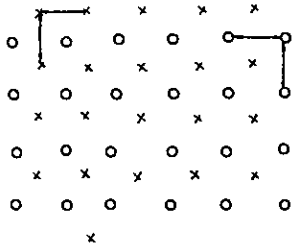
a. Upland Paddy and Maize

Maize	100 x 200 cm
Upland paddy	25 x 25 cm



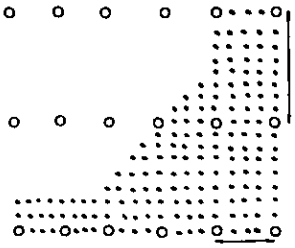
b. Maize and Cassava

Maize	100 x 100 cm
Cassava	100 x 100 cm



c. Upland Paddy, Maize and Cassava

Maize	400 x 100 cm
Cassava	100 x 100 cm
Upland paddy	25 x 25 cm



The cropping patterns illustrated above are the typical wet season patterns. In desas having a relatively short settlement history, mixed cropping of all the three products dominates, whereas in desas established by early settlers, mixed cropping of all the three products is gradually giving place to that of two products only, and it appears that monoculture of maize is conducted only in the dry season and hardly practised in the wet season.

As in the case of other upland crops, two to three seed grains are sown in holes dibbled with a stick. Since no thinning is conducted, the number of plants per hill ranges from one to three and the growth condition does not show uniformity. When matured pistils are harvested with hands, their coat is immediately removed for solar drying which lasts for four to five days. The harvested pistils are then husked by means of a husking board called "parut," and sold to the broker though part of them is consumed by farmers themselves either in grains or flour. The sales price ranges from Rp 10 to Rp 15 depending on the season and quality, and averages about Rp 12.

Cassava: Cassava is a plant belonging to Euphorbiaceae and is considered to be native to Brazil. Its production used to carry a heavy weight in the self-sustenance of food in the province, but at present it is

cultivated for production of tapioca which is an important foreign exchange earner of the country.

Cassava is a perenial shrub and tapioca is obtained from its root tuber. For its multiplication, the cuttage method is employed. To be precise, a healthy stem is cut into pieces having two to three buds and a length of 20 to 30 cm. These cuttings are then planted at proper intervals. In case of monoculture, square planting at a density of 50 to 70 cm is encouraged. As a rule, however, it is grown by mixed cropping with upland paddy or maize, and in this case square planting at a density of about 100 cm is usually adopted. Planting generally takes place in October and harvesting in about eight to twelve months of growth period. Almost all farmers cultivate local varieties, though few of them grow an improved variety called "SPP."

Matured root tuber is either turned up with a hoe or pulled out by hands. The greater part of harvested root tuber is shipped to tapioca plants in various places after stems are removed, skin is peeled off, cuts are made in the tuber, and a few days' solar drying is completed, though part of the harvest is either directly shipped to the market or reserved for domestic consumption. The ex-factory price of dried cassava is Rp 7/kg.

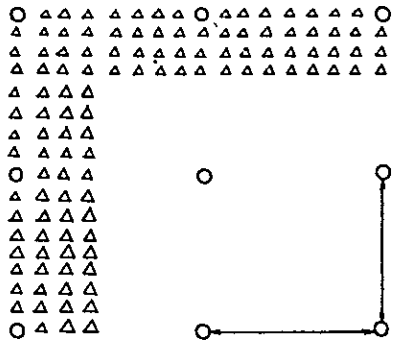
Sweet potatoes: Sweet potatoes are cultivated primarily for self-sustenance of food and mostly consumed by farmers themselves though a small fraction of the production is marketed. As a consequence, their planted area is small. Sweet potatoes are a perenial crop and can therefore be cultivated throughout the year, but planting is generally carried out in mid-October.

Potato cuttings prepared in advance are planted at a density of 100 x 20 cm in a bed containing well prepared and softened soil. The commonest practice is to plant the cuttings in between the rows of other crops. Varieties are limited to local ones, and no attempt is yet made for introduction of improved varieties. Harvesting is conducted in about three months of growth period.

Pulses: Major pulses produced in Lampung are soybeans, green beans and groundnuts. Planted area is small except that of soybeans. These crops have so far been consumed either as foodstaffs or as raw material of confectionary and therefore, their production used to aim primarily at domestic marketing. In recent years, however, they are considered promising export crops and accelerated production is planned.

These pulses are cultivated generally in the dry season by mixed cropping with other crops, chiefly maize. The following is the typical pattern of mixed cropping.

Pulses	25 cm x 25 cm
Maize	200 cm x 200 cm



Improved varieties of these crops are "Ringgit (soybeans)," "Kidang and Djenis (groundnuts)" and "No. 116 (green beans)." Since these varieties are still in the seed multiplication stage and not in the diffusion stage, farmers cultivate local varieties alone. Two to three seeds are sown by the dibbling method in holes made with a stick during the October-November period for wet season crop and February-March period for dry season crop. In either case, the seeds mature in a period of 100 to 110 days.

Matured pulses are pulled out together with the stem, dried for four to five days, and then husked by beating with a stick. More than 90% of the harvest is for marketing and collected by the broker. The sales price varies by year, and 1970 recorded a conspicuous price hike due to the poor crop in major producing areas. The team learned that in the said year, the price per kg rose from the normal year level of Rp 40 to Rp 65 for soybeans and from Rp 60 to Rp 90 for groundnuts and green beans.

In addition to the above-mentioned crops, some farmers grow tobacco and vegetables and practically all are cultivating, both in their garden compounds and in the land surrounding upland fields, special crops such as coconuts, coffee and cloves as well as perenial fruit trees like banana, papaya, rambutan and mandarin orange. The pattern of farm management prevalent in Lampung is intended for gaining living from sufficient production of food crops and sales of cash crops including these supplementary crops. It was learned, however, that farmers in the province are only able to maintain a subsistence level living because of the large size of farmily they must support. Because of the vicious cycle of their poor economic footing, they are forced to stick to the conventional farming practices and unable to take off for technical improvement in land use, cultivation method and winnowing and preparing method. It is therefore belived that in the future financial aid for Lampung's agricultural development, stress must be placed on the need of improving agricultural techniques and awakening the farmers to the importance of production increase.

3.3.2 Outline of Upland Crop Development Plan

Keeping abreast with the policy of the Central Government for agricultural development in Lampung, the provincial government of Lampung mapped out an upland crop development plan as part of the said policy and is effecting institutional improvement at present. However, the plan resorts largely on foreign aid and has not yet been brought to the stage of implementation.

3.3.2-1 Establishment of Uplandland Crop Seed Centre

The Upland Crop Seed Centre was established in 1968 by the provincial government of Lampung in:Tegineneng district, Ketjamatan Natar, Kabupaten Lampung Selatan for multiplication and supply of improved upland crop seeds. Since 1970, the centre has been engaged in the preparatory seed multiplication activity and technical training of farmers with stress placed on the production of marize.

The centre is located in a genuine agricultural district extending in the hilly area of approximately El. 50 m about 40 km apart along the arterial road from Tandjung Karang-Telukbetung, the capital of the province. The centre now has a total 61 ha of upland field and 2 ha of swamp land spreading out from either side of the arterial road and is actively carrying out levelling work using seven 28.5Hp tractors which were procured under the KR aid. Other equipment installed in the centre under the same aid are hand tractors, corn shellers, grain moisture testers, driers, meteorological instrument, etc. Building construction so far completed at the centre covers the office, warehouse, drying ground and manager's living quarters. Buildings planned to be constructed in future are the garrage, work shop, training, conference hall and dormitories. Since dormitories are not yet completed, neither the manager nor engineers have yet assumed their duties at the centre, but the team learned that Directorate of Agriculture has already recruited three staffs for the centre.

The centre's field generally shows a gentle slope and is covered with red latosol soil. Though the drainage condition seems to be satisfactory, the soil is acidic and has a small content of humic soil. It is therefore considered necessary to effect an overall improvement of land infrastructure including the levelling work, land improvement, construction of irrigation facilities for dry season crops, farm road development, etc.

Table 3-8 Seed Production Area of Each Crops and Yield per ha in Upland Crop Center

Crop	Wet Season		Dry Season		Remarks
	Area	Yield	Area	Yield	
	ha	t	ha	t	
Loland Paddy	2	-	-	-	
Upland Paddy	5	1~1.5	-	-	
Maize	30	4.0	35~40	3.0	Urea 100 kg and Triple superphosphate 75 kg per ha are applied.
Soybeans	5	1.0	5	0.5~0.8	
Groundnuts	2	1.0	-	-	Endrin five times are used.
Cassava	10	25.0	-	-	

The above table shows the planned acreage of planting area and the prospect of yield per ha. The centre plans to obtain fundamental seeds either from the Central Agricultural Research Institute or its branch and hopes that the multiplied seeds will be either directly supplied to farmers or shipped to other provinces according to the demand.

3.3.2-2 Accelerated Maize Production Plan

As an export item and as a crop that promises income increase for upland crop farmers, growing importance is attached to the accelerated production of maize. To put in more detail, the centre is expected to take the leading part in the distribution of seeds and fertilizers and in the improvement of cultivation techniques in priority districts to be successively established in major upland field areas, as well as in achieving a higher labour productivity through the common use of tractors, mist dusters, huskers, shellers and trucks. Japanese government is requested to offer financial aid for supply of these machines in addition to jeeps and motorcycles needed for liaison and guidance activity and to extend technical aid for smooth implementation of the plan.

Annual Plan for Establishing Priority Districts

1971/1972	1,500 ha	(300 ha x 5 districts)
1972/1973	6,000	(300 ha x 20 districts)
1972/1974	12,000	(300 ha x 40 districts)

Technical training of 30 farmers who are expected to display propelling force in the first phase of the plan is completed, and two technical extension workers are planned to be appointed in each district. With no required equipment yet installed as scheduled, however, the plan for 1971/1972 was revised and as a result, it is envisaged that a small demonstration farm will be established for technical diffusion. This farm has a total area of 100 ha divided into eight blocks, one block covering an area of 5 to 25 ha.

3.3.2-3 Production Improvement Plan of Pulses

This plan aims at the expanded cultivation of soybeans, groundnuts and green beans in upland fields and formation of pulses producing areas, and also envisages the improvement of their production techniques and quality to give them higher value as cash crops.

For the time being, the plan envisages, for one thing, the establishment of demonstration farms at a number of places in Lampung Selatan and Lampung Tengah which will be intended chiefly for the diffusion of pest and disease control techniques using agro-chemicals, and for the other, tests of adaptability of varieties introduced from the Central Agricultural Research Institute and multiplication of improved seeds.

Establishment Plan of Pulse Demonstration Farms for 1971/1972

Soybeans	90 ha	6 districts	(1 district = 10~20 ha)
Green beans	20	2 "	(1 district = 10 ha)
Groundnuts	20	2 "	(1 district = 10 ha)

The team learned that the provincial government hopes to establish priority districts for pulse production like the ones planned for maize, and expects that Japan would offer the necessary technical and financial aid.

As briefly shown in the separate table, there also is a plan for promoting intensive cultivation and saving the labour of drying and preparating work of cassava. It is considered that Japan's cooperation in the implementation of this plan will have be based on a comprehensive judgement.

Djakarta, 21, August 1971

DEVELOPMENT OF THE SECOND CROPS

Second crops Development Center at Tegineneng (South Lampung).

Impelementation

- Land Areal	60 ha.
- Building constructions	
Office	Constr. completed
Warehouse	" "
Dormitory	" not yet commenced
Conference/Training Hall	" "
Manager's living quater	" completed
Garrage/Workshop	" not yet commenced
Stock pen	" "
Drying ground	" completed
- Manpower	Available
- Equipments and Tools	
Tractor (4 wheel, 28.5 Hp)	7 units (available)
Hand tractor	4 (not yet available)
- Metereological instruments	
Rain gauge	
Thermometer (Max. and Min.)	
Hygrometer	
Pluviometer	1 set (not yet available)
Ray light survey meter	
Manometer	
- Corn sheller, dryer and separator	Available
- Grain moisture tester etc.	"

Equipment still needed

- Hand tractor	4
- Metereological instrument	1 set
- Grain dryers (capacity, 1 ton/hour)	4
- Cecoco peanuts sheller	10
- Cecoco soybean sheller	10
- Water pump:26HP ϕ outlet 4 inches	1 unit
- Generator 6 KVA	1 unit
- Electric Calculator	1 set
- Pick up	1

Production unit

- Corn

Year 72/73 4 units x 1,500 ha = 6,000 ha.

Year 73/74 8 units x 1,500 ha =12,000 ha.

Located at : Central Lampung

Equipments and other necessities needed for each unit of 1,500 ha

Items	Volume	Price (Rp.1,000)	Remarks
a. Production facilities			
Urea fertilizer	300 tons	8,100	Technical Assistance
Seeds	37.5 tons	900	" "
Insecticide	2 tons	800	" "
b. Building constraction			
Warehouse 375 sq. M.	1	-	State Budget
" 225 sq. M.	5	-	" "
c. Processing instruments			
Engine and Blower 20 HP, 90cm	5 units	4,550	Technical Assistance
Husker	10	1,365	" "
Corn sheller	10	975	" "
Portable belt conveyer	5	325	" "
d. Producting equipments/tools			
Tractor 35 HP including equipment	2	-	Technical Assistance
Power knapsack mistduster	5	-	" "
e. Transport facilities			
Truck	1	-	Technical Assistance
Jeep	1	-	" "
Motor cycles	5	-	" "
f. Guidance/Control			State Budget

Equipments and other necessities needed in the year 1972/1973 for 4 units of Corn Projects provided by technical assistance.

a. Production facilities	
Urea fertilizer	1,200 tons
Insecticide	8 tons
b. Processing instruments	
Engine and Bloer 20 HP, 90cm.	20
Husker	40
Corn sheller	40
Portable belt conveyer	20
c. Production tools	
Tractor 35 HP including equip	8
Power knapsack mistduster	20
d. Transport facilities	
Trucks	4

Jeeps	4
Motor cycles	20

- Peanuts

Year 72/73 2 units x 500 ha. = 1,000 ha.

Year 73/74 7 units x 500 ha. = 3,500 ha.

Located at : South Lampung

Equipments and production facilities needed for each unit of 500 ha.

Items	Volume	Price (Rp.1,000)	Remarks
Insecticide	900 kgs.	450	Technical assistance
Zinkphosphide	100 kgs.	50	" "
Sprayer	17	250	" "
Fertilizer	87,500 kgs.	2,375	" "
Motor-cycles	1/2	75	" "
Bicycles	2	40	" "
Warehouse	1	400	State budget
Guidance Maintenance			" "

Equipments and necessities needed in the year 72/73 for two units of Peanuts Projects provided by Technical assistance.

Fertilizer	175 tons
Insecticide	1.8 tons
Zinkphosphide	0.1 ton
Sprayer	34
Motor cycle	1
Bicycles	4

- Soybeans

Year 72/73 1 unit x 500 ha = 500 ha.

" 73/74 2 units x 500 ha = 1,000 ha.

Located in: Central Lampung

Equipments needed in the year 72/73 for 1 unit of 500 ha. of Soybeans Project provided by Technical assistance.

Fertilizer	
Insecticide	1.2 tons
Zinkphosphide	0.1 ton
Sprayer	50
Motor-cycle	1
Bicycles	2

- Cassava

Year 72/73 6 units x 500 ha = 3,000 ha.

" 73/74 10 units x 500 ha = 5,000 ha.

Located in: Central Lampung

Equipments needed for each unit of 500 ha.

Dryer (capacity 1 ton/hour: Lister HR 4) 4

Device for making mechanical chip	5
Device for making mechanical pellets	5
Trucks, 3 tons	5

Equipments needed for 6 units of Cassava Project.

Dryer (capacity 1 ton/hour: Lister HR 4)	24
Device for making mechanical chip	30
Device for making mechanical pellets	30
Trucks, 3 Tons	30

Recapitulation:

Second Crop Project for the Year 72/73.

Second Crop Development Center at Tegineneng 60 ha.

Production units	Corn	6,000 ha.
	Peanuts	1,000 ha.
	Soybean	500 ha.
	Cassava	3,000 ha.

Equipments needed from Technical Assistance

Hand tractors	4
Metereological instruments	1 set
Lister dryer HR 4	28
Cecoco peanuts sheller	10
Cecoco soybean separator	10
Water Pump 16 HP ϕ outlet 4'	1
Generator 6 KVA	1
Electric Calculator	1
Pick up	1
Truck, 3 tons	34
Jeeps	4
Motor-cycles	22
Bicycles	6
Engine & blower 20 HP ϕ 90 cm.	20
Husker	40
Corn sheller	40
Portable belt conveyer	20
Tractor 35 HP. + equipments	8
Power knapsack mistduster	20
Sprayer	84
Device for making mechanical chip	30
Device for making mechanical pellets	30
Urea fertilizer	1,200 tons
Component fertilizer	175 tons
Insecticide	11 tons
Zinkphosphide	0.2 tons

3.4 Utilization of Agricultural Machinery and Equipment

Utilization of agricultural machinery and equipment in Lampung has the following four patterns.

1) Oridinary paddy producing farmers use farming implements such as ani-ani (grain-sickle), Tjiangkul (hoe) and tumbuk when performing farming work in their own or other people's fields. Among these farmers, there is a wide spread practiese to hire cattle-driven farming equipments.

2) Private rice mills run by Chinese or Indonesians employ a milling machine having a capacity of 150 ~ 1,500 kg/ha.

3) MEKATANI employs earth-moving machines such as bulldozers as well as large type farming machines in reclamation work and in cultivating upland fields at a charge. It also leases out hullers and other equipment.

4) Privately operated large farms of maize and groundnuts use large type farming machines and drying facilities.

The following is a brief illustration of the above four patterns.

Ordinary farmers	Farming implements	... for use in their own or other people's fields.
	Cattle-driven farming equipment	... hired.
Private rice mills	Hullers	... for milling rice for farmers' own consumption.
	Milling machine	... for processing stalk paddy for marketing.
MEKATANI	Bulldozers Tractors	... for reclamation work and for paddy field cultivation at a charge.
	Milling machines	... for milling rice for marketing (not in operation at present)
	Hullers	... for leasing out to farmers.
Private large farms	Large type farming machines	... for cultivation on an estate-level.

In the above-mentioned four patterns, different types of equipment and implements are employed by different groups of farming enterprise: In general, however, it may be said that probability is rather low that the

use of highly efficient agricultural machines will be enhanced in the province. Repair facilities of automobiles, for instance, are in a poor state because the absence of an inspection system like the compulsory regular overhaul system of Japan allows any automobile to run on the road so long as it is not older than 50 years. One of the causes of aggravated management of MAKATANI is said to be the failure to secure supply of spare parts. Most milling machines are of the motor-and-pounder type and their low efficiency produces a large percentage of broken rice and provides a low milling extraction rate. Further, the team learned that even privately operated large farms have to wait a period equivalent to a whole season before they receive machines or spare parts ordered for. These facts lead to the conclusion that smooth supply of spare parts and training of management and maintenance supervisors of machines should be given the first consideration in the future introduction of agricultural machines and equipment.

3.4.1 Use of Farming Implements by Ordinary Paddy Producing Farmers

As shown in Table 1, use of farming implements by paddy producing farmers is extremely limited, and most farming work is conducted by manual labour. Because of the poor capital accumulation and abundant labour force, there is little room for introducing costly farming equipment. The only exception to the prevailing practice of carrying out farming work by manual labour is the use of cattle-driven farming equipment for plowing and puddling and of the manual chemical sprayer of the desa office. Use of hired cattle-driven equipment is prevalent in the province for plowing and puddling work since these two types of farming work impose heavy labour on farmers and further incurs shortage of labour force in case of double cropping which necessitate concentrated labour for the harvesting of the first crop. In Septi Raman of Lampung Tengah, farmers own buffaloes at a rate of a head to each ten farm households and two-cattle driven plows and harrows and hired by them for heavy farming work. When such a cattle-driven equipment is employed for double plowing, a period of about seven days is required for plowing each ha. Assuming, therefore, that one-month plowing period is allowed for one cropping season, each cattle-driven equipment can be expected to cover about 4 ha. Considering the number of buffaloes owned by the farmers, it may be said that 40 to 50% of paddy field area in this ketjamatan is plowed by these hired cattle-driven equipment.

Table 2 shows the results of trial calculation of cost per ha of plowing work by manual labour, animal power and powered tiller. As is clear in the table, the highest cost of about Rp 11,000 per ha is incurred by manual labour. At the demonstration farm at Tjihea, powered tillers, each covering 4 to 5 ha, were employed in the dry season of 1971 at a plowing cost of Rp 9,000 per ha, and this clearly shows the use of tillers is advantageous over manual farming work if labour force is lacking and particularly if limit is set on the plowing period by reason of double cropping. However, plowing with hired cattle-driven equipment costs about one-third the expenses needed for operating powered tillers. Since the buffalo-driven plow or harrow is hired at a charge of about Rp 5,000 per ha at present, introduction of powered tillers will be difficult in areas where many buffaloes are used for farming work.

3.4.2 Use of Machines at Rice Mills

In the statistics shown to the team at a desa office in Pringsewu of Lampung Selatan, rice mills were noted to be classified under the category of industry. Rice mills are the only industrial establishments in rural districts of Lampung.

At present, Lampung has a total 52 large scale rice mills called "mills" and 872 small scale ones called "hullers." Mills are owned mostly by Chinese and their establishment calls for the approval of the Central Government. They process stalk paddy or paddy gabah purchased from farmers or brokers at a milling capacity of 500 ~ 1,500/ha, and have a building housing milling machines, concrete solar drying yard, and grain warehouse, etc. Hullers, on the other hand, are established with the approval of the governor of kabupatan and have a smaller milling capacity of 100 ~ 300 kg/ha. Their activity centers on the milling of rice for farmers' own consumption at a charge.

There exists some difference in mechanical facilities between mills and hullers. Since most mills were established 30 to 40 years ago, their machines are old and exhibit a very poor efficiency. With no spare parts being supplied, the operators are forced to repair all the mechanical troubles and have pride in their ability to repair. Hullers are equipped with relatively new machines. Rubber roll type machines which are popular in Japan are not necessarily accepted favourably by hullers because of the trouble of replacing the roll. It appears that the owners and operators are much alike in their conviction that a machine is something that has permanent life span. At present, there are no agents in the province who supply spare parts, nor are there any assembly shops where the machines can be repaired. Further, since farmers have no funds to purchase threshers and milling machines of their own, they have to pay an enormous amount of milling charge to rice mills. For protection of producers, therefore, studies should be made for future joint ownership and operation of milling machines by farmers' organizations.

3.4.3 Use of Machine by MEKATANI

MEKATANI was established with government subsidies for the purpose of reclaiming lands for inducing settlers, but no subsidies have been provided since 1963. With its Lampung office located in Tandjung Karang, MEKATANI is engaged in various lines of business mostly in Lampung Selatan. Though it covers a wide range of activity such as the hired cultivation of PNP and other farms, operation of rice mills, leasing out of machines to hullers, falling of trees and operation of sawmills, its work shows a dwindling trend. To be more precise, its income from hired work at PNP farm for planting perenial crops like rubber, oil palm, etc. is decreasing year after year, and the demand of farms for hired cultivation service using wheel tractors is on the decrease because of the relatively high cost charged (Rp 17,000 per ha). As for its rice mill operation which was commenced in 1959 with the installation of Japanese machines, the poor supply of paddy and inadequate operation and maintenance of machines have resulted in the operation suspension. In 1963, MEKATANI procured 69 units of hullers under the Czechoslovak financial aid. These hullers are leased at a charge of 500 kg of milled rice per month.

3.4.4 Introduction of Agricultural Machinery for Upland Crop Cultivation

Since upland crop producers cultivate upland paddy, maize and cassava by mixed cropping, introduction of agricultural machines is made very difficult. Further, since farmers in upland field areas are just as short of funds as those in paddy field areas, it is next to impossibility that costly farming machines are employed on the farmer's level.

However, estate agriculture of maize, groundnuts, etc. at Mitsugoro Farm and other farms is carried out with large type farming machines and this gives the hope that these farms will eventually come to use most of improved agricultural machines similar to those employed in Japan. Table 3 shows the kinds of machines employed at Mitsugoro Farm No. 2. At this farm, powered sprayers or speed sprayers are used in place of dusters because of the high cost of powder agents. For harvesting, rotary cutters are used to remove stems and leaves, and then peanut diggers are employed to dig out the matured crop. Since the shelling machine used at this farm is small and inefficient, power-driven paddy threshers are employed to cover part of the shelling work, but neither of them exhibits satisfactory shelling performance. At this farm, introduction of improved shelling machines is required for efficient groundnut production.

Maize harvesting machine employed at this farm is the picker huskter. The team noted that its capacity is not fully displayed because its reaping part is not adjusted to the planting density (distance between rows).

Table 3-9 - Utilization of Farming Implements by Paddy Producing Farmers

	Plowing	Puddling	Trans-planting	Weeding	Fertilizer Application	Chemical Spraying	Harvesting	Threshing
Method and Efficiency	(1) Manual labour (tjangkul) 10 persons/ 7 days/ha	Animal power (2 buffalo-driven harrow) 4 days/ha (twice)	Manual labour 10 persons/ 2 day/ha	Manual labour 10 persons/ 5 days/ ha	-	Hand-Type sprayer	Manual labour (ani-ani) 40 ~ 80 persons/ ha	Manual labour 100 kg/ person/day
	(2) Animal power (2 buffalo-driven plow) 7 days/ha for double plowing							
Labour Cost	(1) Manual labour Rp 125 + meals (Rp 25)	Hire charge: Rp 1,000/ ha	Manual labour (female) Rp 75/day	Rp 3,000/ ha	Rp 2,000/ ha	Hire charge: Rp 50/ day	1/6 to 1/8 of harvest	Rp 100/ 100 kg
	(2) Charge of hired animal power plowing service: Rp 5,000/ ha							

Note: Data obtained from interviews in four desas in Lampung.

Table 3-10 - Trial Cost Caulculation of Plowing Work per ha Unit: Rp

Cost Item	Investiment	Annual Depreciation Expense	Maintenance & Other Costs	Annual Fixed Expense	Annual Rate of Utilization	Fixed Expenses per ha	Variable Expenses per ha	Plowing Cost per ha
2 Buffalo-driven Plow	63,000 Buffalo (30,000) x 2 heads + plow (3,000)	6,600 Durable Years: Buffalo - 10 years Plow - 5 years	11,970 Capital interest - 12% per annum Maintenance cost - 7%	18,570	8 ha 7 days/ha, 28 days/season, double cropping	2,321	1,050 7 days x 6 hours/ha x RP 95 (wages)	3,371
Powered Tiller (5 ~ 7 PS)	500,000	100,000 Durable Years: 5 years	95,000 (ditto)	195,000	24 ha 20 hrs/ha, 30 days/season, operation in 2 shifts of 8 hours	8,125	1,380 20 hrs/day x 1.5 lit. x RP 20 (fuel cost) + 1.5 lit. x 20 x 0.3 + wages (Rp 30)	9,505
Tjangkul (Harrow)	5,000 (Rp 500 x 10)	1,000 (ditto)	600	1,600	8 ha 0.5ha x 8hrs x double cropping	200	10,500 7 days x 6 hrs 10 persons x Rp 25 (wages)	10,700

Note: Values for powered tillers are the hire expenses of 60 days operation for double cropping

Table 3-11 - Utilization of Farming Machines and Equipment at Mitsugoro Farm No. 2 for Production of Groundnuts

Type of Work	Machine of Equipment	Efficiency	Remarks
Plowing	Disk plow	4 ha/day	
Harrowing	Disk harrow	5 ~ 6 ha/day	
Levelling	Tooth harrow	7 ~ 8 ha/day	
Row forming and fertilizer application	Corn planter	4 ha/day	Corn planter used in place of fertilizer applying machine
Sowing	Grain drill	5 ha/day with two labourers	
Weeding	Cultivator	3 ha/day with one labour	Manual weeding is also carried out by 15 labourers
Pest and Disease Control	Speed sprayer	8 ~ 10 ha/day with 4 labourers	Spraying conducted twice
Harvesting	Rotary cutler	4 ha/day	12 or le labourers also carried out to dig groundnuts
Pulling	Peanut Digger	4 ha/day with one labourer	
Transportation	Trailer	2 ~ 3 ha/day with 5 ~ 6 labourers	
Drying	(Solar drying)	2 ~ 3 ha/day with 5 ~ 6 labourers	
Shelling	Shelling machine	1 ton/day with 10 labourers	

CHAPTER IV PROPOSALS FOR FUTURE AGRICULTURAL DEVELOPMENT

4.1 Tani Makmur Project

4.1.1 Need for Improving Agricultural Techniques and Raising the Level of Agricultural Income

Agriculture in Lampung, particularly in Lampung Tengah where the food crop production carries a heavy weight, is under the pressure of increasing population, and as a consequence, its population supporting capacity expressed in terms of per capital agricultural production is declining year after year. This is assigable to two factors; one is the slow pace of land productivity improvement for production of paddy which is the major food crop of the province, and the other is the price conditions which are developing a trend disadvantageous for farmers. It is to be added that the future capital input under the agricultural development project will invite inflow of increasingly large labour fource into the province and Lampung Tengah will be expected to produce more rice than ever to meet the correspondingly heavier demand for food.

As things stand now, the present level of paddy production techniques and the distribution mechanism of agricultural products in Lampung Tengah are needful of much improvement to fully cope with the said demand increase and to raise the farmers' income level. The team wishes to point out that the improvement of land productivity for paddy production not only serves for augmenting the supply of foodstaffs but also gives an incentive to the diversification of Lampung's agriculture. It must also be noted that rationalization of distribution and processing is of great significance in that it will bring about increased supply of commodities and reduction of distribution cost, and ultimately contributes to the improvement of farmers' income level.

4.1.2 Outline of Tani Makmur Project

In full recognition of the pressing need of the improvement mentioned above, the provincial government of Lampung mapped out Projek "Tani Makmur," a rice production intensification programme which is planned to be implemented chiefly in Lampung Tengah. The project aims at bringing about a prosperous farmers' community by pushing forward the intensive paddy cultivation and by rationalization of paddy processing and distribution mechanism. To attain this purpose, a number of measures, of which major ones are given below, are planned to be carried out by the joint efforts of farmers and government offices concerned.

a. Introduction or establishment of an agricultural credit system.

b. Establishment of the processing and distribution system controlled by farmers' organizations.

c. Establishment of agricultural techniques suited to respective districts.

d. Training and education of extension workers and key farmers.

e. Improvement of extension facilities and techniques.

For initial stage implementation of Tani Makmur Project, the 2,000 ha irrigated paddy field area in Trimurdjo and neighbouring paddy field areas are selected. According to the selection criteria, the project area is required to be a paddy field area which is needful of advanced farming techniques, easy of access and located close to the provincial agricultural extension office which is to take the leading role in the project implementation. The project area is planned to be expaned by stages as shown below and expected to cover 14 thousand ha in 1975. With the progress of the irrigation development scheme, it is expected to ultimately cover an area of 20 thousand ha.

Year	Cropping Season	Additional Project Area (ha)	Cumulative Total of Project Area (ha)	Ketjamatan
1972/73	Wet	2,000	2,000	Trimurdjo
1973	Dry	2,000	4,000	Metro
1973/74	Wet	2,300	6,300	Pekalongan
1974	Dry	2,200	8,500	Purbolinggo
1974/75	Wet	3,500	12,000	Sekampung Batanghari
1975	Dry	2,000	14,000	Raman Utara

To materialize intensive paddy cultivation, priority is given to the establishment of a standard for fertilizer application under the project, which is fully justifiable since the fertilization standard hitherto recommended to farmers was set up with no due regard to the difference in conditions in respective districts. For the establishment and extension of a suitable fertilization standard, it is planned that an experiment farm (200 ha) and a demonstration farm (100 ha) will be established and that an extension centre will be constructed to elevate the level of extension workers and key farmers. For the smooth progress of the project, it is also planned that a system will be established under which capital goods will be smoothly supplied, agricultural credit will be offered and recovery of capital input can be ensured.

4.1.3 Problems Involved in Tani Makmur Project

Tani Makmur Project is about to be put in practice covering the paddy field area of Trimurdjo and Metro for the present for the prime objective of enhancing intensive paddy cultivation in Lampung Tengah. The course of development charted by the provincial government is quite justifiable in view of the existing state of paddy cultivation in Lampung Tengah and the kabupaten's importance as food producing area. Further, considering the deficient administrative measures as witnessed in the present extension service, it can be said that the project was planned along a realistic line since it aims, above all other things, at the establishment of the standard of fertilizer application. As pointed out already, however, intensive paddy cultivation is not something that can be achieved simply by

the establishment and extension of such a standard. Though it is highly probable that defects such as poor water management which are involved in the present paddy cultivation will be removed by technical guidance activities, realization of intensive paddy cultivation demands that such guidance activities by accompanied by a long-range plan for overall infrastructual improvement covering irrigation facilities, farm roads, etc. and establishment of cultivation techniques compatible with the infrastructural improvement. It is to be borne in mind that all the conceivable promotional means should be combined and employed in a most efficient manner with the expansion of the project area. Particularly in areas where the development of irrigation facilities is planned, improvement plan should be implemented with consideration given to the selection of crops, rationalization of water management, and introduction of animal power and powered farming equipment. Such an improvement plan should incorporate development measures and ideas prepared in advance for actual execution. It is desirable that the extension centre envisaged under Tani Makmur Project will function as an agricultural development centre where the said improvement plan can be ampped out. Since the project aims at raising the income level of farmers in the entire project area, the rationalization of the processing and distribution system should be pushed forward in parallel with the production plan of paddy and other crops to be selected for future farm management.

As prerequisite to the gradual implementation of these development measures and extension of advanced techniques, there is need for training extension workers and key farmers. As described in the foregoing pages, the closer the contact an extension worker maintains with farmers, the larger is the effect of his service. So much is important the role of the extension workers and key farmers who are in close contact with general farmers. Hence, it is an imperative that not only their number be increased but their quality improved.

It is to be noted that the success of a project like Tani Makmur Project hinges on whether farmers show full understanding of it and actively participate in it. At the present stage, no efforts are being made toward gaining the understanding of farmers, though this may be explained by the fact that the project itself still entails some uncertain factors. By bringing farmers to close understanding of the project and inducing them to make a community-wide decision to take part in it, the risk they feel about this new experience can be largely alleviated. For this purpose, steps must be taken without delay for enlightening farmers on the nature of the project and the benefits it will bring about to them.

It is to be remembered that Tani Makmur Project will play the role of a pilot project of regional development, particularly for development of rural districts where the low financial level of farmers is suspected to decline further. It is therefore hoped that the project will be eventually expanded to cover not only paddy field areas but also upland field areas, thereby serving as an important part of Lampung's agricultural development scheme. Needless to say, the project can yield benefits through various technical means, but it is beyond doubt that very large benefits will be produced if the project is impelented on the basis of farmers' community-wide decision and if all the conveniences and supports for such implementation are afforded under a system established by government offices.

4.1.4 Japan's Cooperation in Tani Makmur Project

Tani Makmur Project is essentially intended for the following three purposes.

1) Provision of agricultural materials and equipment and agricultural credit.

2) Improvement of conventional farming techniques and establishment of advanced techniques suited for respective districts.

3) Extension of advanced cultivation techniques.

Not surprisingly, the initiative in its implementation is taken by the Central Government which is fortunately directing its efforts to intensive paddy cultivation through BIMAS Project. Since Tani Makmur Project area is given high priority under BIMAS Project, the interaction of the two project is expected to bring about an immense development effect to Lampung Tengah.

Item 1) above calls for particular attention of the Central Government under BIMAS Project. To attain the purpose given under this item, Japanese government will be willing to offer its advices and cooperation.

For Item 2), Japanese government will be able to extend its cooperation in the establishment of experiment farms and demonstration farms, design of these farms and in many other aspects through the dispatch of experts and supply of equipment and materials. With the functional improvement of the Agricultural Development Centre (See Section 4. 3), Japan's cooperation programmes will be so planned as will be combined effectively to meet the future expansion and progress of Tani Makmur Project.

For Item 3), Japanese gove rnment considers it advisable that the Agricultural Development Centre undertake the education and training of extension workers and key farmers, though they may be given field training if occasion so demands. In addition, Japan will offer advices and assistance in the development of extension techniques, and also provide equipment required for extension service.

4. 2 Improvement of Upland Crop Cultivation Techniques

4. 2. 1 Improvement Measures

4. 2. 1-1 Establishment of Cropping Pattern

The currently practised mixed cropping pattern does not allow for plowing of a wide area because of its large manpower requirement. Though this pattern is suited for intensive land use within a small area, it involves a number of drawbacks such as the complicated cultivation management and heavy management labour and is therefore considered not adaptable to the introduction of high yielding cultivation techniques. The existing mixed cropping should give place to monoculture, and a rational crop rotation pattern should be devised with due account taken of land productivity and adequate labour force distribution.

Principal crops to be cultivated under such rotation pattern can be classified into the following three types.

i) Crops that strongly absorb soil ingredients and exhaust land (Creals such as upland paddy, maize and sorghum).

ii) Crops that take in atmospheric nitrogen and leaves part of it in soil to enhance its productivity legumes such as soybeans, groundnuts and green beans).

iii) Crops that improves the soil texture by deep plowing (Root crops such as cassava and sweet potatoes).

In cultivating cereals which are known to exhaust land to a great extent or any other crops, successive cropping should be avoided since it only adds to the damage of pests and diseases. Characteristics of all the above-mentioned crops should be fully understood so that they may be cultivated by a rotation in which respective preceding crops and succeeding crops can supplement each other so as to maintain land productivity.

The following table shows a three-year rotation pattern of maize, cassava, pulses and green manure crops prepared on the assumption that rice will be purchased and maize and pulses will be cropped twice a year.

	Oct	Feb	Jun	Oct	Feb	Jun	Oct	Feb	Jun	Oct
Plot I	Maize	Pulses	Green manure crops	Cassava (inter-cropping of green manure crops)				Pulses	Maize	Green manure crops
Plot II	Pulses	Maize	Green manure crops	Maize	Pulses	Green manure crops	Cassava (with inter-cropping of green manure crops)			
Plot III	Cassava (with inter-cropping of green manure crops)			Pulses	Maize	Green manure crops	Maize	Pulses	Green manure crops	
	← Initial Year →			← 2nd Year →			← 3rd Year →			

Since cassava has a growth period of approximately ten months, it cannot be shifted completely to green manure crops within a single year, but it is considered to be possible to carry out the intercaopping of green manuare crops during the growth season of cassava. If upland paddy is desired to be cultivated, it can be cultivated either as a inter-cropping of cassava, or in a fourth plot designed for rotation of upland paddy.... fallowing (or sweet potatoes).... green manure crops. As green manure crops, Clataria or Sesbania of Leguminosae are suited. Since these species have a relatively high drought resistance, their cultivation in the fallowed land of the dry season should be enhanced.

4.2.1-2 Production of Seeds and Seedlings of Improved Varieties

Though local varieties are most compatible with the environmental conditions of respective districts and also capable of maintaining a stable yield level, their yield rate is usually lower than improved varieties due to the accumulated deterioration of their heredity factors over many years in the past. For improvement of productivity, therefore, the breeding work should be fostered and the seed growing rechniques improved.

The seed and seedling improvement activity in Indonesia undertaken by the Central Research Institure for Agriculture in Bogor has already recorded some achievements. This activity should be expanded to cover such other works as the reexamination of different local varieties, selection of suitable high yielding improved varieties, and introduction and utilization of such desirable characters as the resistance against pests and diseases. It is also hoped that the facilities for adaptability test and continuous field test will be newly installed or expanded to improve the breeding system in a manner that fits into the characteristics of respective areas.

As for seed multiplication, there are a number of seed farms at present which are operated by the Central and provincial governments as well as on the kabupaten-level. These farms should be increased in both number and scale to cope with the future demand growth, with attention directed to the improvement of seed growing techniques for particularly the selection of seeds having all the inherent characteristics of respective crops.

It is also of controlling importance that guidance and instructions be given to farmers so that they may use seeds and seedlings of improved varieties, and learn to refrain from using heteromorphic or diseased seeds and seedlings found in their own seed farms. They should also be enlightened on the need of storing seeds and seedlings at a dry place free from the damage of insects.

List of Improved Varieties in Lampung

Crop	Number	Variety
Upland paddy	3	Sirendah, Gundilbatu, and Lunik
Maize	2	Metro and Harapan
Soybeans	1	Ringgit
Groundnuts	2	Kidang, and Djenis lokal
Green beans	1	No. 116
Sorghum	1	No. 7C-549
Cassava	1	SPP

4.2.1-3 Diffusion of Improved Fertilization Techniques

Tests have shown that fertilizer application is not only essential but also displays an eminent effect in Lampung. However, due to the high fertilizer cost (approx. Rp 80/kg) and the poor financial state of farmers, introduction and diffusion of fertilizer application is considered to entail difficulties unless supported by government subsidies. In the case of

paddy production, fertilizer application is substantially popularized because farmers are provided with government subsidies under the Accelerated Food Production Project and consequently enabled to purchase fertilizers at a relatively low price (i.e., Rp 30/kg for urea and Rp 35/kg for double superphosphate of lime). The team considers it necessary that similar subsidies be granted for upland crop cultivation as early as possible and that studies be made on the dosage and techniques of fertilizer application for various soil conditions and crops so that fertilization supported by government subsidies will be promptly put into practice.

The soil in the upland field area of Lampung is mostly podzolic soil having a low productivity. It is featured by rapid decomposition of organic matters, active eluviation of basic matters, and consequently shows a marked trend for acidification. Of the three major elements of soil, nitrogen and phosphoric acid are lacking, though potash content is not so small. Excluding pulses, highest fertilization effect on crops is displayed by nitrogen fertilizers which, if combinedly applied with phosphorous fertilizers, will exhibit even a higher effect.

At the Upland Crop Development Centre in Tegineneng, a yield of 3.5 tons/ha of upland paddy was recorded by the application of 50 kg of urea and 75 kg of double superphosphate per ha, and a yield of 4.5 tons/ha of maize was obtained by the application of 100 kg of urea and 75 kg of double superphosphate per ha. Those yield rates are three to five times as large as the rates obtainable by non-fertilized cultivation, and promise a two-fold income even after deducting the fertilizer cost assumed at Rp 80/kg. Thus, the record of the centre indicates that a large investment effect can be expected of fertilizer application.

Effect of Capital Input in Fertilizers (an example per ha)

Upland Paddy	Cultivation with fertilization	Fertilizer cost	Rp 80 x 125 kg	Rp 10,000
		Product	Rp 15 x 3,500 kg =	Rp 52,500
		Income		Rp 42,500
	Cultivation without fertilization	Product	Rp 15 x 900 kg =	Rp 13,500
	Increase rate of income brought about by fertilization	215%		
Maize	Cultivation with fertilization	Fertilizer cost	Rp 80 x 175 kg =	Rp 14,000
		Product	Rp 12 x 4,500 kg =	Rp 54,000
		Income		Rp 40,000
	Cultivation without fertilization	Product	Rp 12 x 900 kg =	Rp 10,800
	Increase rate of income	270%		

In order to promise the fertilizer effect shown in the above table for the entire province, it is necessary to carry out a detailed soil and elements survey in each district and also conduct a series of three elements experiments and three elements requirements experiments so as to be able to set an optimum dosage standard for the target yield of respective crops.

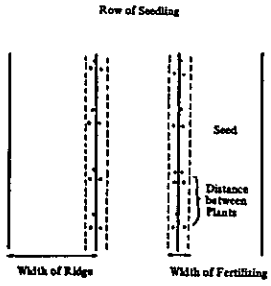
As regards the application techniques of fertilizers, there are many application methods which were all devised to prevent direct contact of seeds with the fertilizer which could impair smooth germination. These methods can be classified into the following three groups.

i) Dibbling application: In this method, fertilizer is supplied into holes dibbled for sowing and then covered with soil.

ii) Row application: This is the common fertilization method employed in advanced countries. Fertilizer is applied within rows formed to have a certain width, and then covered with soil.

iii) Plow-in application: In this method, soil dressing is omitted and fertilizer is applied to the soil surface to mix it into the soil by plowing. Fertilizer is supplied either on the entire soil surface, or by drilling or dibbing.

Which of these methods will be adopted in Lampung depends on the farmers' own discretion and the engineers' decision. Whichever method may be adopted, there is no doubt that fertilizer application will impose a heavier workload on farmers than at present. Row application, for instance, calls for additional manpower in the absence of animal power or powered equipment, but the dibbing method is liable to invite non-uniformity of growth because of the difficulty in supplying a fixed quantity of fertilizer to each point. Fertilizer application on the entire field is not economically commendable in Lampung because it does not promise a good effect unless the dosage is made heavy. The only alternative left, then, is the plow-in row application. In this method, sowing rows are formed at regular intervals suited for the crop grow when the plowing and soil preparation work is completed, and fertilizer is applied uniformly within a width of 5 to 10 cm along the rows thus formed. Then, the applied fertilizer is mixed with soil by means of a hoe within a depth of about 10 cm from the ground surface. The rows so prepared are ready for sowing seeds or planting seedlings. It is to be noted that this method is just an expedient devised to meet the existing economic, manpower and technical situation in Lampung and should naturally be shifted to the row application method when tools and instruments for fertilizing end rowing become available with the introduction of draught animals and powered machines.



In relation to the above-mentioned application methods, consideration should be given to the problem of base fertilizer and additional fertilizer. It is advisable that a portion of fertilizer is suitably apportioned for a number of times of applications during the growth period rather than the whole quantity is supplied as base fertilizer. This is advisable partly because base fertilizer is indispensable for early stage growth which largely affects both the growth in the late stage and the yield, and partly because substantial eluviation of nitrogen content from soil is suspected in Lampung. Number of applications and quantity for each application are a matter to be determined on the basis of experiments in the province.

Fertilizers conceivable for application in Lampung are urea, double superphosphate of lime and potassium chloride. Of these three fertilizers, urea and potassium chloride both have a high hydroscopic property. During the highly humid period, they are liable to stick to hands, from grains to impede uniform spraying, or invite an unexpected situation detrimental to smooth and satisfactory mixing work of fertilizers. Guidance should therefore be provided with stress placed on these points, and it is desirable that introduce compound fertilizers be introduced whenever possible.

4.2.1-4 Improvement of Planting Density

The number of plants to be cultivated within a certain area of land is determined by the area required for each plant to attain the largest yield. It naturally varies by the kind of crop, variety, soil condition, dosage of fertilization application, climatic conditions and so forth. It is the common practice that thin planting is adopted for crops growing thickly above and below the ground, and denser planting for early maturing varieties if a single crop has both early and late maturing varieties. Dense planting, which is to be adopted in highly fertile areas or under heavy dosage of fertilizer application, is quite effective when the duration of sunshine is long. However, if it is conducted at too small intervals, it produces adverse effects such as 1) accelerated competition for survival between individual plants which leads to deficient absorption of nutrition and a large sterility ratio, 2) unsatisfactory growth resulting from insufficient solar radiation and aspiration, and 3) increased damage of pests and diseases as well as of lodging. Interaction of these unfavourable effects results in small production. If, again, thin planting is adopted at too large intervals, the yield of individual plants increases but the yield per unit area declines and grasses growing in the large space between plants demand a heavy weeding work.

As part of technical improvement planned for Lampung, it is recommended that tests be conducted on planting density with due account taken of the merits and demerits mentioned above. It is hoped that the planting density established by such tests will enable each crop to fully exhibit its characteristics according to the soil productivity and other environmental conditions in respective districts and serve, at the same time, to improve and stabilize productivity.

Square planting in which plants are spaced at regular intervals both lengthwise and widthwise produces practically the same yield as obtainable from rectangular planting in which the lengthwise distance between plants differs from the widthwise distance. It is therefore advisable that a planting

pattern having a larger planting width and a smaller lengthwise distance than the prevailing patterns be studied to facilitate farming work such as inter-tillage, weeding, and pest and disease control. For crops that must be planted at small intervals, the maximum allowable number of plants per hill should be made clear for easy farming work even if it may invite some decline of yield. In case of crops grown to obtain caryopses, more seeds than actually needed are sown and thinning is carried out after germination to reduce the number of plants per hill to an adequate degree, and this must be borne in mind when providing technical guidance to farmers.

4.2.1-5 Pest and Disease Control

Mr. Hisashi Kobayashi who made a survey on maize in 1970 gives in his report the latest and valuable information on pests and diseases in Lampung. Since this report deals mostly with maize and there are no data covering all upland crops, detailed surveys will have to conducted by experts in future.

In his report, Mr. H. Kobayashi states that Lampung is subjected to the occurrence of great diversity of pests and diseases and points out that damages ensuing from such occurrence become heavier with the shifting from double cropping to monoculture and from non-fertilized cultivation to fertilized cultivation. He also states that the establishment of a control measures is indispensable for the implementation of the technical improvement plan in the province.

The most important countermeasure against major pests and diseases is to breed and introduce resistant varieties. What can be recommended for the present for control of diseases is to ensure, for one thing, healthy growth of crops through employment of adequate cultivation techniques, optimum dosage of fertilizer application and rational management of field, and to prevent, for another, the spread of diseases by removing diseased individual plants as quickly as possible and bury them deep in the ground or burn them. Chemicals are known to display an excellent control effect against diseases, but their application in Lampung will entail many difficulties because of their high cost. As regards pests, control will be possible without killing them by physical means such as trapping and luring becauses insecticides are available at a relatively low price. Most of insecticides, however, belong to the organic chlorine group and have residual toxic effect which impairs the health of men and animals if accumulated in their body; and some have a strong toxic effect which is liable to develop an acute toxic symptom in human body at time of spraying. It is therefore hoped that new and effective insecticides having a low toxicity will be developed and applied in place of the existing insecticides. It is generally accepted that the control by natural enemy is the most ideal preventive means, and there is strong demand for early establishment of such a biological control method. Researches and experiments in this field are therefore of controlling importance for agricultural production in future.

Occurrence of pests and diseases is largely affected by various environmental factors. Kind of pest or disease, time of outbreak, and intensity of occurrence all vary by year and district. To attain satisfactory control effect, therefore, it is essential to study the occurrence pattern and

forecast the occurrence. Since such a forecast can be made only by an analysis of data accumulated over many years and covering climatic conditions, pattern and condition of occurrence and growth condition of crops in respective districts, establishment of a system for collecting such data is the prime requisite to effective control of pests and diseases.

It is to be added that guidance be given for the control of birds, rats and wild boars because these animals incur substantial damages each year.

4.2.1-6 Other Cultivation Techniques

i) Prevention of missing plant

Any sizable development of missing plant, if observed in the actual cultivation conducted at an optimum planting density, directly results in so much the less production. Development of this failure can be attributed to the following three types of causes -

a) Seeds: improper preparation or storage of seeds, and use of seeds which have no germination ability due to too long a storage period.

b) Inadequate farming work: oxygen deficiency due to excessively deep sowing or planting, direct contact of seeds with fertilizer, and damage caused by inadvertent weeding and thinning work.

c) Natural causes: damages due to water and high humidity, drought, diseases, and damages incurred by insects, birds and other wild animals.

Crops should be grown with head given to the prevention of all the three types of causes given above, and if many missing plants are discovered, additional sowing or replanting should be conducted as soon as possible to minimize the decline of yield. Seeds sown additionally show poor growth as they germinate later and are subjected to the competition with the existing plants and therefore, they are inferior to the initially sown seeds in both yield and quality. More effective than additional sowing would be to replant surplus young plants which should otherwise be thinned out from normally germinated hills. This replanting should be carried out after a rain by removing the plant and soil together so as not to damage the root.

ii) Thinning

In the cultivation of those crops which are grown to obtain caryopses, thinning is an important farming work intended to provide individual plants with an equal area and ensure their smooth growth, and should be so carried out that there will be no hills which have too many plants.

To avert any sudden change in the growth condition and prevent the occurrence of deficit stable caused by pests or diseases, it is advisable that thinning be carried out twice, once when the plant grows to wear two to three leaves and once again when it puts on four to five leaves. It is to be noted that if thinning work is conducted after this period, smooth growth is impeded and plants cannot be thinned out readily. Guidance should be given to farmers so that they will learn the need for thinning out inferior individuals showing poor growth, heteromorphism or damage of pest or disease before healthy plants, and also the need for pulling out carefully so as not to damage unthinned plants.

iii) Intertillage and Weeding:

Intertillage has the effect of weeding and improving the physical properties of soil. It is practised the world over as it softens soil, improves air permeability, increases water peameability and moisture-holding power of soil, and as a consequence serves for better growth of crops.

In Lampung, however, softening of soil by intertillage conducted in the wet season works to the contrary, making the soil liable to erosion. Further, in case of soils having a large moisture content, intertillage not only breaks the single grain structure but also demands a large labour force. For these reasons, its application in the province should awit further studies though it should be conducted several times for the purpose of weeding and mixing fertilizer and soil at time of additional fertilizer application. Intertillage intended for such purposes should be so carried out that the upper part of the surface soil is lightly tilled with attention directed to the root distribution so as to minimize the root breaking. If conducted in such a manner, intertillage will prove useful in preventing moisture evaporation by cutting capilalry activity in soin for cultivation of upland crops during a period when rainfall is small and drought threatens to take place.

Weeding is another important farm work indispensable for satisfactory growth of crops. By preventing the growth of grasses, it enhances solar radiation and wind passage through plants, ensures effective utilization of nutrients and water, and also serves to remove the sources of bacteria and pests. Among many weeds growing in the province, the dominant is alang-alang (Imperata cylindrica) which propagates itself by the growth of the subterrenean stem. As a countermeasure against the growth of this grass, it is believed most effective to dig it out completely at time of plowing and soil preparation work or to bury it in deep in the ground by deep plowing. While these means should be actively employed for its extermination, it is also necessary to exert incessant effort for its extermination even after planting by pulling it out by hands as in the case of other grasses and cutting its roots as well. This grass has a repressive effect on the crop growth in the early growth period. Even after the first weeding is conducted immediately after germination, it is desirable that constant attention be directed to the growth of this grass to check its spread.

The team considers it worthwhile to study the application of herbicides in future, though it involves many problems at present.

4.2.1-7 Problems in Land Use

If intensive use of limited area of farmland alone is desired, it can be materialized by crop rotation for two to three croppings a year. For accelerated production and improvement of income level of ordinary farmers, such intensive land use must be coupled by the expansion of farmland. Lampung province has a vast land area which can be turned into farmland and also has much room for accepting many more settlers and expanding the acreage of cultivated land of ordinary farmers. Limit is set, however, on this large development potential by the present meagre scale of farm management which is evidenced by the fact that most farmers cannot afford draught

animals, to say nothing of powered farming equipment, and are forced to resort to human labour. To break out of this limit, there appears to be no choice but to accelerate the introduction of animal power and mechanical power besides promoting the use of improved agricultural machines and tools which can be efficiently put in use in the province.

The team noticed that both upland crops and paddy, which can be cultivated twice a year, are grown only once a year in many areas where canals are found but no sufficient supply of irrigation water can be expected due to geographical conditions. In these areas, land that could otherwise be used for second cropping is left idle. The team considers that such idle land should be used for cultivation of upland crops to increase the rate of land use in the province.

Most upland crops can be grown in such fallowed paddy fields if they are not ill-drained and have good soil condition. Upland crops to be introduced into such paddy fields should be the ones which promise highest economic effect and produce no adverse effect on the following paddy crop. It is to be noted that drainage ditches and high ridges may be required in growing upland crops in paddy fields in prevention of damages from temporary logging of rain water that could result from the poor water permeability generally observed in the surface soil of paddy fields.

As prerequisite to improved land use rate, there is the problem of stimulating farmers' willingness to work. Though this problem calls for immediate solution, it is to be remembered that the establishment of techniques aimed primarily at labour saving is also a pressing need of the hour.

4.2.1-8 Labour Saving Measures

Expansion of operational holding and elevation of land use rate will obviously present the problem of labour shortage and heavier farm labour. To bring a solution to this problem, labour saving efforts should be made through introduction of draught animals or powered farming equipment which will serve for improvement of work efficiency.

Labour saving is required, among others, for plowing and soil preparation work. At present, the large number of both labourers and working days required for this work sets limit on the acreage of cultivated land, and also allows no sufficient time for preparing for succeeding crops, so that double cropping is hardly practised. In view of this fact, reclamation of alang-alang fields and introduction of large tractors deserves due attention, but this is a work to be undertaken by an organization expected to propel the saving of agricultural labour. For ordinary farm households, a plan for promoting the introduction of animal power should be mapped out to enable them to bear the workload ensuing from the large-scale work of the propelling organization. Implementation of this plan demands that farmers have the fund to purchase animals and can take good care of them. For this purpose, a credit system should be established under which farmers will be provided with a loan repayable over a long period or in calves or foals under liberal conditions, and studies should be made for smooth supply of forage and prevention of diseases.

Introduction of animal power should be accompanied by the application of various farming equipment. For the immediate future, introduction of plowing and soil preparing equipment such as plows, harrows and ridgers will have to be planned under a long-term repayment system. With the accumulation of funds in future, introduction of such other equipment as tools and instruments for fertilizing, sowers, intertillers, weeders and so on would have to be considered. All these equipment should be inexpensive, highly durable and easy to handle, and studies should be made for development and utilization method of equipment meeting such requirements.

While the use of sprayers is a must for effective control of pests and diseases, development and introduction of winnowing and preparing equipment, designed for quality improvement and higher processing capacity, are an important approach to labour saving.

In short, labour saving should be pushed forward in a manner that promises the lowest financial burden for farmers, contributes to the improvement of both productivity and quality, and assures an income level surpassing the investment effect. It is therefore hoped that basic studies on farming equipment will be made in parallel with economic survey.

4.2.1-9 Extension of Techniques and Enlightenment of Farmers

In order that farmers are enabled to take direct advantage of newly developed techniques in their production activity, administrative actions should be taken for establishment of farmers' technical guidance system and farmers themselves should be organized.

At present, the Agricultural Extension Office is taking the leading part in the technical guidance activity as well as in the organization of farmers in Lampung. However, if the staffs of the provincial government and kabupaten extension offices are excluded, the number of extension workers expected to play the major role in the guidance of farmers is less than one for each ketjamatan, and it is believed that each extension worker is compelled to cover as many as about three thousand farm households. The existing extension system is far too imperfect to cope with the future technical improvement, and should be reinforced by a sharp increase of extension workers and their proper disposition. Duties of the extension worker should be such that he constantly endeavours to grasp the problems he faces to map out and carries out his extension plan in the specialized field and district he covers under instructions from the higher level organ, and also reviews and evaluates the outcome of his own extension service and exerts efforts to cover any defects in his service in a manner that contributes to the fostering of farmers' organizations and strengthening collective and individual technical guidance activity. He should also engage himself, whenever occasion so demands, in the enlightenment of farmers through establishment of a demonstration farm, holding of agricultural fairs and exhibitions, and audio-visual education. To enable him to improve capabilities though contact with his colleagues, it is necessary to establish a system for periodical training of extension workers and reinforce their training institutions.

Farmers, on the other hand, will have to be awakened to the significance of actively cooperating with extension workers in the development of their respective districts. It will be quite useful for future agricultural development to accelerate the education of farmers, particularly those in younger age groups, and to promote the diffusion of fundamental agricultural knowledges and production techniques through the existing agricultural centres.

4.2.2 Fundamental Approach to Technical Cooperation in Upland Crop Development

The existing state of Lampung's upland crop cultivation indicates that its development will contribute to the economic development of the whole nation, and will also promise stabilized supply of various products needed by Japan. Japan should offer its financial and technical aid for such development, and to make the aid truly effective, it should not be offered in an all-round manner. Rather, the aid should be extended concentrically to priority districts and priority crops to be designated according to the progress of development so that all the aid programmes will be organically and sucessfully woven into an efficient development system.

From the said viewpoint, it leaves very little doubt that Tegineneng and its neighbourhood should be designated as the top priority district because this area is in the central part of Lampung and close to the province's capital and export port, and embraces a vast wild field and farmland area where advanced cultivation techniques are not at all introduced. As for the priority order of crops excluding perenial crops, it is considered reasonable to give top priority to maize because it is designated as the second important crop after paddy by the Indonesian government and its accelerated production under an aid programme is proposed by the Japanese government. The team is of the opinion that the accelerated maize production should be pushed forward in due consideration of the maintenance of land productivity and overall production volume and with efforts directed towards establishing a rationalized farm management of maize and other crops.

Maize is not a very profitable crop for farmers; the income per unit area of maize is lower than that of pulses and cassava. However, judging from the experimental cultivation conducted either with fertilizer application or with countermeasures taken against pests and diseases, it is believed that if improved cultivation techniques are introduced it will produce a gross income which is approximately equivalent to that of other crops as shown in the table below. Introduction of improved cultivation techniques is therefore considered to bring about the highest production increase to maize and promise a payability that can well stand comparison with other crops.

It goes without saying that Japan's cooperation in the accelerated maize production should be offered in the form of the so-called project method in which technical aid is to be concentrically extended together with financial aid required for the development of priority districts. Further, the aid should be offered after a detailed survey and discussions between the two governments about details.

Gross Income by Crop (per ha)

Crop	Income by Conventional Cultivation Techniques					Income by Improved Cultivation Techniques				
	Price per kg	x	Yield per ha	=	Income (Rp)	Price per kg	x	Yield per ha	=	Income(Rp)
Upland Paddy	RP 15	x	900 kg	=	RP 13,500	Rp 15	x	3,000 kg	=	Rp 45,000
Maize	12	x	900	=	10,800	12	x	4,000	=	48,000
Pulses	60	x	600	=	36,000	30	x	1,500	=	45,000
Cassava	2.5	x	9,200	=	23,000	2.5	x	20,000	=	50,000

Note: Price per kg of pulses produced by conventional cultivation techniques (Rp 60) is considered an abnormally high price invited by the poor crop in the major producing areas in 1970. With the future production increase and resulting recovery of the balance between demand and supply, the price will very probably decline and maintain the Rp 30 level.

As already pointed out, the aid programmes should be implemented in an integrated and systematic way for improvement of production techniques, reduction of production cost, improvement of quality and distribution, etc. For this purpose, a system should be established under which problems can be pointed out, basic and applied researches are conducted to produce evidence of the problems, and the outcome of such activity can be developed into a new extension service.

The provincial government of Lampung has already established an upland crop seed centre in Tegineneng district with the view to enhancing the seed multiplication of maize and other crops and training of farmers. It is possible to provide intensive guidance on farm management and technical extension by enlarging the research and experiment function of this centre through financial aid provided for improvement of its facilities, by supplying the centre with equipment and materials for technical cooperation and dispatching to it experts specialized in different fields, and by selecting priority districts which will be increased in future with the centre taking the leading part in their development. The team believes that if such guidance activity is financially backed up to materialize the establishment of tractor stations, winnowing and preparing facilities and collecting yards, and also supported by the dispatch extension experts who will be stationed in the province to offer their advices and recommendations, the development will prove quite effective and its pace accelerated.

It is to be added that these plans should be carried out in collaboration with the existing commercial estates so as to improve their technical level and obtain their assistance in the collection and marketing of products.

4.3 Agricultural Development Centre

4.3.1 Its Necessity and Background

Agricultural development in Lampung calls, above all other things,

for the improvement and extension of the basic agricultural techniques. The provincial government of Lampung established its Seed Farm in Tegineneng about 36 km to the north of Tandjung Karang in 1970. While the primary purpose of this farm was to multiply seeds of chiefly maize, the Japanese Preliminary Survey Team for Accelerated Maize Production in Indonesia (Leader: Dr. Keiji Urano) dispatched around the end of 1970 recommended to the Indonesian government that the farm's function be expanded to that of a maize centre which would not only engage in seed multiplication but also undertake such other activities as tests and experiments for development of techniques, training of extension workers, installation and operation of demonstration farms, and so on. [1] In view of the fact that the province's agricultural development scheme is beginning to be put in practice, it is hoped that the maize centre, which is to be established under Japanese technical aid, will not only handle maize but also cover other crops including paddy. The proposed site of the centre embraces a paddy field of about 1 ha and has a water source for dry season cultivation. This paddy field can be expanded to cover an area of 4 to 5 ha. A paddy field can also be created, if need arises, in one of the corners of the 30 ha farmland area facing the said site across the national highway. Indonesian authorities originally had the intention to leave the seed multiplication of paddy to the Seed Farm in Metro about 20 km from Tegineneng. However, this original idea was abandoned as Indonesian government agreed to the team's opinion that a higher efficiency can be achieved rather by concentric seed multiplication activity at one place i. e., Tegineneng, than by establishing a number of seed farms in different places, for different crops. As a consequence, a general agreement was reached between the Indonesian authorities and the team that an Agricultural Development Centre should be established. What is left to be done in future, therefore, is to draw up a detailed plan for its establishment and discuss with Indonesian authorities for its implementation.

The following subsections give an outline of the plan conceivable at present.

4.3.2 Purpose and Functions

The centre will be established primarily for promoting agricultural development of Lampung and perform the following functions.*

1) Provision of advices and information required for the planning and execution of development projects.

2) Performance of surveys, researches and experiments bearing on agricultural development.

3) Training of extension workers and key farmers.

4) Provision of advices for agricultural development, particularly for land improvement work and management and maintenance of related facilities.

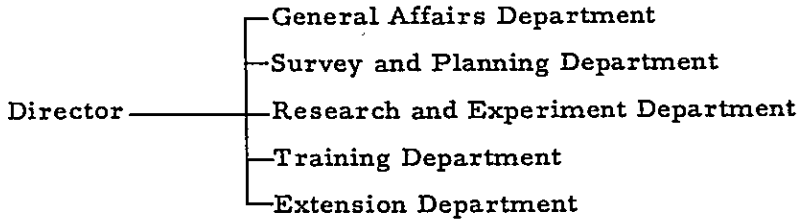
5) Provision of guidances for the installation, operation and management of demonstration farms.

6) Multiplication and distribution of seeds and seedling of improved varieties.

* Item 9) and 4) were added by the team after its return to Japan, and the opinions of Indonesian authorities have not yet been confirmed as of November 1971.

4.3.3 Organization

The centre is planned to be composed of the following five departments.



It is planned that a total of ten Japanese experts will be dispatched to three of the above-mentioned five departments, i. e., one agricultural economist to the Survey and Planning Department, one each of experts specialized in breeding, cultivation (paddy and upland crops), soil, fertilizer, pathology, pest and disease control, civil engineering, and agricultural machinery to the Research and Experiment Department, and one each of extension experts specialized in paddy and upland crops to the Extension Department. Granting that these ten experts suffice for the design of buildings and facilities, it is desirable that additional experts will be dispatched as need arises. Indonesians are naturally to assume the posts of the director and chiefs of respective departments, and will also take the leading part in the extension work with texts provided by Japanese experts.

4.3.4 Organizational Status of Centre

The paramoung problem involved in the establishment of the centre is to determine its organizational status, i. e., to determine whether it should be placed under the control of the provincial government or Central Government.

Within the setup of the Central Government, civil engineering works are under the jurisdiction of the Ministry of Public Works, and food crops such as paddy, pulses, tuber crops, tuber root crops, etc. are under the control of the Directorate General of Agriculture of the Ministry of Agriculture, whereas industrial crops, estate agriculture and research and experiment institutes are controlled by the Directorate General of Agriculture of the same ministry. If the centre is placed under the direct control of the Central Government, there will arise the problem of determining which of the government offices the centre should belong to, and there also is the probability that the above-mentioned vertical organizational setup of the Central Government will be directly introduced.

The centre's research and experiment activities should of course be conducted in close collaboration with the Central Agricultural Research Institute which belongs to the Directorate General of Agriculture. However, if the centre is established as one of its branches, it could result in too narrow a scope of its activity.

As a realistic and rational solution to this problem, the team proposes that the centre be set up as an organ belonging to the provincial government and yet performing the function of a local experiment station affiliated to the central research organ.

It is also proposed that the centre maintain close contact with the branch of the Central Agricultural Research Institute located in Tamambogo from the very beginning, and aborb it with the expansion of the centre's activity if the approval of the Central Government is obtained.

4.3.5 Research and Experiment Activity

Subject Crops: Major crops in Lampung such as paddy, maize, soybeans, groundnuts, cassava, hot pepper, coffee, etc.

Major Subjects of Research and Experiments:

1) Study on the agricultural production, market trend and development programmes.
2) Analysis of meteorological conditions.
3) Soil classification and study of soil characteristics.
4) Selection of crops suited for introduction.
5) Selection and breeding of suitable varieties of respective crops.
6) Study of cultivation method of respective crops by cropping season and soil nature.
7) Analysis and control of pests and diseases of major crops.
8) Study of harvesting, winnowing and preparing method of respective crops.
9) Study on the irrigation requirement of respective crops.
10) Study for improvement of land infrastructure and soil conservation.
11) Development and improvement of farming equipment.

4.3.6 Training and Extension Activities

Extension workers stationed in Lampung number 76 who are considered to cover about 100 thousand ha of paddy field and about 200 thousand ha of upland field. Each extension worker is therefore expected to cover an area of as large as four thousand ha. Since these extension workers are given a one-week training only once a year without even using texts, their capability cannot be considered to be on a high level. In the case of Lampung Tengah where 30 additional extension workers are planned to be stationed as from 1972, it will be an urgent need to improve their ability. The team considers that a minimum of 30 days should reserved for the training of extension workers (Extension workers in Japan are given training for a period equivalent to about one-tenth of their actual service period). In parallel with the training of extension workers, the centre should also provide training to key farmers who are giving propelling force to the extension work.

It is expected that the extension service will be offered, as in the past, through key farmers and demonstration farms. In both training and extension activities, Indonesian staffs should take the leading part and

Japanese experts should act as advisers and assist in their activities.

4.3.7 Facilities of Centre

Existing facilities and building and facilities to be constructed in future are as shown below, though all these need to be confirmed by further detailed surveys and through discussions with Indonesian government.

1) Existing Facilities (Source: Footnote 1) in subsection 4.3.1 and the present survey)

Office (2)	10m x 40m and 6m x 12m
Warehouse	8m x 15m
Concrete drying yard	15m x 30m
Dormitory for staffs (2)	7m x 10m and 7m x 14m
Dormitory for labourers (2)	5m x 30m x 2 (8 families)
Water pump	15 Hp
Farming equipments	
Wheel tractor (28.5Hp)	7 units
Automatic tiller	4 " (delivery expected shortly)

2) Facilities Required in Future

Paddy field (4 ~ 5 ha) and reservoir for dry season crops
Power generation facilities
Water supply facilities
Centre building (housing laboratory rooms)
Rest house for staffs and visitors
Lecture room and laboratory room for training
Dormitory for trainnees
Crop inspection room
Rest room for farmers
Farming equipment repair facilities
Farming equipment storehouse

The generator facilities should comprise two sets, one having a capacity of about 50 Kw for daytime operation and the other with a capacity of about 5Kw for night tight security purpose. For water supply, it is desirable that a well be dug with an over-head tank installed to secure water supply for a certain time in case of service interruption.

4.3.8 Living Environments of Japanese Experts

It is advisable that Japanese experts live in Tandjung Karang because the distance between the city and the proposed site of the centre allows for commutation by car. Tandjung Karang is a rapidly developing city with a population of about 200 thousand, and has no security problems at present.

Its power generation facilities was improved in 1970, and its rather small water supply capacity can be supplemented by drilling a well. Further, construction of houses for foreigners is now in progress.

For the education of experts' children, a Japanese school with a dormitory will have be constructed in Jakarta. Completion of this school will unlock the education problem confronting the many Japanese living in Indonesia.

ANNEX TABLE

(1) Annex Table

Annex Table 1 - Paddy Field Area by Year in Four Districts in Mid-stream Basin of Sekampung River

(Unit: ha)

Irrigation District	Design Irrigation Area	Wet Season				Dry Season		
		1967/68	1968/69	1969/70	1970/71	1968	1969	1970
Sekampung								
Trimurdjo	5,014	3,020	3,020	3,054	-	2,763	2,611	2,787
Batanghari	3,869	3,363	3,042	3,061	-	1,102	1,395	2,100
Sekampung	5,472	1,820	1,870	2,050	-	562	1,150	1,215
Raman	2,869	1,275	1,504	1,453	-	870	970	940
Metro	1,411	993	1,008	1,049	-	0	592	706
Pekalongan	3,274	1,100	1,258	1,429	-	0	300	637
Total	21,909	11,575	11,702	12,096	13,061	5,297	7,018	8,385
Raman Utara								
Raman Adji I	2,068	-	-	560	-	77	614	355
Raman Adji II	2,118	-	-	940	-	629	485	400
Raman Adji III	2,093	-	-	855	-	0	314	250
Total	6,279	706	2,340	2,355	2,524	706	1,413	1,005
Batanghari Utara								
Taman Asri	3,921	-	-	2,166	-	974	1,204	1,012
Purbolinggo	3,421	-	-	800	-	88	125	445
Total	7,342	2,220	2,630	2,966	3,124	1,062	1,329	1,457
Punggur Utara								
Trimurdjo	-	-	-	-	-	0	0	989
Punggur	-	-	-	-	-	0	0	0
Kotagadjah	-	-	-	-	-	0	0	0
Total	30,843	1,419	2,124	2,028	3,000	0	0	989
Grand Total	66,373	15,920	18,796	19,445	21,709	7,065	9,810	11,836

Annex Table 2 - Rainfall Data in Metro

Rain-gauge Station: Metro (No. 228c)
Elevation : +57m
Unit : mm

(1) Monthly Rainfall Data

Month / Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nob	Dec	Total	Max. one-day Rainfall	
														Rainfall	Date
1950	227	229	173	98	139	231	202	140	167	239	432	221	2,498	98	11.26
51	379	239	161	34	86	111	115	122	78	104	71	185	1,685	100	1.5
52	408	274	350	176	157	120	65	154	161	131	395	448	2,839	131	11.26
53	282	308	198	106	282	56	105	21	28	19	202	47	1,654	144	5.5
54	139	243	267	364	304	161	-	66	61	152	-	-	-	(84)	(5.16)
55	507	287	213	182	70	114	216	47	96	50	208	371	2,361	130	3.30
56	314	266	294	78	51	112	100	255	232	105	211	252	2,270	144	8.26
57	379	163	365	169	70	85	142	63	35	56	196	89	1,812	87	1.31
58	430	255	204	114	53	33	142	62	70	89	248	303	2,003	103	1.4
59	347	348	382	51	192	106	117	4	43	73	156	85	2,004	68	5.24
60	558	254	210	83	127	108	86	246	130	76	126	324	2,328	90	12.19
61	381	295	102	302	200	132	13	0	0	0	65	130	1,620	115	2.14
62	301	125	316	189	59	127	76	49	141	140	188	293	2,004	134	9.10
63	389	342	235	132	132	33	0	0	0	20	122	196	1,608	105	2.8
64	300	181	492	325	62	92	67	77	83	361	235	237	2,512	120	1.20
65	356	164	235	109	36	8	35	3	7	4	185	247	1,389	75	11.14
66	319	79	139	199	12	26	32	1	28	39	149	131	1,154	80	4.5
67	261	233	139	132	41	0	38	0	0	17	-	-	-	56	4.5
Average	349	238	243	167	115	95	91	73	76	98	199	229	1,973		

Rain-gauge Station: Metro (No. 228c)
Elevation : +57m
Unit : day

(2) Monthly Number of Rainy Days

Month / Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1950	17	16	12	7	7	10	9	9	6	9	16	16	134
51	15	13	12	2	6	5	5	5	6	6	11	14	100
52	17	19	17	12	10	4	12	11	12	10	18	18	160
53	20	14	17	10	17	7	5	2	6	3	6	6	113
54	15	13	13	14	12	14	-	7	7	11	-	-	-
55	18	15	13	15	4	5	9	7	8	7	18	18	137
56	17	18	15	7	4	7	5	7	-	9	12	12	-
57	14	7	18	10	9	4	11	8	-	6	7	7	-
58	11	14	16	9	8	3	5	10	4	6	18	18	122
59	14	14	13	6	12	9	6	1	4	7	19	18	123
60	-	19	12	9	10	6	5	10	9	4	9	19	-
61	14	13	11	18	16	8	2	0	0	0	11	9	102
62	18	12	16	11	9	-	8	-	3	11	16	16	-
63	18	14	18	17	15	5	0	1	0	4	14	16	122
64	19	15	19	16	9	8	8	4	11	14	19	14	156
65	18	9	18	7	9	4	1	2	2	4	9	19	102
66	20	9	14	15	4	7	4	1	4	6	10	9	103
67	17	11	12	11	6	0	1	0	0	1	-	-	-
Average	16.6	13.6	14.8	10.9	9.3	6.2	5.6	5.0	5.1	6.9	13.3	14.3	121.6

Annex Table 3 - Meteorogical Data Recorded at Dam Arogoguruh

(1) Monthly Rainfall

(Unit: mm)

Month / Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1964							91	71	135	232	174	227	-
65	220	202	254	65	89	110	50	15	14	82	200	150	1,451
66	320	241	362	481	35	47	3	8	25	40	218	235	2,015
67	246	219	56	223	145	67	-	-	0	40	90	297	-
68	456	429	296	165	215	139	189	-	28	233	261	305	-
69	211	299	205	297	150	67	60	68	53	102	135	149	1,796
70	261	381	680	296	272	113	80	12	107	13	38	57	2,310
71	50	305	405	431	184	113	34	92					-
Average	252	297	323	280	156	94	72	44	52	106	159	203	

(2) Monthly Number of Rainy Days

(Unit: days)

Month / Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1964							7	4	8	12	7	14	-
65	10	13	13	85	5	8	3	2	1	5	8	14	90
66	14	9	11	16	2	7	1	2	5	8	12	10	97
67	17	16	12	15	9	4	-	-	0	3	4	11	-
68	16	15	15	11	9	8	10	-	3	12	8	18	-
69	14	16	13	8	8	6	3	4	3	8	7	7	97
70	13	7	13	9	8	4	4	3	4	2	10	20	97
71	20	23	20	15	15	10	4	6					
Average	14.9	14.1	13.9	11.7	8.0	6.7	4.6	3.5	3.4	7.1	8.0	13.4	

(3) Maximum Monthly Rainfall through Year

(Unit: mm)

Month / Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nob	Dec	Max. one-day Rainfall through Year: Rainfall	Max. one-day Rainfall through Year: Date
1964							40	35	46	35	85	47	-	-
65	47	33	93	30	55	35	38	10	14	35	48	27	93	3. 4
66	55	95	79	81	30	15	3	5	8	10	45	50	95	2. 6 2.26
67	45	50	10	12	25	50	-	-	0	20	40	50	-	8.11 12.24
68	75	75	97	20	68	30	160	-	15	37	75	75	160	7.18
69	52	95	75	125	40	15	30	50	32	30	31	39	125	4.14
70	40	98	155	99	60	56	40	8	42	10	12	8	155	3. 4
71	12	74	62	76	38	50	15	34					-	-

Annex Table 4 - Average Monthly Discharge of Sekampung River

Observation Point: Dam Argoguruh

Unit: m^3/sec

Month / Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nob	Dec	Average
1966							20.0	15.2	18.2	20.8	28.8	40.7	-
67	-	111.9	66.1	76.6	73.2	27.8	20.8	13.3	10.7	9.1	7.3	100.2	-
68	131.5	62.4	80.8	246.2	80.2	41.6	52.9	65.7	63.8	75.6	104.0	133.7	94.9
69	128.5	139.9	133.9	153.5	93.6	85.9	72.3	25.3	56.9	29.2	48.2	72.3	86.6
70	138.1	248.2	200.7	158.8	122.6	80.3	40.8	38.0	39.5	35.9	27.0	84.2	101.2
71	194.5	85.0	95.1	110.0	55.6	51.6	29.0	21.5					-
Average	148.2	129.5	115.3	149.0	85.0	57.4	39.3	29.8	37.8	34.1	43.1	86.2	79.7

Annex Table 5 - Harvested Area and Yield of Paddy in Katjamatan Trimurdjo (1961~1970)

Year	Wet Season Paddy			Dry Season Paddy		
	Paddy Field Acreage	Unit Yield	Yield	Paddy Field Acreage	Unit Yield	Yield
		ton/ha	ton	ha	ton/ha	ton
1961	3,336	2.00	6,672	1,390	-	-
1962	3,510	2.47	8,675	1,260	-	-
1963	2,875	1.98	5,682	658	0.11	74*
1964	2,095	3.00	6,285	780	1.50	1,173
1965	3,000	3.00	10,762	1,100	1.36	1,500
1966	2,999	2.46	7,373	1,730	1.50	2,595
1967	3,181	2.01	6,392	1,179	0.30	350**
1968	3,113	2.50	7,772	882	4.21	3,716**
1969	2,998	2.12	6,342	916	3.61	3,306
1970	2,289	3.50	8,012	1,214	3.50	4,249
Average	2,939	2.52	7,397	1,106	-	-

Notes:
1. Yield is expressed in gabah (unhusked rice).
2. Data of dry season paddy for 1961 and 1962 are not available.
3. * indicates that the yield dropped by damages caused by rats, and ** likewise indicates that the yield declined by locust damages.

Annex Table 6 - Planned and Actual Irrigation Areas in Sekampung (1970/71)

(Unit: ha)

Turnout Number	Cumulative Total of Canal Length	Number of Intake at Turnout	Planned Irrigation Area		Actual Irrigation Area		Rate of Irrigation	
			Distance	Cumulative Total	Distance	Cumulative Total	Distance	Cumulative Total
Main Canal	m						%	%
Dam Argoguruh	0							
KH 1	8,000	2	115	20,647	115	13,061	100	63
KH 2	9,000	1 2	12,872 12,459 413	20,532	8,413 8,049 364	12,946	66 65 88	63
KH 3	12,000	1 3	2,984 2,213 771	7,660	1,842 1,154 688	4,533	62 52 89	59
KB 1	16,000	2	216	4,676	215	2,691	100	59
KB 2'	17,000	1	41	4,460	17	2,476	41	56
KB 2"	17,400	1	35	4,412	15	2,459	43	56
KB 2A	18,000	1	293	4,384	153	2,444	52	56
KB 2	19,500	1	247	4,091	230	2,291	93	56
KB 3	22,000	1 3	686 481 205	3,844	500 300 200	2,061	73 62 98	54
KB 4	24,000	2	235	3,158	175	1,561	74	49
KB 5	26,500	2	74	2,928	74	1,386	100	47
KB 6	28,000	1 2	881 617 264	2,854	419 177 242	1,312	48 29 92	46
KB 7	30,000	1 4	639 392 247	1,973	303 93 210	893	47 24 85	45
KB 8'	32,000	1	180	1,334	110	590	61	44
KB 8	35,500	2	235 326 210	1,154	170	480	72	42
KB 9	37,000	1 2	536	919	220 140 80	310	41 25 67	34
KB 10	38,700	2	383	383	90	90	24	24
KH 2	0							
KBH 1	800	1	13	12,459	13	8,049	100	65
KBH 2	1,900	1	288	12,466	288	8,036	100	65
KBH 3	3,400	2	231	12,158	231	7,748	100	64
KBH 4	4,600	2	401	11,927	401	7,517	100	63

Turnout Number	Cumulative Total of Canal Length	Number of Intake at Turnout	Planned Irrigation Area		Actual Irrigation Area		Rate of Irrigation	
			Distance	Cumulative Total	Distance	Cumulative Total	Distance	Cumulative Total
	m						%	%
KBH 5	6,000	3	705	11,526	705	7,116	100	62
KBH 6	8,200	3	460	10,821	460	6,411	100	59
KBH 7	11,800	3	476	10,361	457	5,951	96	52
KBH 8'	-	1	80	9,885	75	5,494	94	56
KBH 8"	-	1	50	9,805	50	5,419	100	55
KBH 8	15,300	1 4	1,871 1,208 663	9,755	1,269 730 539	5,369	68 60 81	55
KBH 9	17,700	4	742	7,884	633	4,100	85	52
KBH 10	20,000	2	203	7,142	184	3,467	91	49
KBH 11	22,500	2	323	6,939	291	3,283	90	47
KBH 12	25,000	1 3	998 774 224	6,616	128 395 133	2,992	53 51 59	45
KBH 13	25,800	1 1	1,089 971 118	5,618	398 280 118	2,464	37 29 100	44
KBH 14'	-	1	270	4,529	224	2,066	83	46
KBH 14	28,500	1 4	3,160 2,415 795	4,259	1,562 1,190 372	1,842	49 49 47	43
KBH 15A	-	1	70	1,099	50	280	71	26
KBH 15	31,000	2	229	1,029	130	230	57	22
KBH 16	32,200	3	800	800	100	100	13	13
Secondary Irrigation Canal								
KH 3	0							
KR 1	2,000	2	355	2,213	330	1,154	93	52
KR 2	6,200	2	312	1,858	290	834	93	44
KR 3	8,800	2	130	1,546	102	534	79	35
KR 4'	-	2	156	1,416	127	422	81	31
KR 4"	-	2	135	1,200	110	305	82	24
KR 4	11,000	3	691	1,125	175	195	25	17
KR 5	13,200	2	434	434	20	20	5	5
KB 3	0							
KBW 1A	400	1	44	481	42	300	96	62

Turnout Number	Cumulative Total of Canal Length	Number of Intake at Turnout	Planned Irrigation Area		Actual Irrigation Area		Rate of Irrigation	
			Distance	Cumulative Total	Distance	Cumulative Total	Distance	Cumulative Total
KBW 1	2,200m	1	105	437	100	258	95%	59%
KBW 2'A	2,900	1	12	332	12	158	100	48
KBW 2A	3,400	1	78	320	78	146	100	46
KBW 2'	4,200	1	38	242	34	68	90	28
KBW 2	5,400	2	204	204	34	34	17	17
KB 6	0							
KBZ 1'	-	1	54	617	52	177	96	28
KBZ 1	2,920	3	563	563	125	125	22	22
KBM	0							
KBM 1'	1	8	392	8	93	100	24	
KBM 1	2,700	3	384	384	85	85	22	22
KB 9	0							
KBO 1	2,540	3	326	326	80	50	25	25
KBH 8	0							
KBJ 1	1,960	3	505	1,208	386	730	76	60
KBJ 2	4,100	1	211	703	62	344	29	49
KBJ 3	5,800	2	492	492	282	282	57	57
KBH 12	0							
KBM 1	1,500	4	774	774	395	395	51	51
KBH 13	0							
KS1 1	2,100	1	162	971	90	280	56	29
KS1 2	4,630	3	809	809	190	190	24	24
KBH 14	0							
KMI 1	2,420	4	1,106	2,415	490	1,190	42	49
KMI 2	4,700	2	376	1,249	150	700	40	56
KMI 3	7,100	3	873	873	550	550	63	63

Notes: 1. Figures enclosed with a circle indicate the numbers of secondary canals branching off from the main canal.
2. Figures in parenthesis indicate the distance covered by the main canal and by the secondary canal.
3. The cumulative total of planned irrigation area shown in this table (20,647.7 ha) does not conform to the official figure of 21,909 ha.

Annex Table 7 - Rate of Planned and Actual Irrigation Areas in Raman Utara District (1970/71)

(Unit: ha)

Turnout Number	Cumulative Total of Canal Length	Number of Intake at Turnout	Planned Irrigation Area		Actual Irrigation Area		Rate of Irrigation	
			Distance	Cumulative Total	Distance	Cumulative Total	Distance	Cumulative Total
	m						%	%
Main Canal								
Dam Raman	0							
BRU 1'	4,360	1	40	6,279	18	2,523	45	40
BRU 1	6,360	2	117	6,239	46	2,505	39	40
BRU 2	7,100	1	34	6,122	32	2,459	94	40
BRU 3	8,538	2	115	6,088	21	2,427		40
BRU 4	9,488	2	1,590 1,405 185	5,973	486 450 36	2,406	31 32 20	40
BRU 5	10,148	2	38	4,383	17	1,920	45	44
BRU 6	11,054	2	134	4,345	30	1,903	22	42
BRU 7	12,125	3	249	4,211	79	1,873	32	45
BRU 8	13,130	2	113	3,962	55	1,794	49	45
BRU 9	14,311	3 4	929 208 511	3,849	365 33 220 112	1,739	37 16 43 53	45
BRU 10	15,719	2	165	2,920	131	1,385	79	47
BRU 11	17,804	1 3	662 392 270	2,755	230 130 100	1,254	36 33 37	46
BRU 12	19,679	1 3	714 524 190	2,093	437 263 174	1,021	61 50 91	49
BRU 13	20,976	3	264	1,379	100	587	61	43
BRU 14A	-	1	107	1,115	60	427	56	38
BRU 14	21,476	2	66	1,008	66	367	100	36
BRU 15	22,726	1 1	244 186 58	942	120 120 0	301	49	32
BRU 16	23,746	2	53	698	44	181	83	26
BRU 17	24,976	2	93	645	77	137	83	21
BRU 18	25,776	3	321	552	60	60	19	11
BRU 19	27,726	2	231	231	0	0	0	0
Secondary Canal								
BRU 4	0							

Turnout Number	Cumulative Total of Canal Length	Number of Intake at Turnout	Planned Irrigation Area		Actual Irrigation Area		Rate of Irrigation	
			Distance	Cumulative Total	Distance	Cumulative Total	Distance	Cumulative Total
BA 1	1,250m	2	67	1,405	28	450	42%	32%
BA 2	2,232	4	659	1,338	104	422	16	32
BB 1	3,357	2	117	433	32	79	27	18
BB 2	4,307	2	316	316	47	47	15	15
BA 3	4,382	2	95	679	61	318	64	47
BA 4	6,562	2	100	584	2	257	2	44
BA 5	9,082	2	55	484	54	255	98	53
BA 6	11,032	5	429	429	201	201	47	47
BRU 4	0							
BC 1	400	3	185	185	36	36	20	20
BRU 9	0							
BD 1	1,242	3	300	511	92	220	31	43
BD 2	2,348	2	44	211	44	138	100	65
BD 3	3,948	2	107	167	94	94	56	56
BRU 9	0							
BE 1	929	2	208	208	33	33	16	16
BRU 11	0							
BF 1	600	4	392	392	130	130	33	33
BRU 12	0							
BG 1	565	2	125	524	123	263	98	50
BG 2	3,561	2	114	399	70	140	61	35
BG 3	4,727	2	285	285	70	70	25	25
BRU 15	0							
BH 1	1,000	2	186	186	120	120	65	65

Annex Table 8 - Rate of Planned and Actual Irrigation Area in Batanghari Utara District (1970/71)

(Unit: ha)

Turnout Number	Cumulative Total of Canal Length	Number of Intake at Turnout	Planned Irrigation Area		Actual Irrigation Area		Rate of Irrigation	
			Distance	Cumulative Total	Distance	Cumulative Total	Distance	Cumulative Total
Main Canal	m							
Dam Garongan	0							
G 1	10,716	2	321	7,562	226	3,124	70	41
G 2	11,984	1 4	478 190 288	7,241	249 83 166	2,898	52 44 58	40
G 3	12,699	1	61	6,763	61	2,649	100	39
G 4	13,409	1 1	956 814 142	6,702	590 496 94	2,588	62 61 66	39
G 5	13,659	1	135	5,746	94	1,998	70	35
G 6	15,529	3	478	5,611	275	1,904	58	34
G 7	16,679	1 1	390 339 51	5,133	260 32 28	1,629	67 68 55	32
G 8	17,029	1 1	998 936 62	4,743	466 416 50	1,367	47 44 81	29
G 9	19,600	1 3	429 170 259	3,745	193 23 171	903	45 13 66	24
G 10A	-	1	38	3,316	38	710	100	21
G 10B	-	1	52	3,278	28	672	54	21
G 10	21,675	3	210	3,226	138	644	45	20
G 11	23,035	1	154	2,916	83	506	54	17
G 12	27,421	1 3	1,188 1,061 127	2,762	205 117 88	423	17 11 69	15
G 13	28,627	2	307	1,574	116	218	38	14
G 14	29,487	2	266	1,267	67	102	25	8
G 15	31,579	4	442	1,001	17	35	4	4
G 16	33,903	2	179	559	6	18	3	3
G 17	34,453	2	160	380	6	12	4	3
G 18	35,139	2	220	220	6	6	3	3
Secondary Canal								
G 2	0							

Turnout Number	Cumulative Total Canal Length	Number of at Turnout	Planned Irrigation Area Distance	Planned Irrigation Area Cumulative Total	Actual Irrigation Area Distance	Actual Irrigation Area Cumulative Total	Rate of Irrigation Distance	Rate of Irrigation Cumulative Total
TB 1	1,042m	2	190	190	83	83	44%	44%
G 4	0							
TE 1	1,484	1	122	814	116	496	95	61
TE 2	3,332	4	495	692	297	380	60	55
TE 3	6,410	2	197	197	83	83	42	42
G 7	0							
TP 1	500	2	123	339	116	232	94	68
TP 2	3,034	2	216	216	116	116	54	54
G 8	0							
TK 1	625	2	136	936	94	416	69	44
TK 2	2,750	5	554	800	238	322	43	40
TK 3	5,450	2	246	246	84	84	34	34
G 9	0							
PU 1	2,239	2	170	170	22	22	13	13
G 12	0							
P 1	3,414	2 1	1,061	638 337 86 1,061	0 117 117 0	117	0 11 18 0	11
P_2Ki	4,438	5	638	638	117	117	18	18
P_2Ka	5,214	3	737	737	0	0	0	0

Annex Table 9 - Irrigation Rate in Area Planned to be Covered by Tertiary Canels
Three Districts in Mid-stream Sekampung Basin

District / Irrigation Area	Irrigation Rate(%)	Sekampung: Less than 20	20~40	40~60	60~80	80~95	95~100	Total	Average Rate in Percentage	Raman Utara: Less than 20	20~40	40~60	60~80	80~95	95~100	Total	Average Rate in Percentage	Batanghari Utara: Less than 20	20~40	40~60	60~80	80~95	95~100	Total	Average Rate in Percentage
Less than 20					1		4	5	% 4	2		1	1		2	6	% 7				2			2	% 3
20~ 40		1		1		1	4	7	5	2	1	1	2	2	10	18	21				1		1	2	3
40~ 60				1	2	4	5	12	9	3	3	3	5	1	4	19	22	1		4	1	2		8	11
60~ 80		1	1		4	2	3	11	8	3	2	2	2	2		11	12	2		1		4	2	9	12
80~100			1		2	3	4	10	8	3	4	2			1	10	11	3	1	5	1			10	14
100~120			1	1	3		6	11	8	3	3	2	1	1		10	11	6	1	2	1		1	11	15
120~140			1	1	1	4	6	13	9	3	3	1				7	8	7	1	3	2		1	14	20
140~160			3	2	2	2	1	10	8	2		1				3	3	1	2	1	3		1	8	11
160~180				2		1	2	5	4	1	2	1				4	5	1	1	2				4	6
180~200		1			5	3	1	10	8										2	1				3	4
200~220		2	1	3	1		1	8	6																
220~240		1	3			2		6	4															1	1
240~260			1	1		2	-	4	3																
260~280						3	2	5	4																
280~300		2		2			2	6	4																
300~500		3	3	1	1	2		10	8																
Total		11	15	15	22	29	41	133	-	22	18	14	11	6	17	88	-	21	8	19	12	6	6	72	-
Rate in Percentage		8	11	11	17	22	31	-	100	25	20	16	13	7	19	-	100	29	11	27	17	8	8	-	100

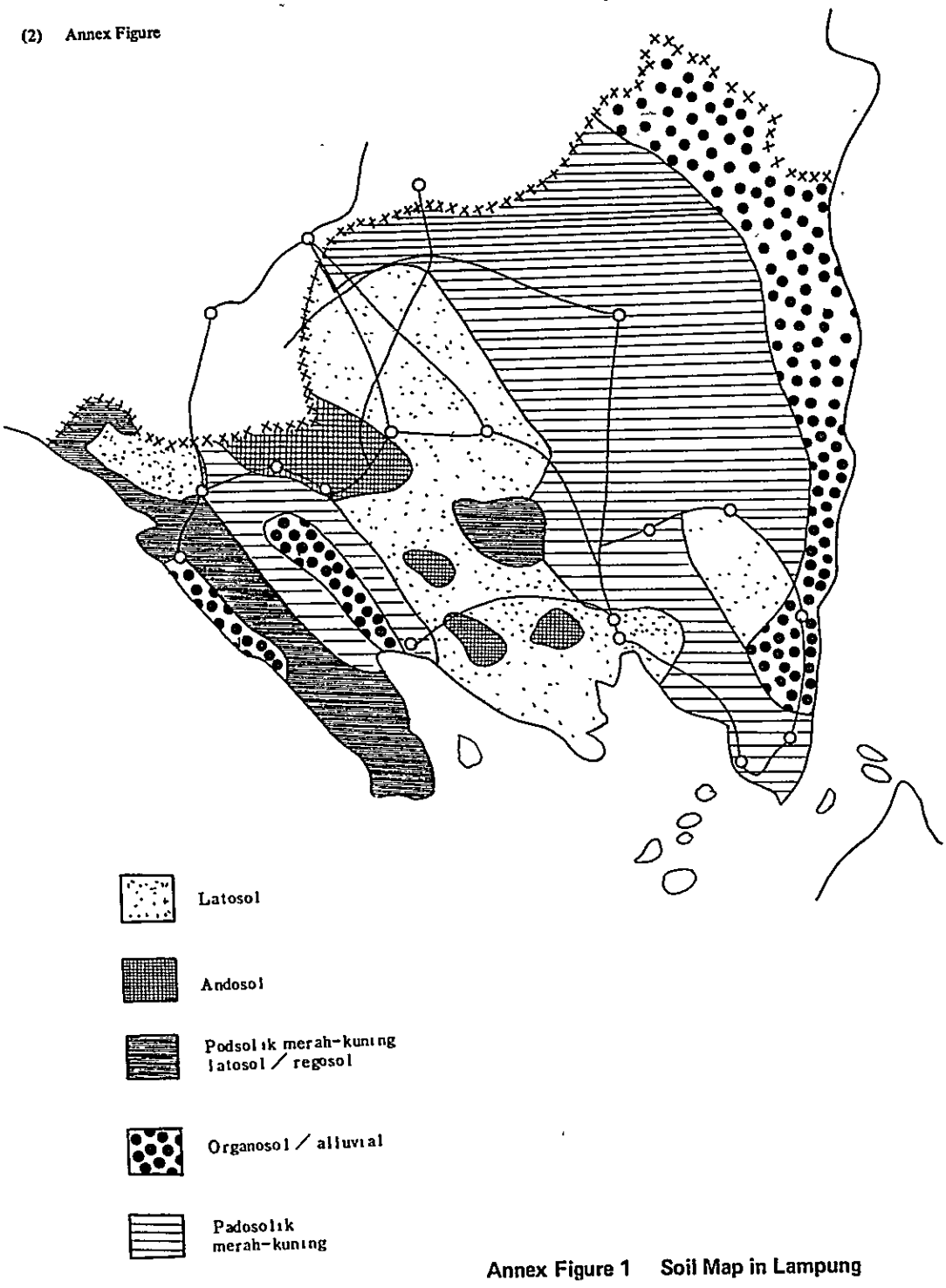
Note: Planned irrigation are per intake is 155 ha in Sekampung, 71 ha in Raman Utara and 105 ha in Batanghari Utara.

Annex Table 10 - The Chart of Rice Field Acreag (in ha)

	Province	Fully Technical	Semi technical	Non technical	Total	"Lebak" ared lake/ flood region	Rain fad	Total
1	Djakarta Raya	496903	186925	331123	2014951	-	299275	1304226
2	West Java							
3	Central Java	389045	120395	212015	721455	2737	324424	1048616
4	Secial Province of Jaogjakarta	7218	35702	127623	170543	-	7894	178347
5	Easte Java	537204	113475	249313	899992	-	292544	1192536
	Java	1430370	456497	920074	2806941	2737	914137	3723725
6	Atjeh	-	91782	4695	96477	-	5943	102420
7	North Sumatra	19973	27576	96806	144355	18064	117502	339921
8	West Sumatra	4214	53853	29961	88028	-	-	88028
9	Riau	-	935	1922	2857	4864	2665	10386
10	Djambi	3200	3985	6150	13335	33628	22386	66349
11	South Sumatra							
12	Lampung	51356	10892	16369	78617	26610	3986	109213
	Sumatra	78743	189023	155903	423369	83166	212482	716317
13	West Kalimantan	-	-	10877	10877	44148	46089	101114
14	Central Kalimantan							
15	South Kalimantan	-	18159	66463	84622	70181	10598	165401
16	East Kalimantan	-	-	16354	16354	-	-	16354
	Kalimantan	-	18159	93694	111835	114329	56687	282869
17	Notthand Central Sulawesi	10673	2800	23893	37366	2030	1805	41201
18	Southand East Sulawesi	122894	15435	60550	198879	10550	7568	216997
	Sulawesi	133567	18235	84443	236245	12580	9373	258198
19	Maluku	-	15	-	15	-	55	70
20	West Irian	-	-	-	-	-	-	-
21	West Nusa Tenggara	64544	42592	27450	134586	-	18774	153360
22	East Nusa Tenggara	5000	2350	47169	54519	1096	1894	57509
	Bali	-	30680	50533	81213	-	-	81213
		69544	75637	125152	270335	1096	20723	392152
	Indonesia	1712224	757551	1379266	3849041	2139081	213402	5276351

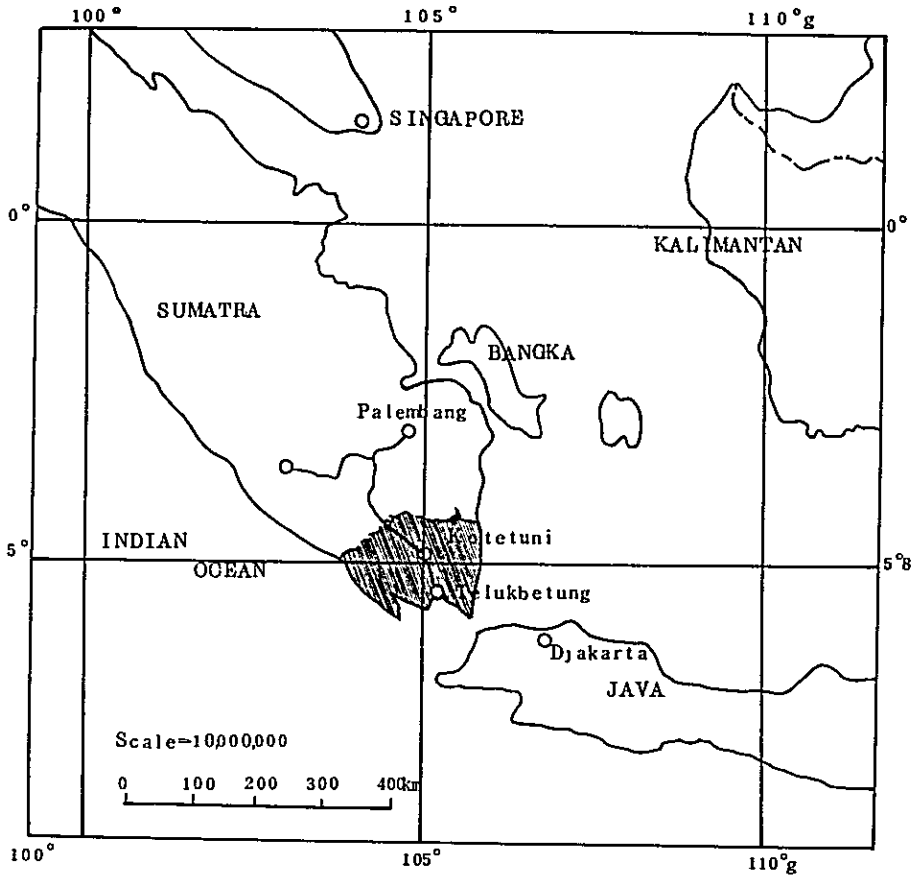
Source: Data for February 1964 provided by the Water Resources Department, Ministry of Public Works.

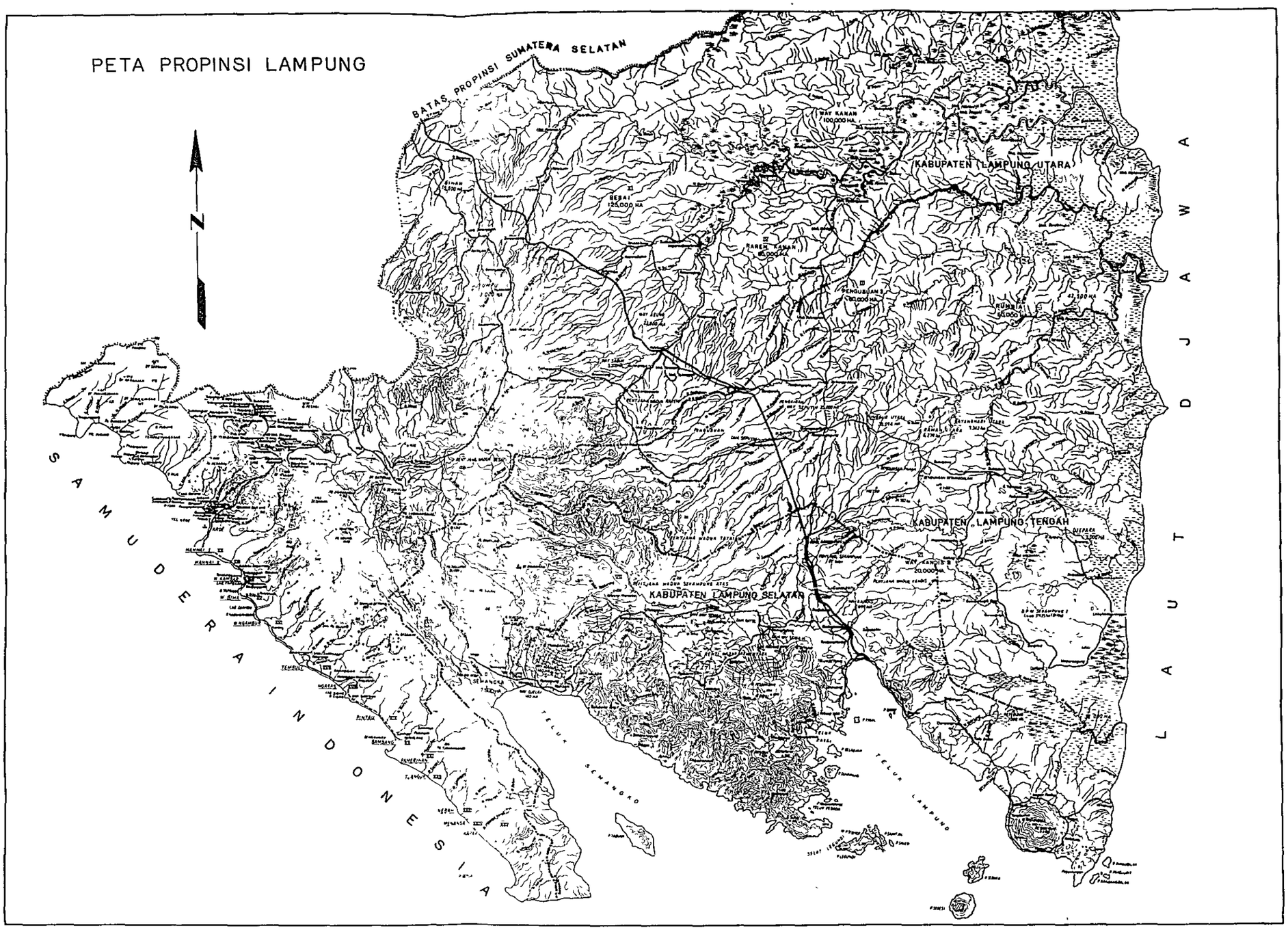
(2) Annex Figure



Annex Figure 1 Soil Map in Lampung

Annex Figure 2 LOCATION MAP OF LAMPUNG PROVINCE




PETA PROPINSI LAMPUNG
BATAS PROPINSI SUMATERA SELATAN
N
KABUPATEN LAMPUNG UTARA
KABUPATEN LAMPUNG TENGAH
KABUPATEN LAMPUNG SELATAN
TELUK SEMANGKO
TELUK LAMPUNG
S A M U D E R A I N D O N E S I A
L A U T
D J A W A