ANNEX - IV

SOIL MECHANICS FOR PROJECT FACILITIES DESIGN

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ANNEX - IV

SOIL MECHANICS FOR PROJECT FACILITIES DESIGN

1. GENERAL

The Project includes such structures as diversion dam, intake facility, canals and its related structures. It is considered that the diversion dam should be designed based on the soil mechanics consideration utilizing the available informations concerning the soils and its mechanics, as the dam is considered to be vital. But, unfortunately the informations regarding the soil mechanics in the Project area are not enough to design the project facilities properly. As such, various design conditions of the soil which are required for the design of the dam will be discussed in the followings using the data which have become available in the course of the feasibility study.

2. FOUNDATION SOIL

Such structures as the diversion dam, temporary diversion work, spillway, siphons, bridges, etc. and embankment and cutting for the canals are considered in the Project. It may be judged, generally speaking, that as the scale of these structures is relatively small, the intensity of pressure to be borne by these structures will not be so much. Accordingly there will be no significant problems in the foundation treatment. But, it is better to confirm the safety of the structures and soils as much as possible utilizing the data available although they are not at all sufficient for the in-depth discussions.

2.1 Foundation of Diversion Dam

Some borings have been carried out at the proposed dam site by the Government of Indonesia and additional borings are also going on at the said site. Some of the boring data obtained from the proposed dam site show that there exist sand deposits of about 3.50m depth in the center of the Cibeureum river and the N-values within this layer range 3 to 31 and in deeper layer, N-values become larger. The said layer contains gravel whose diameters are 3 to 50mm and the percent of the gravel is around 5%.

The upper portion of the layer is very loose, accordingly the bearing capacity at the upper portion of the layer is negligible. But in the deeper layer, lower than 2.0m below the ground, the layer is moderately confined and the expected bearing capacity will be around 10.0 t/m^2. The permeability of this layer is relatively high ($k=10^{-2}$ to 10^{-3} cm/sec). At the both banks of the dam site, weathered soils having the depth of about 10.0m which are composed of clayey sand are observed and the N-values in the layer range 13 to 18. Sand layer is partially sand-wiched in the layer. This sand layer should be excluded when the construction of the dam is started. The bearing capacity of this weathered layer may be estimated by the following equation.

$$C = N/16 \ (kg/cm^2) \quad \ldots\ldots (1)$$

$$qd = 5.14 \cdot C \quad \ldots\ldots (2)$$

Assuming that N=16, we obtain $C=1.0$ kg/cm^2. Putting this into equation (2), we obtain $qd=5.14$ $kg/cm^2=50$ ton/m^2.

The soil layer existing lower than 10.0m from the ground is generally hard and compacted and it is composed of clayey shale rock, accordingly there will be no problems in bearing capacity.

2.2 Other Foundation Soils

During the second feasibility study field survey, cone penetration tests were carried out in the concaved portions of the Project area as well as in the marshy area within the Project area. The results obtained are presented in Fig.IV-1. According to the results, the soils upto the depth of 0.1 to 0.8m are weak. If this weak foundation is removed, it is expected that the foundation soil which has a bearing capacity of about 10 to 15 ton/m^2 may be expected. As to the foundation soil for the bridges, the bearing capacity of about 15 to 20 ton/m^2 may be expected after removing the surface soil of about 2 to 3m depth.

2.3 Embankment Material

In this section, discussions are made only on the material to be used for the embankment of the diversion dam and the main canal. The surface soil and weathered soil near the ground surface in the Project area are generally suitable for the core material of the diversion dam and also for the embankment of the main canal.

Generally speaking, these soils are composed of very fine grains and are sticky. Accordingly, if these soils are disturbed under the high water content conditions, the soils will suddenly lose the strength and it will make the earth work difficult. But, under the natural conditions, these soils show the natural moisture content of about 25 to 50%, which is very close to the most optimum water content or a little bit higher than that. Utilizing the properties of these soils, these soils may be compacted fully after spreading them with the thickness of about 20 to 30cm. If it is possible to maintain the compaction rate of more than 95%, reliable strength as the foundation soil and relatively high impermeability may be expected.

In this case, it is expected to adopt the values of C=1.0 kg/cm^2 and angle of internal friction of ϕ=0° or C=0.4 kg/cm^2 and angle of internal friction of 10° to 20° for the design of the foundation, and the permeability in the soils thus compacted will range from 10^{-5} to 10^{-7} cm/sec. As to the rock material in the Project area, such rocks as sand stone and andesite which belong to the Miocene Epoch Age, the stability of these materials will be high and the angle of internal friction of more than 40° may be expected.

3. MATERIAL FOR THE DIVERSION DAM

A zoned rock fill type dam as shown in Fig. IV-2 has been proposed considering the geologic conditions of the dam site, construction cost, etc. In this section, some detailed discussions will be made on the design of the dam using limited data obtained mainly from the Government of Indonesia. In the design of the dam the upstream and downstream slopes of each zone have been decided as follows.

Zone	Upstream slope	Downstream slope
Impervious zone	1 : 0.2	1 : 0.2
filter	1 : 0.3	1 : 0.3
transition	1 : 1.2	1 : 1.0
rock	1 : 3.0	1 : 2.5

The material required for these zones must have the following properties.

(a) Impervious zone

The material used for the impervious zone shall have the high impermeability of about $k=10^{-5}$ cm/sec and shall be composed of fine grain of soils. The soils shall have the properties of $C=1.0$ kg/cm^2, $\phi=0^o$ or $C=0.4$ kg/cm^2, $\phi 10$ to 20^o and the dry density of 1.0 to 1.4 t/m^3. The grain size distribution curve shown in Fig. IV-3 presents the ranges of the grains which can be used for the fill type dam. As for the grain size distribution of the soils obtained from several soil surveys, they have shown the similarity with the said distribution curve. So it may be judged that the soils considered for the dam should be compacted under the condition that the moisture content of the soil is maintained at a little bit higher than the most optimum moisture content, and the compaction ratio should be maintained at around 90 to 95%. The soils to be used for the dam shall be spread with the thickness of 20cm and after that the soils shall be compacted by roller confirming the compaction ratio mentioned above.

(b) Filter zone

Filter zone shall be provided between the materials whose permeabilities are different each other to avoid the flowing-out of the impervious materials in the dam due to seepage flow. The filter zone must have the function to avoid piping action which may collapse of the dam. Usually, sand, gravels and artificially crashed stones are used for the filter zone. These materials are composed of cohesionless ones. The material used for the filter zone is usually composed of fine grain of less than 0.074mm and the total percentage of the fine grain is less than 50%, and the permeability of the material is 10 to 100 times bigger than that of the core material to be potected. These materials are obtainable from the Cibeureum and Ciberang rivers bed and also from the coastal area of Java sea.

(c) Transition zone

The transition materials are provided between the pervious and impervious zones to avoid the sudden change in grain size of the material. The required conditions for the grains to be used for the transition zone are not so severe compared with those for the filter zone. Sands, gravels and mucks are usually used for the transition zone. But, these materials are generally not obtainable in natural condition. So it is recommended to use sand stones, andesites and agglomerates which belong to Miocene Epoch Age for the transition zone. These materials are available in Bedengantjol which is located between the national road connecting Bogor to Rangkasbitung and the railway. These materials shall be crashed into pieces prior to its use as the transition materials.

(d) Rock zone

Rock materials used for rock zone shall have the required shear strength and the permeability of more than $k=10^{-3}$ cm/sec and shall be chemically stable as well as hard and durable. The materials suitable for rock zone may be produced from the crashed sand stones, andesites and agglomerates. Adopting these materials as the rock zone, it is expected that they have the cohesion of $C=0.2$ kg/sm^2, angle of internal friction of $\phi 35^o$ and dry density of $d=1.6$ t/m^3 or $C=0$, $\phi 40^o$ and $d=1.6$ t/m^3. It is expected that further detailed study on the decision of the each section of the dam will be made in the future paying attention to the above mentioned figures.

Fig. IV-1-(1) Results of Conepenetration Test(conducted Nov. 1982)

PLACE	DEPTH (cm)	q_c (kg/cm²)	PLACE	DEPTH (cm)	q_c (kg/cm²)
1 -1 Near the river at Gageg.	5	-	1-2 Near the river at Gadeg	5	6.39
	10	1.54		10	
	20	3.23	could not be penetrated at the depth of 0.05 m.	20	
	30	4.24		30	
	40	7.32		40	
	50	5.70		50	
	60	8.70		60	
	70	9.24		70	
could not be penetrated at the depth of 0.80 m.	80	7.63		80	
	90			90	
	100			100	

PLACE	DEPTH (cm)	q_c (kg/cm²)	PLACE	DEPTH (cm)	q_c (kg/cm²)
1-3	5	-	2-1 IP 1	5	-
In the prepared paddy field for transplanting.	10	4.77	In the prepared paddy field for transplanting.	10	2.31
	20			20	3.00
could not be penetrated at the depth 0.10 m.	30			30	2.70
	40		q_c=0 in the depth of 0.30 to 1.10 m.	40	2.31
	50			50	3.08
	60			60	4.24
	70			70	5.39
	80			80	-
	90		could not be penetrated at the depth of 1.20 m.	90	-
	100			100	-

Fig. IV-1-(2) Results of Conepenetration Test(conducted in Nov. 1982)

PLACE	DEPTH (cm)	qc (kg/cm²)	PLACE	DEPTH (cm)	qc (kg/cm²)
2-2 (P 1	5	1.16	3 Near the railway	5	7.55
	10	1.69	could not be pene-	10	
"	20	1.93	trated at the depth of 0.05 m	20	
At the depth of 0.6 m to 1.10 m, qc=0	30	2.70		30	
	40	3.00		40	
could not be pene-	50	2.70		50	
trated at the depth of 1.20 m	60			60	
	70			70	
	80			80	
	90			90	
	100			100	

PLACE	DEPTH (cm)	qc (kg/cm²)	PLACE	DEPTH (cm)	qc (kg/cm²)
4-1 Near the road	5		4-2 Near the road	5	
from Cikande to Rangkasbitung	10	5.73	from Cikande to Rangkasbitung	10	3.49
	20	6.16	could not be pene-	20	4.62
	30	7.32	trated at the depth of 0.40 m.	30	5.39
could not be pene-	40			40	7.32
trated at the depth of 0.30 m.	50			50	
	60			60	
	70			70	
	80			80	
	90			90	
	100			100	

Fig. IV-1-(3) Results of Conepenetration Test(conducted Nov. 1982)

PLACE	DEPTH (cm)	qc (kg/cm²)	PLACE	DEPTH (cm)	qc (kg/cm²)
5 IP 92 Beginning point S 1 could not be penetrated at the depth of 0.05 m.	5	7.70	6 End point of S 1 could not be penetrated at the depth of 0.20 m.	5	-
	10			10	6.16
	20			20	7.70
	30			30	
	40			40	
	50			50	
	60			60	
	70			70	
	80			80	
	90			90	
	100			100	

PLACE	DEPTH (cm)	qc (kg/cm²)	PLACE	DEPTH (cm)	qc (kg/cm²)
7 IP 101 Beginning point of S 4 could not be penetrated at the depth of 0.20 m.	5	-	8 End point of S 4 could not be penetrated at the depth of 0.05 m.	5	6.93
	10	5.39		10	
	20	7.70		20	
	30			30	
	40			40	
	50			50	
	60			60	
	70			70	
	80			80	
	90			90	
	100			100	

Fig. IV-1-(4) Results of Cone-penetration Test(coducted in Nov. 1982)

PLACE	DEPTH (cm)	qc (kg/cm²)	PLACE	DEPTH (cm)	qc (kg/cm²)
9-1 IP 112 Beginning point of S-6. could not be penetrated at the depth of 5.0 m	5	3.33	9-2 Penetration test was conducted in the paddy field. could not be penetrated at the depth of 0.5 m.	5	-
	10			10	2.31
	20			20	3.23
	30			30	4.24
	40			40	4.85
	50			50	5.03
	60			60	
	70			70	
	80			80	
	90			90	
	100			100	

PLACE	DEPTH (cm)	qc (kg/cm²)	PLACE	DEPTH (cm)	qc (kg/cm²)
10 End point of S 6. could not be penetrated at the depth of 0.05 m.	5	6.93	11 End point of main canal could not be penetrated at the depth of 0.05 m.	5	10.01
	10			10	
	20			20	
	30			30	
	40			40	
	50			50	
	60			60	
	70			70	
	80			80	
	90			90	
	100			100	

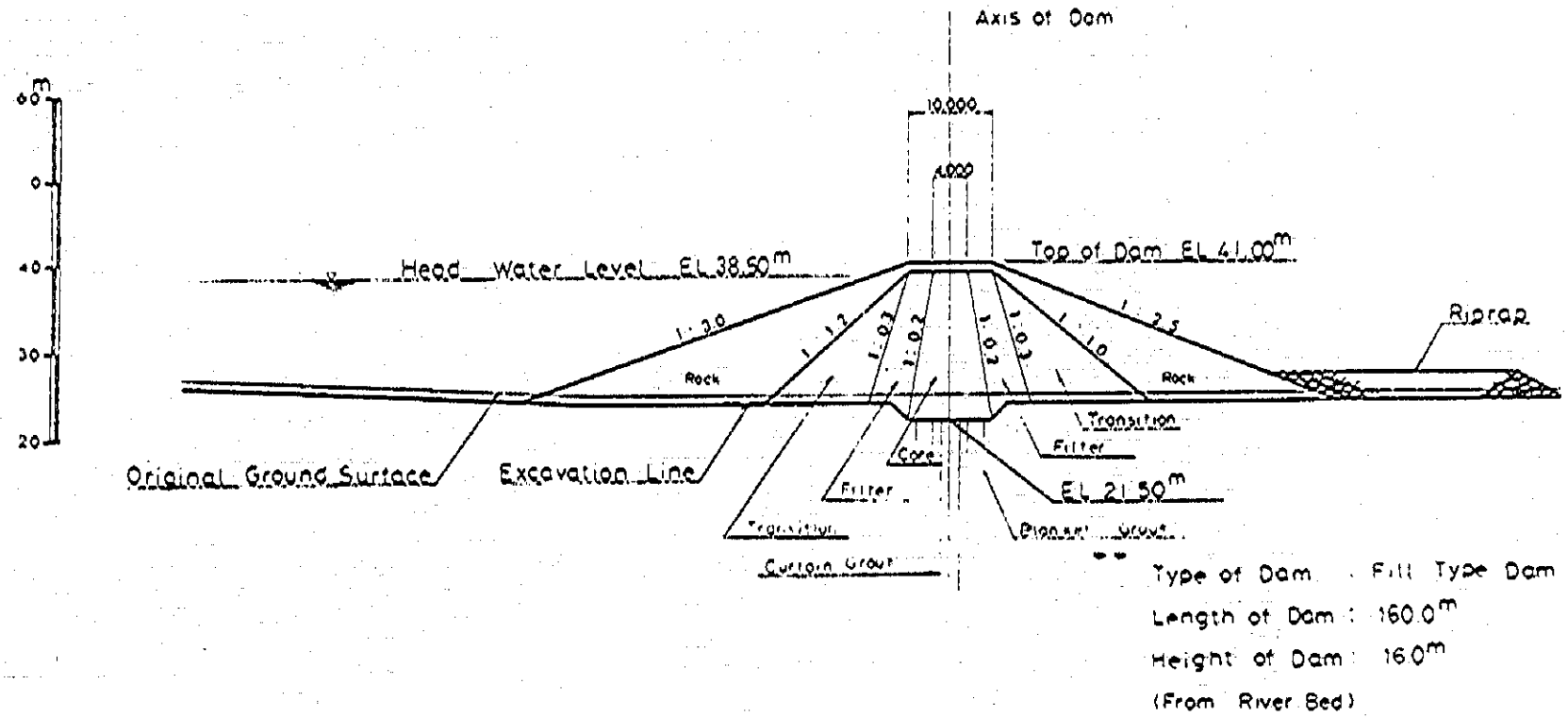

Fig. IV-2 TYPICAL CROSS SECTION OF DAM

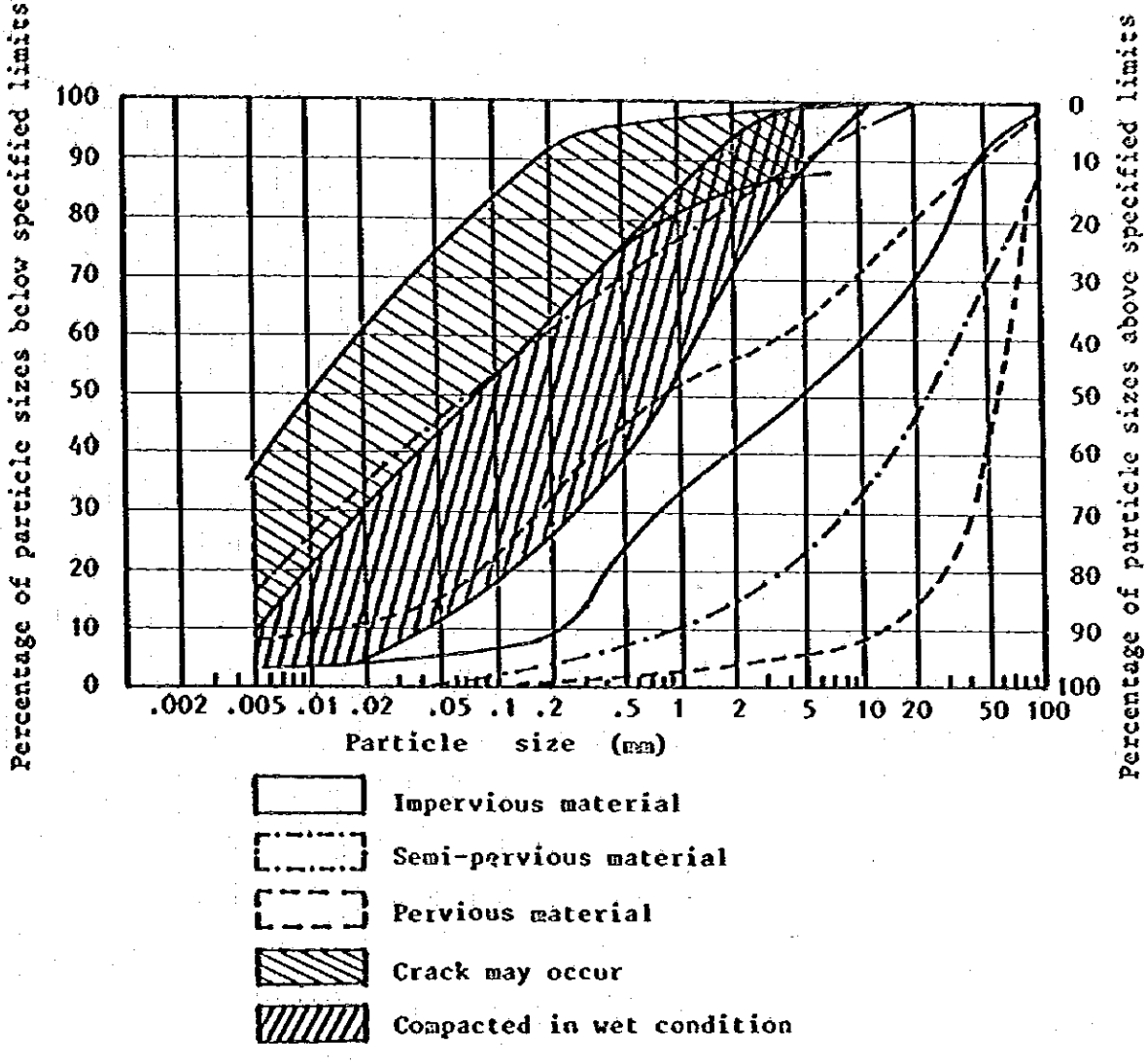

Fig. IV-3 Material Selection Chart

ANNEX - V

AGRICULTURE

ANNEX - V AGRICULTURE

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ANNEX - V

AGRICULTURE

1. GENERAL

The present studies on agriculture in the project area were mainly designed for the purpose to assess the potential productivity and to measure the possible differences in agricultural production between conditions with and without the K-C-C Irrigation Development Project.

The main objectives of these studies are:

(1) to study the present agricultural production in the project area,

(2) to find the optimum cropping patterns and farming practices in the area and evaluate the development potential in agricultural production,

(3) to estimate the improvement of agricultural outputs under the with-project condition.

In order to clarify the prevailing agricultural conditions and the development potential, the following field investigation and data collection were made in and around the project area:

(1) present land use survey using land use map/1 of 1/25,000 scale, with confirmation by aerial photographs and field reconnaissance,

(2) collection of data and information on present agricultural production including crop being grown, present cropping pattern, crop yield and production, farming practices, etc.,

(3) farm economy survey for collecting more practical information on farming practices and farm inputs.

/1: Laporan Survey Kapabilitas Tanah Daerah Aliran Ciujung, Serang-Banten, Jawa Barat, Direktorat Tata Guna Tanah, Direktorat Jenderal Agraria, 1979.

The data and information were mainly obtained from the government authorities concerned such as the Provincial Office of Agriculture Service, Agriculture Office in Kab. Serang, Central Research Institute for Food Crops in Bogor (BORIF), the Singamarta Experimental Station under BORIF, BAPPEDA Office, Bupati Office of Serang, Statistic Office in Serang, and Rural Extension Offices and Camat Offices in Kecamatans of Kopo, Cikande, Carenang and Pamarayan. The data and informations collected and referred are listed in Table V-1.

In parallel with such data collection, an extensive field investigation was made over the study area and on the basis of the overall results of field investigation and preliminary results of data analysis, interviews with some farmers were carried out so as to confirm the data and information mentioned above and also to obtain more practical and reliable information on farming practices and farmers intention concerning to the development.

2. PRESENT CONDITIONS OF AGRICULTURE

2.1 Present Land Use

The land use survey was carried out on the basis of land use map scaled 1/25,000 which had been prepared by Directorate of Land Use in 1979, and with confirmation by the field reconnaissance and aerial photographs as mentioned in the preceding chapter. The present land use in the study area is summarized as follows:

Land use category	Area	Proportional extent
	(ha)	(%)
Total area	11,500	100
Wetland rice field	5,000	43
Dryland field	1,000	9
Mixed farm and homeyard	5,000	43
Village and others	500	5

The land use in the study area is classified into four wide categories, i.e. wetland rice field, dryland field, mixed farm and homeyard, village and others.

The farmland comprising rice field and dryland field amount to about 6,000ha or 52% of the total area. Rice field occupies about 5,000ha or 83% of the main farmland. The rice field has been developed to possible maximum extent, however most of the rice field has been cultivated under rainfed condition.

Dryland field of about 1,000ha is developed near to the top of hilly area and used for mainly palawija crops like as vegetables, groundnuts, chillies, cassava and etc. under the rainfed condition. In the mixed farm and homeyard most of villagers grow fruit trees like as banana, coconuts, cassava, bamboo, forest, etc. The mixed farm and homeyard used for cultivation of crops is estimated at about 5,000ha or 43% of the total area. The remaining of about 500ha is villages, rivers, roads and others.

The present land use in the study area is illustrated on Fig. V-1.

2.2 Present Cropping Patterns

The main crops grown in the study area are wetland rice, followed by palawija crops such as vegetables, chillies and groundnuts which have been recently introduced into the study area by the efforts of the agricultural extension services. Other crops grown as adjunct to rice are coconuts, banana, etc. These crops are generally grown in the homeyard area sporadically located around the village area.

Most of the rice field in the study area is put under the rainfed condition, consequently rice farming is concentrated in the wet season and the rice field after harvesting of the wet season crop is generally left as fallow during the dry season. The palawija crops are generally grown in the dryland field in the rainy season. The cultivation pattern is affected by seasonal distribution of rainfall. The planting time and the harvesting time fluctuate year by year depending on the available rainfall water. The wet season rice is planted at the onset of the monsoon, usually in October to December, and harvested in April to June depending on the variety cultivated. The palawija crops are planted at the onset of the wet season mainly in the dryland field.

The agricultural survey has been made over the study area and it has been found that the cropping patterns prevailing in the study area can be classified into five major types as follows:

Cropping pattern			Planted area	Proportion
			(ha)	(%)
(1)	Rice	- (fallow)	4,050	67
(2)	Rice	- Rice	290	5
(3)	Rice	- Palawija	660	11
(4)	Palawija	- Palawija	370	6
(5)	Palawija	- (fallow)	630	11
	Total		6,000	100

Data source: The data shown above are estimated based on the Laporan Rencana Akhir Penetapan Pola Pertanaman Yang Akan Ditetapkan Dalam "OPSUS" Subur Makmur di Wilayah I Banten, Kecamatan PAMARAYAN dan KOPO, 1982. Agriculture Office, Serang Kabupaten.

The pattern (1) "Rice - (fallow)" is adopted about 80% of the rice field or about 68% of the total cultivated field and predominant in the study area, and found mainly in the rainfed rice field. The pattern (2) "Rice - Rice" is found in very limited areas where at the foot of hill and very short irrigation water is available during the dry season. The pattern (3) "Rice - Palawija" is found in the rainfed rice field at the higher part of hills and never found along the bottom of valleys. The pattern (4) "Palawija - Palawija" and (5) "Palawija - (fallow)" are found in the dryland field under the rainfed condition.

The present multi-cropping intensity is estimated at about 122%. Such low cropping intensity is basically attributable to shortage of available irrigation water.

These cropping patterns prevailing in the study area and the cropping intensity are summarized in Table V-2 and illustrated on Fig. V-2 with related climatological factors.

2.3 Present Farming Practices and Farm Inputs

The rice cultivation is carried out by labour intensive form from the stage of seeding to harvesting. Animal power, mainly buffaloes, is extensively used for land preparation. The use of agricultural machinery is not common.

The cultivation method of wetland rice is mostly ordinary transplanting method. In some places where it is difficult to get sufficient water to start nursery and puddling, the direct sowing method (Go-Go Rancah) is applied and after getting sufficient water of rainfall, it is kept under submerged condition. This method has been introduced recently and not practiced in large area yet. Besides these two methods, there is method to be called "Joged" which transplants seedlings under the dry field condition in case where the puddling water is not available in time and kept under the submerged condition after getting sufficient rainfall, this method is also applied in very limited area.

The varieties widely used are local varieties called as "Cerai", long growth duration from seed to seed of about five months. Besides the local varieties, in some places, new high yielding varieties such as Cisadane, Cimandiri, Citarum have been introduced for the rainy season crop. IR 36 is also introduced for the purposes of dry season cropping or multi cropping of rice a year due to short growth duration of about 105 days from seed to seed.

The fertilizers and agro-chemicals are widely used. The fertilizers being used are urea, triple superphosphate (T.S.P.). The average dosages are 100kg of urea and 50kg of T.S.P. per hectare. Use of insecticides and rodenticides is common. Major insecticides are Diazinon and Sevin mainly for stem borers and bugs. Application is done by using knapsack type sprayers and motorized portable sprayers. Zincphosphate is widely used as rodenticide.

Harvesting is generally done by method of "Ani-ani" or "Sabit" using sickle and threshed by manpower.

The cultivation of palawija crops is recently introduced with recommendation by the agricultural extension services with new varieties and cultivation methods.

The farm inputs and labour requirements for cultivation of rice and palawija crops under the present condition are shown in Tables V-3 and V-4.

2.4 Crop Yield and Production

The crop yield and production under present condition are estimated on the basis of production data obtained from agricultural office in the level of each

Kecamatans i.e. Pamarayan, Kopo and Cikande concerned to the study area. The total rice production per year is almost constant in these Kecamatans with gradual increase as shown in Table V-5. The yield fluctuates year by year but not in wide range.

The average planted area of rice in Kecamatans, Pamarayan, Kopo and Cikande, from 1977 to 1981, is estimated at about 13,600ha. The planted area of palawija crops is about 5,000ha on an average. The average harvested areas of rice and palawija crops from 1977 to 1981 in Kecamatans, Pamarayan, Kopo and Cikande are about 12,700ha and about 4,400ha, respectively (see Tables V-5 - V-15). The difference between planted and harvested areas are considered as the areas damaged by various causes such as flood, drought, insects and rodents. The average damaged areas for rice and palawija are estimated at 900ha (or about 7%) and 600ha (or about 12%), respectively.

Applying the above proportions for estimation of the planted, harvested and damaged areas in the project area are culculated as follows:

(Unit: ha)

Total	Planted area	Harvested area	Damaged area
Rice field	3,800	3,530	270
Palawija crop field (10% of rice field)	380	330	50

The average planted area and production of rice in these three Kecamatans are 13,600ha and 43,100 tons per year. The average yield is estimated at 3.2 ton/ha. The production of palawija crops fluctuates in wide range in year by year, but the unit yield for palawija crops are almost constant crop by crop (see Tables V-6 V-15). The present productions of rice and palawija crops in the project area are also estimated by using the average unit yields derived from the above Tables and the estimated planted areas in the project area as shown below.

	Crop	Planted area (ha)	Unit yield (ton/ha)	Production (ton)
1.	Rice	3,800	3.2	12,160
2.	Palawija:	380		
	Maize	35	0.7	25
	Groundnuts	155	0.8	124
	Chillies	155	1.8	279
	Vegetable beans	35	2.1	74

Note: Rice field only is considered to be the field included in the Project area.

2.5 Livestock Production

Livestock raising is not a mainline of agricultural activities in the study area. Most of livestock are grazed on a small scale in and around the rice field. The important animal is buffalo as draught animal for farming. The number of livestock animals in the study area is summarized below, and details are in Table V-16.

Animals	Total number	Per farm household
Cattle	23	-
Horse	141	-
Buffalo	11,809	0.5
Goat	11,547	0.5
Chicken	153,709	6.9
Duck	14,986	0.7

3. BASIC CONCEPT FOR DEVELOPMENT

3.1 Agricultural Constraints

Most of the project area covered with well developed rice fields. However, rice cultivation is generally made under rainfed condition. Irrigation facilities are quite limited in this area. The cultivation pattern is, therefore, directly

affected by seasonal distribution of rainfall. Rice cultivation is concentrated in the wet season and is very limited in the dry season. The areas under rice cultivation fluctuate year by year, depending on available rainfall.

In the wet season, road condition becomes muddy and it makes transportation of farm inputs and products so difficult, especially in the imperfectly drained areas and the poorly drained areas. The present poor road condition also hampers agricultural activities in this area.

The average holding size of farm land in the Project area is rather small and there is very limited availability of additional arable land to be newly reclaimed. It means that the holding farm size of farmers tends to become smaller with population growth. Under such circumstances, the farm income should be increased through the improvement of unit land productivity.

As far as cultivation technique concerned, there is much room for improvement. The agricultural extension services have been making efforts to introduce new high yield rice varieties, palawija crops with advanced cultivation techniques. Instead of the efforts, the farmers in the Project area are mostly still continuing cultivation of low yield local rice verieties which are tolerant to drought and with long growth duration. The reason of the above situation is mainly due to the rainfed cultivation.

The constraints which hinder the improvement of land productivity, are mainfold as mentioned above. The decisive constraint among them is, however, lack of infrastructural facilities like perennial irrigation and drainage systems and farm road network.

3.2 Basic Concept for Agricultural Development

The Project aims at the increse in agricultural production and thereby improvement of the farmer's living standard in the Project area through exploitation of new water resources from the Cibeureum river as well as provision of prerequisite facilities for irrigation and drainage purposes. The Project should also contribute to the realization of the government policy for equalization of social welfare in the country and to saving of foreign exchange for imported rice. With this in view, the major concept for agricultural development in the Project area would be as follows;

(1) Unit yield and production of wet season rice should be stabilized and improved through establishment of new irrigation system and, introduction of irrigation farming practices,

(2) Planted area of dry season rice should be increased with year-round irrigation system and thereby total production of rice be maximized,

(3) Special attention should be given to the incease in irrigation area upto the potential maximum area of 3,500ha in corformity with the Government policy for equalization, as well as for maximum total benefits,

(4) Present farm road network should be improved and the agriculture activities be made more active, and

(5) Agricultural institutions, which support agricultural development, should be strengthened, especially in the field of agricultural extension services and water management.

4. Agricultural Development Plan

4.1 General

The project area is considerably matured area for agricultural production under rainfed condition with a fixed crop rotation system. Under such condition, the agricultural economy of the area is rather stable and no significant improvement is made unless large scale irrigation project is implemented. In the long run, however, the production techniques such as new varieties, efficient use of fertilizers, prevention of pests and diseases are gradually progressing and certainly lead to changes of agricultural production. These changes are, however, neglected in the estimation of possible changes attributable to the project, partly because, they have influence on both with and without the project and partly because the effect of these factors is generally so insignificant.

The future agricultural economy of the project area will be forecasted on the conditions reflecting the changes attributable to the project. Although the agricultural productivity in the project area may gradually increase to a slight extent even in the future without the project condition, such changes are disregarded in the analyses of agricultural benefits.

4.2 Basic Conditions

(1) Location

The K-C-C survey area is located at about 90km west of Jakarta along the national road from Jakarta to Merak, the ferry port to Sumatra. The study area for the K-C-C Irrigation Development Project is situated in the southern part of the K-C-C area bounded by the Kabupaten road between Cikande and Babakan. The study area is about 11,500ha and administratively includes most part of two Kecamatans of Kopo and Pamarayan and small part of Kecamatan Cikande (See Fig. V-3).

(2) Human Resources

The population in the study area is estimated at about 59,800 as of 1980. The population growth rate is estimated at about 2.7% per annum during the period from 1971 - 1980. The total working population in the age group of 15 - 49 years old is 26,910. The total number of household is about 13,080 and the average size of family is 4.57 persons. The number of farm household is 12,630 and about 97% of the total number of household. The average cultivation area of rice field per farmhousehold in the project area is estimated at about 0.4ha. The details of the demographic condition in the study area are given in Chapter 2 of ANNEX-VI.

(3) Soils

The soils in the Project area are classified into four (4) soil units, i.e. Eutric Fluvisols, Eutric Gleysols, Orthic Acrisols and Dystric Nitosols according to the FAO/UNESCO soil classification system. In the light of the land capability analysis, the most of the rice fields in the Project area, except for the rice field of the depression or having shallow effective soil depth, are suitable for irrigation farming with rice and palawija crops.

(4) Climate

The data of climatic factors in the study area are as shown in Fig.V-2. The climate of the study area is influenced by the tropical monsoon of South-East Asia with distinct wet and dry seasons.

The average total annual rainfall is about 1,700mm of which 70% occurs in the wet season from November to May and the remaining of 30% falls in the dry season from June to October.

The mean monthly air temperature in the study area ranges between 26.3°C and 27.2°C. The mean monthly maximum air temperature is 33.5°C of October and the mean monthly minimum air temperature is 21.5°C of July and August. The relative humidity in the study area does not fluctuate largely throught a year, and ranges from 77% to 84%. The mean daily sunshine hours in each month fluctuates between 3 and 5.3 hours in December and August, respectively. Solar radiation estimated based on the sunshine hours ranges between 313 to 391 cal/cm^2/day, in June and September, respectively. The details of meteorological data are given in ANNEX-I. Judging from the aboves, the agroclimatological condition in the study area is very suitable to develop irrigated rice cultivation throughout a year as well as palawija crops.

4.3 Change in Land Use

As most of the lands to be covered by the project are well developed rice field, there should be no major changes in kind of crops to be adopted in the area. The rice will remain as the most important crop.

Following the completion of the K-C-C irrigation project, all the rice field in the project area will be fully irrigated and more intensive use of the farmland will become possible. The project will provide the farmers with good opportunities to expand the volume of their farm business.

The present condition of rice fields will change with the Project as follows:

(Unit: ha)

Description			Without Project	With Project
1. Gross area of rice field			3,800	3,800
2. Irrigation/drainage canals and farm roads and field borders			-	300
3. Rice field			3,800	3,500
4. Net irrigation area			-	3,500
5. Area planted :	wet season	rice	3,800	3,500
	dry season	rice	0	3,500
	dry season	palawija	380	3,500
6. Area harvested:	wet season	rice	3,530	3,500
	dry season	rice	0	3,500
	dry season	palawija	330	3,500

The land use patterns can not basically be changed without provision of irrigation development. The land use in the surrounding areas which will not be incoorperated in the Project area is obliged to remain as it is.

4.4 Formulation of Cropping Pattern

4.4.1 Basic Principles

For formulation of future cropping pattern, the following basic principles which govern the selection of crops and cropping pattern under the project, have been conceived:

(1) The crops and cropping pattern must create maximum benefits for the farmers as well as the nation as a whole,

(2) The crops and cropping pattern must make optimum utilization of water to be supplied by the project,

(3) The crops and cropping pattern should be practicable with the limited number of family labour, and

(4) The crops and cropping pattern must conform with the existing social tradition, and be acceptable to the farmers.

4.4.2 Selection of Crops

In due consideration of the basic principles described above, rice and palawija crops such as groundnuts, mungbeans and soybeans are selected as the major crops.

(1) Rice

Rice is the most profitable crop, among other possibly grown crops, under present economic situations. The farmers have long experience for rice cultivation and are likely to master the irrigated rice cultivation and to realize the maximum irrigation benefits under the project. As Indonesia is still rice import country (import of rice is about a half million tons in 1981), the increase of rice production will possibly contribute to foreign exchange saving. The rice varieties of about 120 days growth period, new high yielding variety such as Cisadane, is used for the wet season crop. For the dry season crop, variety of about 105 days growth period, such as IR 36 is recommendable.

(2) Palawija Crops

Most of palawija crops do not require much water compared with rice. The growth periods are relatively short. The palawija crops could be grown in between two crops of rice. The present low production of palawija in the project area has resulted from short irrigation water which depends on rainfall and the cropping time for palawija is affected by the most important rice cultivation under present condition. After completion of the project, the palawija crops could also be grown under the irrigated condition with proper farming practices and therefor it is anticipated that the best quality products are produced. Generally, produces of palawija crops have large market outlet if quality is good enough and are profitable. The palawija crops cultivated under irrigated condition, leguminous crops such as groundnuts, mungbeans are preferable viewpoint to maintain soil fertility, and to increase production of proteins. Vegetables such as chillies, cucumbers are also profitable crops considering the transportation facility to Jakarta as a large market.

4.4.3 Proposed Cropping Pattern

Based on the above mentioned principles and conditions, the cropping pattern of "Rice-Rice-Palawija" a year is formulated for the Project area as the most optimum cropping pattern. Besides these above conditions, the results of experiment/1 on cropping patterns which had been carried out at the Singamarta Experiment Station under CRIFC Bogor were fully taken into consideratin. The proposed cropping pattern is illustrated on Fig. V-4. In this cropping pattern, first rice crop (wet season crop) is sown during the beginning of October to the end of November, and harvested during February to March. The second rice crop (dry season crop) is sown during the middle of February to the middle of April and harvested during the beginning of June to the end of July. The second rice crop is followed by palawija crops such as groundnuts which have a rather short growth duration of about 80-90 days.

To confirm the balance of available labour and required labour for the proposed cropping pattern with the proposed farming practices, labour balance study was made on the unit labour requirement basis, and shown on Fig. V-5. As the result of the study, the proposed cropping pattern is practicable to be carried out with the presently available family labour force.

4.5 Proposed Farming Practices

Proper irrigation farming is the most essential factor for realizing the full exploitation of agricultural potential in the project area. It is necessary to introduce new high yielding varieties with appropriate farming practices along with the development of irrigation facilities and institutional supports. The existing farming practices with local varieties should be improved and replaced with farming practices proposed as follows. The details of the farming practices are given in Tables V-17 ~ 19.

/1: POLA TANAM, page 53-66,
Laporan Tahunan LP3, 1977/78 - 1979/80.
Badan Penelitian dan Pengembangan Pertanian,
Lenbaga Pusat Penelition Pertanian, Bogor.

4.5.1 Rice Cultivation

(1) Seed preparation

The rice seed have to be the certificated extension seed and be selected by using a solution of 1.13 specific gravity before incubation. The selected seed also have to be disinfected by using adequate disinfectant like Benlate T. Incubation practice before sowing is recommendable for obtaining high germination ratio.

(2) Nursery

The nursery have to be prepared as flat as possible. The area of nursery required is about 1/20 of the rice field to be planted. Fertilization is essential and the recommendable dosage is about 500g of urea per m^2. Careful water management is very important for healthy growth of seedlings. The nursery period is about 15-20 days after sowing.

(3) Field preparation

The field preparation is carried out by animal power ploughing in depth of about 15cm. Puddling work is also required under submerged condition by animal power. During these operations dike maintenance should be done for effective water management.

(4) Transplanting

Transplanting density is necessary to follow the recommendations by the agricultural extension services, by variety to be used, by season of cropping, field soil fertility and applicable amount of fertilizers and etc. Usually 17 to 22 hills per m^2 is recommended in Indonesia, say spacing with 25cm x 25cm to 30cm x 15cm. To obtain vigorous tillering after transplanting, transplanting depth of seedling should be about 3cm, deep inserting and deep water reduce the number of tillers.

(5) Fertilizer application

Proper application of fertilizer is essential for full exploitation of agricultural potential under irrigated condition. It is recognized through soil chemical analysis that the soils of the project area are rather poor in plant nutrients, especially nitrogen, phosphorous and potassium. These chemical element have to be

supplemented by fertilization. Considering the soil condition, the suitable fertilizers are, urea, triple super phosphate (T.S.P.) and potassium chloride (KCl). The total fertilizer requirement for sustaining the target yields would be 200 kg/ha of urea, 100 kg/ha of T.S.P. and 100 kg/ha of KCl. The basic fertilizer application is 65 kg/ha of urea, 100 kg/ha of T.S.P. and 100 kg/ha of KCl when field preparation is practiced. Top dressing is made in twice, i.e., at the maximum tillering stage of about 15 days after transplanting and at the initial young panicle formation stage of about 45 days after transplanting. The amount of fertilizer to be applied per hectare is about 65kg of urea for each dressing time.

(6) Weeding

After transplanting, weeding is carried out in twice, depending on the conditions of weed growth by labour. For effective operation of weeding, the rotary weeder is recommendable.

(7) Plant protection

As regards the plant protection, intensive application of insecticides is required for control of plant hoppers, stem borers, etc. Considering the life-cycle of these insects, 3 to 4 times application during one cropping season is necessay. In addition it would be necessary to apply fungicide to control diseases, and rodenticide. In selecting suitable agro-chemical, chemical toxicity which directly or indirectly affects the humanbeing should be taken into consideration. For the safe and effective use of agro-chemicals and the prevention of environment pollution it is recommended that the farmers should be guided and trained by agricultural extension services on the choice of pesticides, storage, application techniques, the use of protective measures, and the safe disposal of containers. Information on advances in the treatment of victims of pesticide poisoning should reach health authorities and hospitals in areas where pesticides are extensively used. The farmers should choose the chemicals by recommendations from agricultural services. On this context, carbonate and organophosphate, i.e. Diazinon, Sumition, Dimecron, etc. are recommendable as insecticides and antibiotic chemicals, i.e. Kasumin, Kasurabcide, etc. as fungicides and Zincphosphate as rondenticide. It is recommended that plant protection works should be carried out in a systematic way through the farmer's cooperatives under the guidance by the agricultural extension services to attain safe and effective use of pesticides.

(8) Farm mechanization

Rapid introduction of farm mechanization to the Project area seems to be difficult. At present, farm mechanization in the Project area has been gradually progressed in the field of rice processing and spraying of agro-chemicals. Tractorization is not common in the Project area. The proposed farming practices could be carried out by the presently available family labour force, and cheap labour for temporary works is also easily obtainable from the surrounding areas.

4.6 Anticipated Crop Yield and Production

4.6.1 Target Yields of Crops

The present rice yield in the Project area is relatively low as compared with that in West Java on average due to unstable irrigation water supply. The unit yield fluctuates year by year but not in wide range. After completion of the Project, the rice yield will be increased and stabilized through improvement of irrigation farming practices and further expansion of agricultural support services. The present low yields of palawija crops will be much improved by irrigation farming.

The anticipated crop yields at the full developed stage are assumed as shown below: The unit yield of crops without Project condition in assumed to stay in the same level as the present yield, because the cultivation of crops is the Project area is on the considerably matured stage under rainfed condition. It is considered that the increase of unit yield without developing irrigation facilities will be insignificant for measuring the profit brought by the Project.

Crop	Present	Without Project	With Project
	(ton/ha)	(ton/ha)	(ton/ha)
Wet season rice	3.2	3.2	5.0
Dry season rice	3.2	3.2	5.0
Palawija crops:			
- Maize	0.7	0.7	2.0
- Groundnuts	0.8	0.8	1.2
- Mungbeans	0.7	0.7	1.2
- Soybeans	0.7	0.7	1.2
- Chillies/1	1.8	1.8	3.0

/1: Non dried fruit

4.6.2 Build-up Period of Target Yield of Crops

In order to attain the projected target yields at a possible earlier stage, it is essential to improve and strengthen the present agricultural supporting services including further expansion of BIMAS/INMAS Programs in keepting pace with the project implementatin. Most of the farmers in the Project area are not yet familiar with new farming practices such as proper fertilization, plant protection, water management, etc. It would take long time to train them in these field sufficiently for managing the profitable irrigation farming. Proper operation of the irrigation facilities would be one of the most important matter, particularly proper distribution of irrigation water on-farm level would largely contribute to the project target yield in success. The technical guidance services would be carried out to acquire the full knowledge of operation techniques by farmers themselves.

Taking into consideration the aboves, the build up period is assumed 3 to 5 years by kind of crops. The crop yields during the build-up period are assumed as shown below.

(Unit: ton/ha)

Crop	Present yield	Year after commencement of irrigation				
		1	2	3	4	5
Rice	3.2	4.0	4.4	4.6	4.8	5.0
Palawija crops:						
Maize	0.7	1.2	1.6	1.8	2.0	
Groundnuts	0.8	1.0	1.1	1.2		
Mungbeans	0.7	1.0	1.1	1.2		
Soybeans	0.7	1.0	1.1	1.2		
Chillies/1	1.8	2.4	2.6	2.8	3.0	

4.6.3 Anticipated Crop Production

The yield and production of rice in the Project area would increase year by yer with the proper irrigation as well as further level-up of farmers' techniques for cultivation and on-farm facilities operation supported by the agricultural institutional services.

Based on the projected progress of increase of crop yield assumed in the above, the anticipated annual crop production and increment are estimated in Table V-22. The annual production of rice at the full development stge is estimated at

about 35,000 tons, and the increment is about 22,800 tons of rice (dried paddy). The annual production of palawija crops at the full development stage is estimated at about 4,200 tons, and the increment is about 3,900 tons of groundnuts for example.

Table V-1

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Table V-2 PRESENT CROPPING PATTERNS IN THE STUDY AREA

	Cropping patterns	Planted area	Cropping intensity	Proportion
		(ha)	(%)	(%)
(1)	Rice - (fallow) (one crop a year)	4,050	100	67
(2)	Rice - Rice (two crops a year)	290	200	5
(3)	Rice - Palawija (two crops a year)	660	200	11
(4)	Palawija - Palawija (two crops a year)	370	200	6
(5)	Palawija - (fallow) (two crops a year)	630	100	11
	Total	6,000	122 (weighted average)	100

Table V-3 FARM INPUTS AND LABOUR REQUIREMENT FOR RICE FARMING UNDER PRESENT CONDITION

	Description		Requirement/ha
I.	Labour		
	1. Nursery preparation/seeding		8 man/day
	2. Ploughing (two times)		30 man/day 30 head/day (Buffalo)
	3. Harrowing and Puddling		30 man/day 30 head/day (Buffalo)
	4. Dike making		10 man/day
	5. Grass slashing		10 man/day
	6. Transplanting		30 man/day
	7. Fertilizing		10 man/day
	8. Weeding		44 man/day
	9. Spraying		6 man/day
	10. Harvesting (Ani-ani)		20 man/day
	11. Threshing		14 man/day
	12. Drying		4 man/day
	13. Water management		2 man/day
II.	Inputs		
	1. Seed		25 kg
	2. Fertilizer	Urea	100 kg
		T.S.P.	50 kg
	3. Agro-chemicals	Insecticide	2 l
		Rodenticide	200 g
		Klerat	2 kg
III.	Miscellaneous		
	Bags, mats, tools and etc.		(10% of total production cost approximately)

Data source: Monografi-Daerah, Kabupaten Serang, 1973 and 1978, Dinas Pertanian, Kabupaten Serang.

Table V-4

FARM INPUTS AND LABOUR REQUIREMENT FOR PALAWIJA CROPS PER HECTARE UNDER PRESENT CONDITION

Description		Groundnuts	Cassava	Maize	Mungbeans	Sweetpotato
I. Labour						
1. Grass slashing	(man/day)	10	-	-	5	-
2. Ploughing	"	15	15	10	10	12
Buffalo	(head/day)	15	15	10	10	12
3. Hoeing	"	18	18	9	10	10
4. Ridging	"	5	-	-	-	20
5. Planting/seeding	"	15	10	1	5	8
6. Weeding (two times)	"	20	50	25	25	40
7. Filling the dead plant	"	5	-	2	-	-
8. Fertilizing	"	5	-	7	-	3
9. Spraying	"	6	-	3	3	-
10. Harvesting	"	20	35	10	10	8
11. Binding	"	-	-	4	-	10
12. Others (about 5% of the above total labour)		7	7	4	4	6
		136				
II. Inputs						
1. Seed	(kg)	120	16,000 scions	40	120	25,000 scions
2. Fertilizer Urea	(kg)	25	-	100	-	-
T.S.P.	(kg)	50	-	100	-	-
3. Agro-chemicals	(f)	1	-	1	1	-
III. Miscellaneous (7% of the total cost above, approximately)						

Source of data: Monografi Daerah, Kabupaten Serang, 1973 and 1978, Dinas Pertanian, Kabupaten Serang

Table V-5

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF RICE IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested area (ha)	Damaged area (ha)	Damaged area (%)	Total production (ton)	Average yield (ton/ha)
1977	Pamarayan	4,389	4,008	381	8.7	11,880	2.7
	Kopo	3,210	2,997	213	6.6	9,340	2.9
	Cikande	3,635	3,348	287	7.9	15,680	4.3
	Total	11,234	10,353	881	7.8	36,900	3.3
1978	Pamarayan	4,606	4,333	273	5.9	11,860	2.6
	Kopo	3,826	3,775	51	1.3	12,430	3.2
	Cikande	5,311	4,960	351	6.6	15,080	2.8
	Total	13,743	13,068	675	4.9	39,370	2.9
1979	Pamarayan	4,141	3,980	161	3.9	12,750	3.1
	Kopo	3,478	3,399	79	2.3	12,500	3.6
	Cikande	6,388	5,891	497	7.8	18,070	2.8
	Total	14,007	13,270	737	5.3	43,320	3.1
1980	Pamarayan	5,144	4,764	380	7.4	15,550	3.0
	Kopo	3,823	3,687	136	3.6	12,870	3.4
	Cikande	5,950	5,350	600	10.1	17,970	3.0
	Total	14,917	13,801	1,116	7.5	46,390	3.1
1981	Pamarayan	3,709	3,520	189	5.1	10,500	2.8
	Kopo	3,540	3,204	336	9.5	12,070	3.4
	Cikande	6,953	6,278	675	9.7	26,960	3.9
	Total	14,202	13,002	1,200	8.4	49,530	3.5
Average		13,620	12,699	922	6.8	43,100	3.2

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-6

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF MAIZE IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	270	131	91	0.7
	Kopo	130	90	63	0.7
	Cikande	25	10	9	0.9
	Total	425	231	163	0.7
1978	Pamarayan	285	285	228	0.8
	Kopo	148	148	118	0.8
	Cikande	68	68	50	0.7
	Total	501	501	396	0.8
1979	Pamarayan	69	56	39	0.7
	Kopo	109	13	94	0.7
	Cikande	40	95	67	0.7
	Total	218	285	200	0.7
1980	Pamarayan	271	238	36	0.2
	Kopo	128	42	59	1.4
	Cikande	140	40	6	0.2
	Total	539	320	101	0.3
1981	Pamarayan	245	208	187	0.9
	Kopo	156	170	136	0.8
	Cikande	118	115	103	0.9
	Total	519	493	426	0.9
Average		440	386	257	0.7

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-7

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF GROUNDNUTS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	224	210	147	0.7
	Kopo	61	66	53	0.8
	Cikande	605	660	590	0.9
	Total	890	936	790	0.8
1978	Pamarayan	252	232	162	0.7
	Kopo	278	427	341	0.8
	Cikande	615	590	472	0.8
	Total	1,145	1,249	975	0.8
1979	Pamarayan	113	75	56	0.7
	Kopo	89	64	51	0.8
	Cikande	664	629	523	0.8
	Total	886	768	630	0.8
1980	Pamarayan	266	362	290	0.8
	Kopo	385	413	370	0.9
	Cikande	851	975	877	0.9
	Total	1,502	1,750	1,537	0.9
1981	Pamarayan	408	209	167	0.8
	Kopo	912	681	595	0.9
	Cikande	814	685	616	0.9
	Total	2,134	1,575	1,378	0.9
Average		1,307	1,256	1,062	0.8

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-8

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF MUNGBEANS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	15	-	11	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1978	Pamarayan	-	-	-	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1979	Pamarayan	-	-	-	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1980	Pamarayan	14	14	9	0.6
	Kopo	2	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1981	Pamarayan	30	25	19	0.8
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
Average		-	-	-	-

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-9

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF SOYBEANS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	4	-	-	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1978	Pamarayan	-	-	-	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1979	Pamarayan	-	-	-	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1980	Pamarayan	-	-	-	-
	Kopo	-	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
1981	Pamarayan	-	-	-	-
	Kopo	53	-	-	-
	Cikande	-	-	-	-
	Total	-	-	-	-
Average		-	-	-	-

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-10 PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF SOYBEANS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	308	272	2,067	7.6
	Kopo	147	279	1,562	5.6
	Cikande	145	55	484	8.8
	Total	600	606	4,113	6.8
1978	Pamarayan	333	349	2,443	7.0
	Kopo	305	263	1,811	6.9
	Cikande	25	120	960	8.0
	Total	663	732	5,214	5.6
1979	Pamarayan	245	191	2,292	12.0
	Kopo	235	285	2,565	9.0
	Cikande	61	31	310	10.0
	Total	541	507	5,167	10.2
1980	Pamarayan	554	769	6,767	8.8
	Kopo	190	184	1,619	8.8
	Cikande	308	320	2,848	8.9
	Total	1,052	1,273	11,234	8.8
1981	Pamarayan	869	859	7,559	8.8
	Kopo	53	-	-	-
	Cikande	115	120	1,080	9.0
	Total	1,180	1,166	10,247	8.8
Average		807	857	7,195	8.0

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-11

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF SOYBEANS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	145	208	1,539	7.4
	Kopo	68	93	698	7.5
	Cikande	224	269	2,018	7.5
	Total	437	570	4,255	7.5
1978	Pamarayan	122	157	1,256	8.0
	Kopo	92	95	760	8.0
	Cikande	42	30	210	7.0
	Total	256	282	2,226	7.9
1979	Pamarayan	116	96	1,440	15.0
	Kopo	61	66	990	15.0
	Cikande	59	71	399	5.6
	Total	236	233	2,829	12.0
1980	Pamarayan	137	127	1,016	8.0
	Kopo	85	80	640	8.0
	Cikande	275	275	2,200	8.0
	Total	497	482	3,856	8.0
1981	Pamarayan	302	258	2,012	7.8
	Kopo	147	67	523	7.8
	Cikande	185	205	1,681	8.2
	Total	634	530	4,216	8.0
Average		412	419	3,476	8.7

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-12 PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF VEGETABLE BEANS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	242	156	156	1.0
	Kopo	91	93	112	1.2
	Cikande	335	330	445	1.3
	Total	668	579	713	1.2
1978	Pamarayan	69	58	93	1.6
	Kopo	38	69	105	1.5
	Cikande	99	143	257	1.8
	Total	206	270	455	1.7
1979	Pamarayan	164	164	262	1.6
	Kopo	48	48	47	1.0
	Cikande	60	68	156	2.3
	Total	272	280	884	3.2
1980	Pamarayan	61	29	67	2.3
	Kopo	17	9	25	2.8
	Cikande	575	500	850	1.7
	Total	653	538	942	1.8
1981	Pamarayan	175	150	390	2.6
	Kopo	22	22	35	1.6
	Cikande	300	210	546	2.6
	Total	497	382	971	2.5
Average		459	410	793	2.1

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-13

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF CUCUMBERS IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1977	Pamarayan	122	120	636	5.3
	Kopo	50	49	235	4.8
	Cikande	45	40	240	6.0
	Total	217	209	1,111	5.3
1978	Pamarayan	42	56	157	2.8
	Kopo	29	29	102	3.5
	Cikande	20	21	76	3.6
	Total	91	106	335	3.2
1979	Pamarayan	98	90	109	1.2
	Kopo	43	41	105	2.6
	Cikande	24	24	84	3.5
	Total	165	155	298	1.9
1980	Pamarayan	24	20	52	2.6
	Kopo	20	19	67	3.5
	Cikande	195	189	634	3.4
	Total	239	228	753	3.3
1981	Pamarayan	80	69	214	3.1
	Kopo	8	8	21	2.6
	Cikande	-	-	-	-
	Total	88	77	235	3.1
Average		160	155	546	3.4

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-14

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF CHILLIES IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1976	Pamarayan	72	72	36	0.5
	Kopo	95	95	67	0.7
	Cikande	-	160	240	1.5
	Total	167	327	343	1.0
1977	Pamarayan	146	151	36	0.2
	Kopo	69	96	32	0.3
	Cikande	1,550	1,500	630	0.4
	Total	1,765	1,747	698	0.4
1978	Pamarayan	42	17	32	1.9
	Kopo	33	14	29	2.1
	Cikande	774	459	1,170	2.5
	Total	849	490	1,231	2.5
1979	Pamarayan	77	78	125	1.6
	Kopo	11	9	23	2.6
	Cikande	855	650	1,430	2.2
	Total	943	737	1,578	2.1
1980	Pamarayan	91	75	143	1.9
	Kopo	16	16	26	1.6
	Cikande	900	650	1,885	2.9
	Total	1,007	741	2,054	2.8
Average		1,100	808	1,181	1.8

Source of data: Keadaan Bahan Pangan, 1976 - 1980, Agriculture Office, Serang

Table V-15

PLANTED, HARVESTED AND DAMAGED AREAS, PRODUCTION AND YIELD OF EGGPLANT IN KECAMATANS, PAMARAYAN, KOPO AND CIKANDE

Year	Name of Kecamatan	Planted area (ha)	Harvested Area (ha)	Total Production (ton)	Average Yield (ton/ha)
1976	Pamarayan	72	72	36	0.5
	Kopo	95	95	67	0.7
	Cikande	160	135	351	2.6
	Total	327	299	770	2.6
1977	Pamarayan	13	13	38	2.9
	Kopo	44	42	130	3.1
	Cikande	39	39	146	3.7
	Total	96	94	314	3.3
1978	Pamarayan	16	16	61	3.8
	Kopo	24	19	21	1.1
	Cikande	10	7	35	5.0
	Total	50	42	117	2.8
1979	Pamarayan	110	109	305	2.8
	Kopo	39	38	65	1.7
	Cikande	-	-	-	-
	Total	149	147	370	2.5
1980	Pamarayan	11	5	8	1.6
	Kopo	12	7	18	2.6
	Cikande	-	-	-	-
	Total	23	12	26	2.2
Average		129	119	319	2.7

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agriculture Office, Serang

Table V-14

NUMBER OF LIVESTOCK IN THE STUDY AREA

Kecamatan	Desa	Number of farm household	Total Number Cattle	Horse	Buffalo	Goat	Chicken	Duck	Per farm household Cattle	Horse	Buffalo	Goat	Chicken	
Kopo	Pagintungan	419	-	-	213	593	5,118	118	-	-	0.6	1.4	12.6	0.4
	Gabus	155	5	3	192	32	5,837	347	0.01	0.01	1	0.1	14.4	1
	Junti	856	-	5	346	5	8,015	855	-	0.01	0.4	0.01	7	1
	Kopo	524	-	-	396	-	10,569	565	-	-	0.6	-	20.4	1
	Cemplang	397	-	-	109	16	5,458	18	-	-	0.3	0.1	13.4	0.1
	Carenang	341	1	-	151	137	6,192	110	-	-	0.4	0.4	18.2	0.4
	Garut	413	-	-	193	113	5,659	478	-	-	0.6	0.2	14	1
	Cikabu	365	-	-	331	230	4,131	1,247	-	-	0.9	0.6	12.3	3.1
	Jawilan	761	-	-	354	51	5,143	563	-	-	0.5	0.1	6.7	0.7
	Parakan	283	1	2	217	359	2,031	217	-	-	0.7	0.5	8.1	0.5
	Nanggung	551	-	1	357	412	7,656	100	-	-	0.6	0.7	12	0.2
	Pasir Buyut	510	-	-	279	38	5,039	231	-	-	0.6	0.1	9.9	0.5
	Nyompok	455	-	-	211	59	5,855	955	-	-	0.5	0.1	12.7	2.2
	Renda Sumur	-	-	-	309	-	3,931	149	-	-	0.8	-	24	1
	Majasari	-	-	-	336	-	3,442	153	-	-	0.7	0.5	8.3	0.5
	Sub Total	6,659	7	11	4,168	2,017	85,643	6,652	-	-	0.6	0.3	12.4	0.9
Cikande	Bakung	968	3	9	951	347	2,338	636	0.01	0.01	0.5	0.4	6.6	1.4
	Kamurang	-	3	4	163	193	2,733	647	0.01	0.01	0.5	0.4	6.6	1.4
	Julang	1,011	-	19	539	337	1,516	536	-	0.01	0.8	3	0.3	
	Gembor Udik	-	-	4	242	157	1,451	107	-	0.01	0.8	0.5	3	0.3
	Koper	513	-	7	335	535	6,413	426	-	0.01	0.6	1	7.6	0.8
	Songgom Jaya	-	-	3	148	103	2,136	153	-	0.03	0.8	0.6	10.8	0.6
	Parigi	539	1	14	324	165	3,615	173	-	0.03	0.8	0.6	10.2	0.6
	Cikande	313	-	5	219	352	1,135	149	-	-	0.6	0.9	3	0.4
	Leuwi Limus	611	-	6	353	111	1,315	358	-	-	0.6	0.2	2.1	0.5
	Kelor	111	-	15	157	319	3,171	326	-	0.03	0.3	0.5	5.3	1.3
	Cijeruk	858	-	6	355	315	2,263	483	-	-	0.4	0.4	2.6	0.6
	Kibin	812	-	12	351	136	6,878	769	-	0.03	0.4	0.2	6	1
	Nambo Udik	655	-	3	162	188	1,451	749	-	-	0.3	0.3	1.9	1
	Nambo Ilir	1,043	3	12	363	339	1,315	459	-	-	0.4	0.3	2.6	0.7
	Barengkok	-	-	2	817	118	1,363	281	-	-	0.4	0.3	2.6	0.7
	Negara	511	-	5	117	143	1,103	317	-	-	0.2	0.2	2.9	0.4
	Sub Total	8,555	10	117	6,189	3,781	37,615	6,418	-	-	0.5	0.8	4.5	0.6
Pamarayan	Pamarayan	318	-	3	137	334	5,017	243	-	0.01	0.5	0.9	3.2	0.5
	Kampung Baru	556	-	1	163	240	1,165	235	-	-	0.3	0.4	2.2	0.4
	Malabar	313	1	1	131	154	1,183	183	-	-	0.5	0.7	5.7	0.5
	Slokang	318	5	3	139	217	1,074	131	0.01	-	0.4	0.9	3.3	0.4
	Bebakan	431	-	-	188	593	2,336	115	-	-	0.4	0.9	3.6	0.3
	Pengawinan	366	-	-	137	359	2,618	131	-	-	0.4	0.7	8.1	0.3
	Pasir Limus	511	-	-	147	417	2,026	197	-	-	0.7	0.6	3.9	0.4
	Kander	743	-	6	497	741	2,149	318	-	-	0.5	1.0	1.0	0.4
	Binong	544	-	-	238	548	1,970	187	-	-	0.5	1.0	2.8	0.3
	Bandung	558	-	-	351	487	2,333	216	-	-	0.4	0.9	4.0	0.4
	Pudar	355	-	-	105	411	1,430	138	-	-	0.3	1.1	4	0.3
	Kebonsana	438	-	-	218	511	1,326	136	-	-	0.5	1.2	3	0.3
	Damping	333	-	-	245	159	1,654	137	-	-	0.6	0.8	3.1	0.4
	Wirana	488	-	-	249	317	2,318	115	-	-	0.5	0.6	3.1	0.3
	Sangiang	359	-	1	351	313	2,443	146	-	-	0.7	0.9	6.7	0.6
	Sub Total	6,781	6	13	3,443	5,763	30,511	3,438	-	-	0.5	0.8	6.5	0.6
Grand Total		22,118	23	141	13,839	11,547	153,789	16,518	-	-	0.5	0.5	6.9	0.7

Source of data : Laporan Populasi Ternak Semester II [illegible]
Dinas Peternakan Kabupaten Daerah Tingkat II, Serang
Monografi Kecamatan Kopo Kabupaten Serang [illegible]
Biro Pusat Statistik Kabupaten Serang, [illegible]

Table V-17 PROPOSED FARMING PRACTICES FOR RICE CULTIVATION

Operation item	Required input		Required labour	Timing of operation/1	
	Kind of input	Amount /ha		Wet season	Dry season
			(man/day/ha)		
1. Seed preparation	Seed Benlate T	25kg 200g	5	-20	-20
2. Nursery preparation & management	Urea	5kg	15	-25	-25
3. Field preparation/2					
Ploughing			15	-5	-5
Harrowing & puddling			15		
Dike making & others			5		
4. Fertilizer application (Basal dose)	Urea T.S.P. KCl	75kg 100kg 100kg	3	-5	-5
5. Transplanting			50	0	0
6. First weeding			20	+15	+15
7. Second fertilizer app.	Urea	65kg	2	+15	+15
8. First pesticide application	Insecticide	1ℓ	3	+30	+30
9. Second weeding			20	+30	+30
10. Second pesticide app.	Insecticide Fungicide	1ℓ 1ℓ	3	+30	+30
11. Third fertilizer app.	Urea	60kg	2	+50	+45
12. Second pesticide app.	Insecticide Fungicide	1ℓ 1ℓ	3	+65	+65
13. Harvesting & threshing/3			45	+100	+95
14. Water management			6		

/1: Timing of operation is shown by number of days after transplanting

/2: Ploughing and harrowing are done with buffalo

/3: Including related operations such as transportation of straw, drying and etc.

Table V-18 PROPOSED FARMING PRACTICES FOR GROUNDNUTS

Operation item	Required input		Required labour	Timing of operation/1
	Kind of input	Amount /ha		
			(man/day/ha)	(days after sowing)
1. Field preparation/1				
Ploughing			15	-5
Harrowing			5	-2
Ridging			5	-1
2. Fertilizer				0
	Urea	75kg		
	T.S.P.	100kg		
	KCl	100kg		
3. Sowing	Seed	100kg	15	0
4. Pesticide application/2	Insecticide	1ℓ	3	+1
	Fungicide	1ℓ		
5. Weeding			20	+14
6. Hilling up			5	+30
7. Pesticide application/1	Insecticide	1ℓ	3	+60
	Fungicide	1ℓ		
8. Harvesting & threshing			40	+80
9. Water management			5	

/1: Ploughing, harrowing and ridging are done with baffalo

/2: The necessity of pesticide application depends on the outbreaking of damages by pests, here assumed twice applications of insecticide and fungecide, respectively on an average

Table V-19 PROPOSED FARMING PRACTICES FOR CHILLIES

Operation item	Required input		Required labour	Timing of operation/1
	Kind of input	Amount /ha		
			(man/day/ha)	(days after sowing)
1. Field preparation/1				
Ploughing			15	-15
Harrowing			5	-5
Ridging			5	-5
2. Nursery	Seed	1kg	17	-45
3. Fertilizer				
	Urea	1kg	17	-45
	T.S.P.	30kg		
	KCl	50kg		
4. Transplanting			40	0
5. Hilling & propping up			5	+30
6. Pest control	Insecticide	3ℓ	9	+10
	Fungicide	3ℓ		
7. Weeding			40	+30
8. Harvesting & drying/2			100	+100
9. Water management			10	

/1: Ploughing, harrowing and ridging are done with baffalo

/2: Harvesting is done in twice or three times for a crop

Table V-20

RICE YIELD IN DEMONSTRATION FARMS IN KECAMATAN CIKANDE

Kind of crop	Variety	Demonstration area: Desa	Demonstration area: Area (ha)	Date of planting: Date	Date of planting: Month	Date of planting: Year	Date of harvesting: Date	Date of harvesting: Month	Date of harvesting: Year	Yield (ton/ha)
I. Rice										
(Wet season-crop)	IR 36	Parigi	50	25	10	81	18	2	82	7.4
	"	Cijeruk	0.1	9	10	81	9	3	82	7.8
	"	"	0.1	30	10	81	9	3	82	7.9
	"	Koper	43	11	10	80	28	1	81	8.7
	"	"	50	3	11	80	4	2	81	9.4
	"	Namboudik	0.1	15	9	80	5	1	81	5.8
	"	Koper	0.25	10	11	80	24	2	81	6.2
	"	"	5	10	11	80	15	2	81	6.3
	"	Cikande	3.75	7	12	79	15	3	80	5.9
	"	Nambo Eril	3.25	2	12	79	10	3	80	6.8
	"	"	4	27	11	79	2	3	80	6.7
	"	Parigi	5	9	10	79	-	-	-	7.4
	"	Koper	6	23	12	79	19	3	80	6.7
	"	Cikande	50	12	12	79	20	3	80	6.5
	"	Nambo Eril	50	28	11	79	15	3	80	6.9
	"	Parigi	30	20	12	79	23	3	80	6.9
	"	"	25	10	12	79	21	3	80	6.7

(continued)

Kind of crop	Variety	Demonstration area		Date of planting			Date of harvesting			Yield
		Desa	Area	Date	Month	Year	Date	Month	Year	
			(ha)							(ton/ha)
	IR 36	Cikande	0.45	13	12	79	25	3	80	8.0
	"	Leuwi Limus	0.25	10	12	79	24	3	80	7.2
	"	Nambo Eril	0.3	14	12	79	27	3	80	7.1
	"	"	0.6	6	12	79	20	3	80	6.2
	"	"	0.25	19	11	79	2	3	80	5.4
	"	Parigi	0.25	10	12	79	20	3	80	7.0
	"	Koper	0.15	21	12	79	17	3	80	7.5
	"	"	0.25	1	1	80	23	3	80	7.8
	"	Julang	0.15	12	12	79	1	3	80	8.0
	"	Parigi	1.25	4	1	79	25	3	79	5.1
	"	Julang	6	4	1	79	25	4	79	5.3
	"	Cijeruk	2	3	1	79	12	4	79	4.6
	"	Cikande	25	29	12	78	4	4	79	4.2
	"	Nambo Eril	35	13	1	79	26	4	79	4.6
	"	Parigi	25	2	1	79	7	4	79	4.7
	"	Koper	50	10	12	79	12	3	79	4.7
	"	Nambo Eril	0.1	17	12	79	5	4	79	5.3
	"	"	0.1	8	12	78	1	4	79	5.2
	"	"	0.1	29	11	78	17	2	79	5.6
	"	"	0.1	4	1	79	27	4	79	4.3

(continued)

Kind of crop	Variety	Demonstration area		Date of planting			Date of harvesting			Yield
		Desa	Area	Date	Month	Year	Date	Month	Year	
			(ha)							(ton/ha)
	IR 36	Koper	0.1	30	10	78	20	3	79	6.2
	"	Parigi	0.1	27	1	79	18	4	79	6.0
	"	Koper	0.1	30	10	78	14	3	79	6.2
	"	"	0.1	30	12	78	24	3	79	4.3
	"	Bakung	0.1	3	1	79	25	3	79	6.8
	"	Cijeruk	0.1	17	2	79	12	4	79	4.3
	"	"	0.1	28	12	78	16	4	79	4.6
	"	"	0.1	7	1	79	20	4	79	4.5
	Cisadane	"	40	2	10	81	20	2	82	10.0
	"	Nagara	20	2	10	81	21	2	81	7.6
	"	Cijeruk	20	20	9	81	26	1	82	9.6
	"	Koper	0.1	8	10	81	8	3	82	8.3
	"	"	0.1	1	10	81	26	3	82	8.4
	"	Cijeruk	4	5	9	80	20	2	82	5.8
	Citarum	Kamurang	3.25	11	12	79	22	3	80	7.1
	"	"	4	18	12	79	22	3	80	6.9
	"	Bakung	0.13	2	11	79	20	3	80	8.5
	"	"	0.25	18	12	79	22	3	80	8.2
	"	Ketos	1.5	17	1	79	25	4	79	4.8

(continued)

Kind of crop	Variety	Demonstration area		Date of planting			Date of harvesting			Yield
		Desa	Area (ha)	Date	Month	Year	Date	Month	Year	(ton/ha)
	IR 36	Koper	0.1	30	10	78	20	3	79	6.2
	"	Parigi	0.1	27	1	79	18	4	79	6.0
	"	Koper	0.1	30	10	78	14	3	79	6.2
	"	"	0.1	30	12	78	24	3	79	4.3
	"	Bakung	0.1	3	1	79	25	3	79	6.8
	"	Cijeruk	0.1	17	2	79	12	4	79	4.3
	"	"	0.1	28	12	78	16	4	79	4.6
	"	"	0.1	7	1	79	20	4	79	4.5
	Cisadane	"	40	2	10	81	20	2	82	10.0
	"	Nagara	20	2	10	81	21	2	81	7.6
	"	Cijeruk	20	20	9	81	26	1	82	9.6
	"	Koper	0.1	8	10	81	8	3	82	8.3
	"	"	0.1	1	10	81	26	3	82	8.4
	"	Cijeruk	4	5	9	80	20	2	82	5.8
	Citarum	Kamurang	3.25	11	12	79	22	3	80	7.1
	"	"	4	18	12	79	22	3	80	6.9
	"	Bakung	0.13	2	11	79	20	3	80	8.5
	"	"	0.25	18	12	79	22	3	80	8.2
	"	Ketos	1.5	17	1	79	25	4	79	4.8

(continued)

Kind of crop	Variety	Demonstration area: Desa	Demonstration area: Area (ha)	Date of planting: Date	Date of planting: Month	Date of planting: Year	Date of harvesting: Date	Date of harvesting: Month	Date of harvesting: Year	Yield (ton/ha)
	Ditarum	Kibin	0.1	7	1	79	22	4	79	5.8
	Brantas	Cikande	2	26	12	78	24	3	79	5.2
	"	Koper	1.75	13	12	78	23	3	79	4.8
	"	Binuang	1.5	6	1	79	27	4	79	4.7
II. Rice										
(Dry season-crop)	IR-36	Cikande	5	13	5	81	26	8	81	5.4
	"	Koper	40	16	3	81	25	6	81	9.3
	"	"	35	21	4	81	24	7	81	6.7
	"	Bakung	20	15	5	81	28	8	81	5.9
	"	Koper	29	10	5	79	15	8	79	4.5
	"	"	6.3	10	5	79	15	8	79	5.5
	"	"	0.1	15	5	79	10	8	79	6.2
	"	Ketos	0.6	15	5	79	30	8	79	4.5
	"	Kibin	0.1	15	5	79	2	9	79	4.3
	"	Cijeruk	0.1	11	3	80	10	8	80	6.2
	"	Parigi	0.5	5	5	80	-	-	-	6.3
	"	Ketos	3	4	6	80	-	-	-	5.4

(continued)

Kind of crop	Variety	Demonstration area		Date of planting			Date of harvesting			Yield
		Desa	Area (ha)	Date	Month	Year	Date	Month	Year	(ton/ha)
	IR 36	Teras	5	6	5	80	-	-	-	5.3
	"	Cikande	20	5	4	80	25	8	80	4.9
	"	Bakung	15	15	5	80	-	-	-	6.6
	"	Koper	30	20	5	80	-	-	-	8.2
	Citarum	"	5	10	5	79	15	8	79	5.0
	"	Bakung	0.2	18	4	79	2	8	79	3.2
	"	Kibin	0.6	16	5	79	1	9	79	4.2
	"	"	0.6	15	5	79	30	8	79	4.6
	"	Ketos	0.6	16	5	79	2	9	79	4.6

Source of data: Laporan Kegiatan Demonstrasi Plot: Cikande Agricultural Extension Office, 1981 and 1982

Table V-21

RICE YIELD UNDER THE BIMAS, INMAS PROGRAMS

Year	Name of Kecamatan	BIMAS		INMAS	
		Planted Area (ha)	Yield (ton/ha)	Planted Area (ha)	Yield (ton/ha)
1977	Pamarayan	1,510	4.8	101	3.5
	Kopo	1,043	4.8	503	4.5
	Cikande	1,356	4.5	745	3.2
	Total/Average	3,909	4.7	1,349	3.7
1978	Pamarayan	780	4.8	520	3.8
	Kopo	1,513	4.8	492	3.7
	Cikande	1,480	4.5	988	3.7
	Total/Average	3,773	4.7	2,000	3.7
1979	Pamarayan	444	6.0	175	4.5
	Kopo	166	6.2	46	4.4
	Cikande	198	6.0	888	4.4
	Total/Average	808	6.0	1,109	4.4
1980	Pamarayan	158	5.2	105	4.2
	Kopo	228	5.3	67	4.3
	Cikande	372	5.5	153	4.2
	Total/Average	758	5.4	325	4.2
1981	Pamarayan	122	5.5	124	4.4
	Kopo	447	5.7	45	4.5
	Cikande	1,058	5.9	1,715	4.5
	Total/Average	1,627	5.8	1,884	4.5
	Average	-	5.3	-	4.1

Source of data: Keadaan Bahan Pangan, 1977 - 1981, Agricultural Office, Serang.

Note: Data of 1979 and thereafter are of BIMAS KHUSUS and INMAS KHUSUS, respectively

Table V-22 Anticipated Crop Production

YEAR	1			2			3			4			5		
ITEM	W/O	W	I	W/O	W	I	W/O	W	I	W/O	W	I	W/O	W	I
PLANTED (HA)															
W.S.R	3800	3500	-300	3800	3500	-300	3800	3500	-300	3800	3500	-300	3800	3500	-300
D.S.R	0	3500	3500	0	3500	3500	0	3500	3500	0	3500	3500	0	3500	3500
W.PAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D.PAL	380	3500	3120	380	3500	3120	380	3500	3120	380	3500	3120	380	3500	3120
U.YIELD (T/HA)															
RICE	3.2	4	0.8	3.2	4.4	1.2	3.2	4.6	1.4	3.2	4.8	1.6	3.2	5	1.8
PALA.	0.8	1	0.2	0.8	1.1	0.3	0.8	1.2	0.4	0.8	1.2	0.4	0.8	1.2	0.4
PRODUCT (TON)															
W.S.R	12160	1400	1840	12160	15400	3240	12160	16100	3940	12160	16800	4640	12160	17500	5340
D.S.R	0	14000	14000	0	15400	15400	0	16100	16100	0	16800	16800	0	17500	17500
TOTAL	12160	28000	15840	12160	30800	18640	12160	32200	20040	12160	33600	21440	12160	35000	22840
D.PAL	304	3500	3196	304	3850	3546	304	4200	3896	304	4200	3896	304	4200	3896
TOTAL	304	3500	3196	304	3850	3546	304	4200	3896	304	4200	3896	304	4200	3896

Year: After commencement of irrigation
W/O: Without project
W : With project condition
I : Production Inerment

W.S.R : Wet season rice
D.S.R : Dry season rice
D.PAL: Dry season palawija

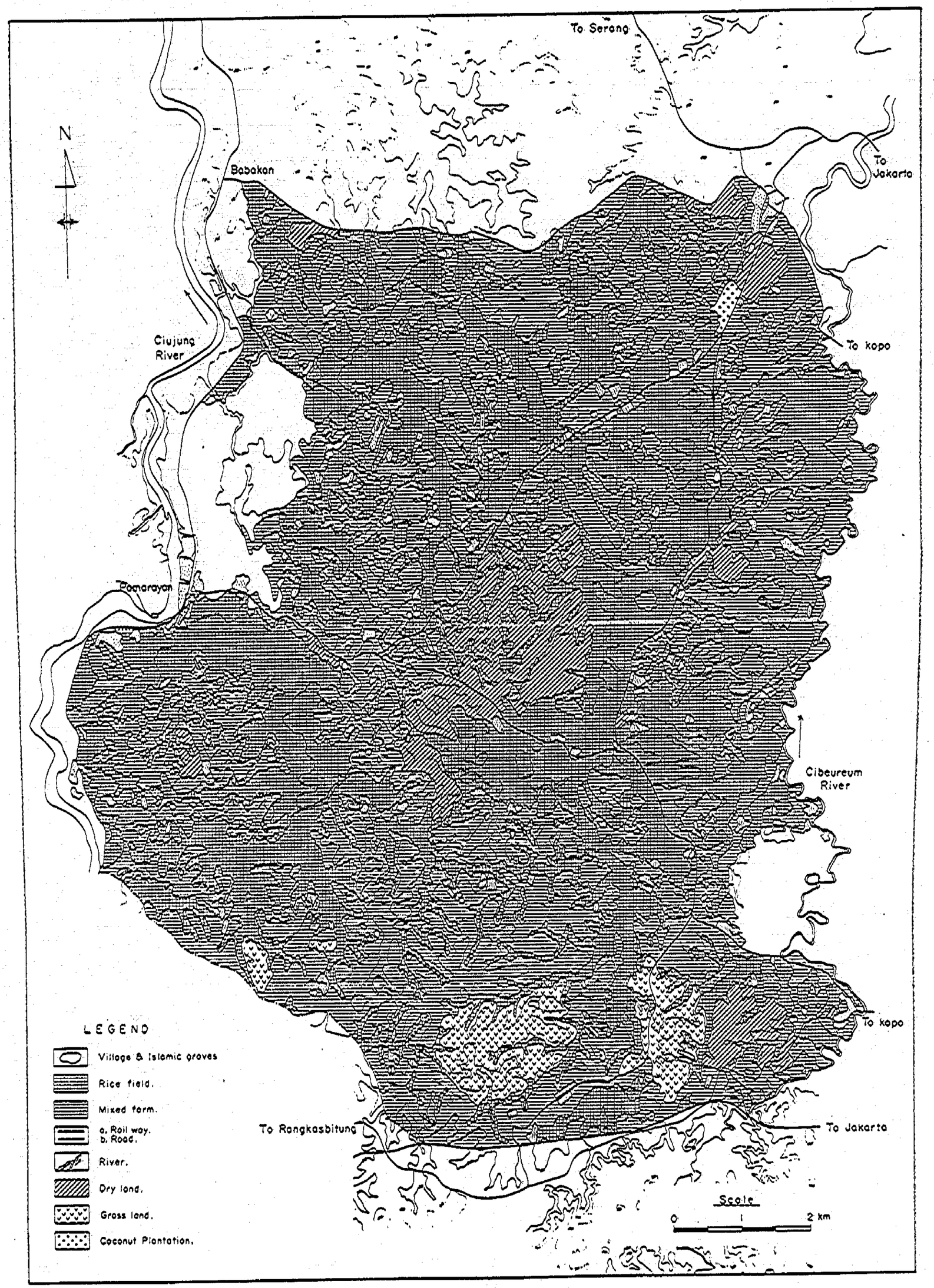
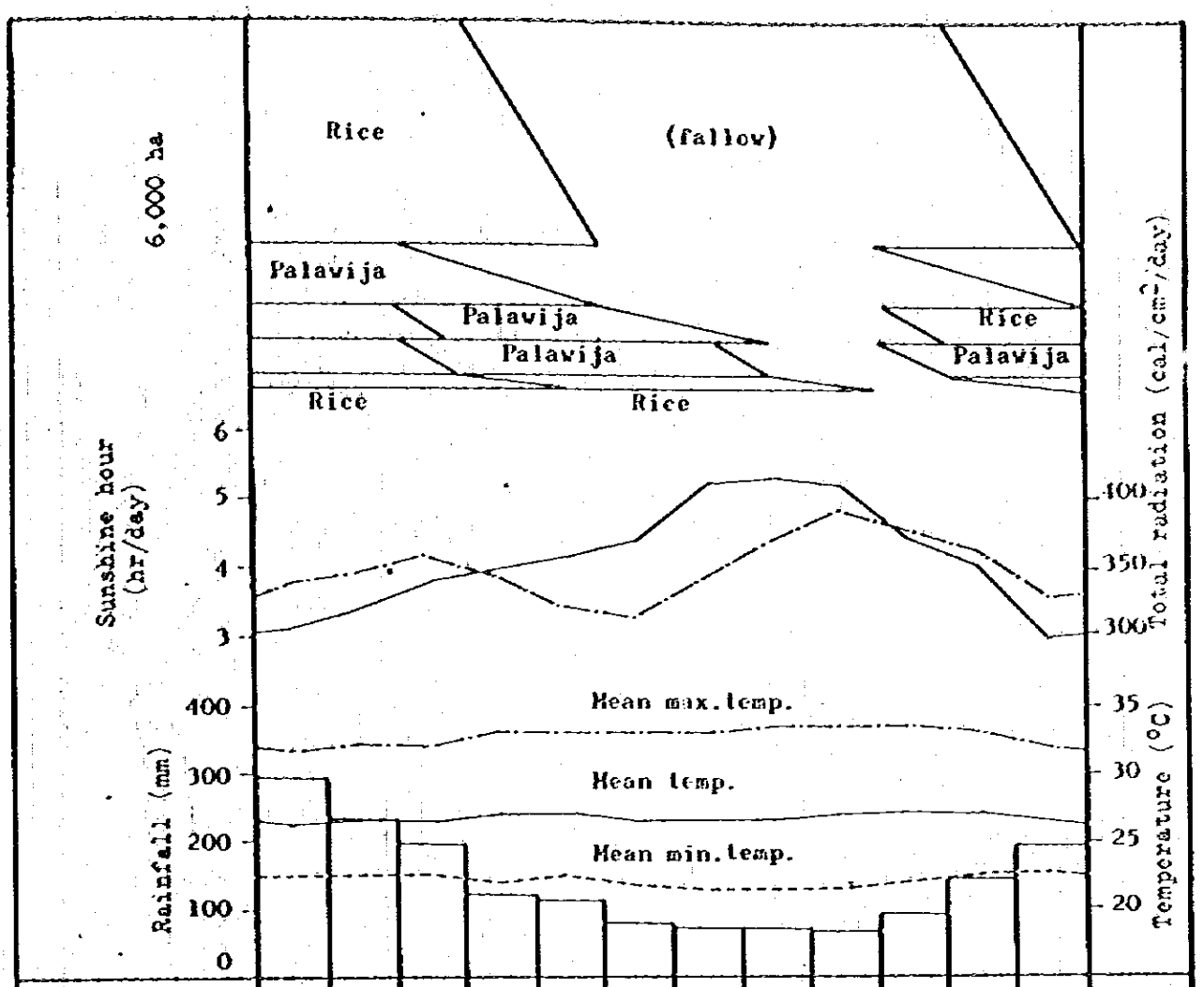


Fig. V-1 PRESENT LAND USE IN THE STUDY AREA



Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	289	230	195	121	116	78	76	73	70	91	145	193
Mean temp. (°C)	26.3	26.7	26.6	27.0	27.1	26.6	26.4	26.6	26.8	27.2	27.1	26.6
Mean max. temp. (°C)	31.4	31.8	31.9	32.9	33.1	33.0	32.8	33.3	33.4	33.5	33.0	32.3
Mean min. temp. (°C)	22.6	22.5	22.6	22.2	22.5	21.7	21.5	21.5	21.6	22.2	22.6	22.7
Relative humidity (%)	84	82	84	82	81	80	80	78	77	77	78	82
No. of rainy day	18	16	14	11	10	6	6	6	6	8	11	15
Sunshine hour (hr./day)	3.1	3.3	3.8	4.0	4.2	4.4	5.2	5.3	5.2	4.4	4.0	3.0
Total radiation (cal/cm²/day)	336	348	357	342	322	313	340	368	391	379	363	330

Note: The values of total radiation are estimated based the sunshine hour shown above. Climatical data shown are obtained at Serang, 1942 - 1981.

Fig. V-2 PRESENT CROPPING PATTERN IN THE STUDY AREA AND RELATED CLIMATOLOGICAL FACTORS

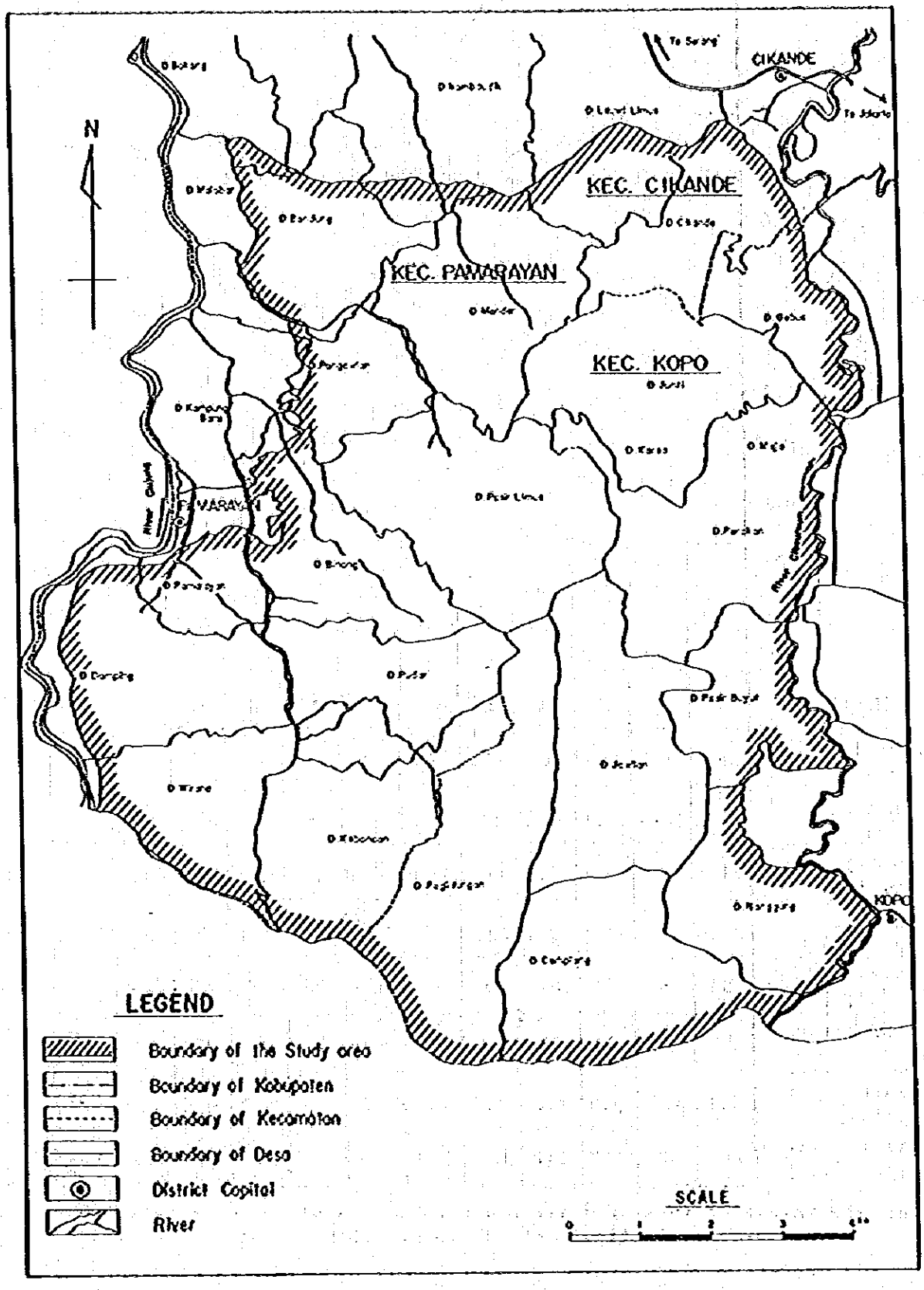


Fig. V-3 ADMINISTRATIVE BOUNDARIES IN THE STUDY AREA

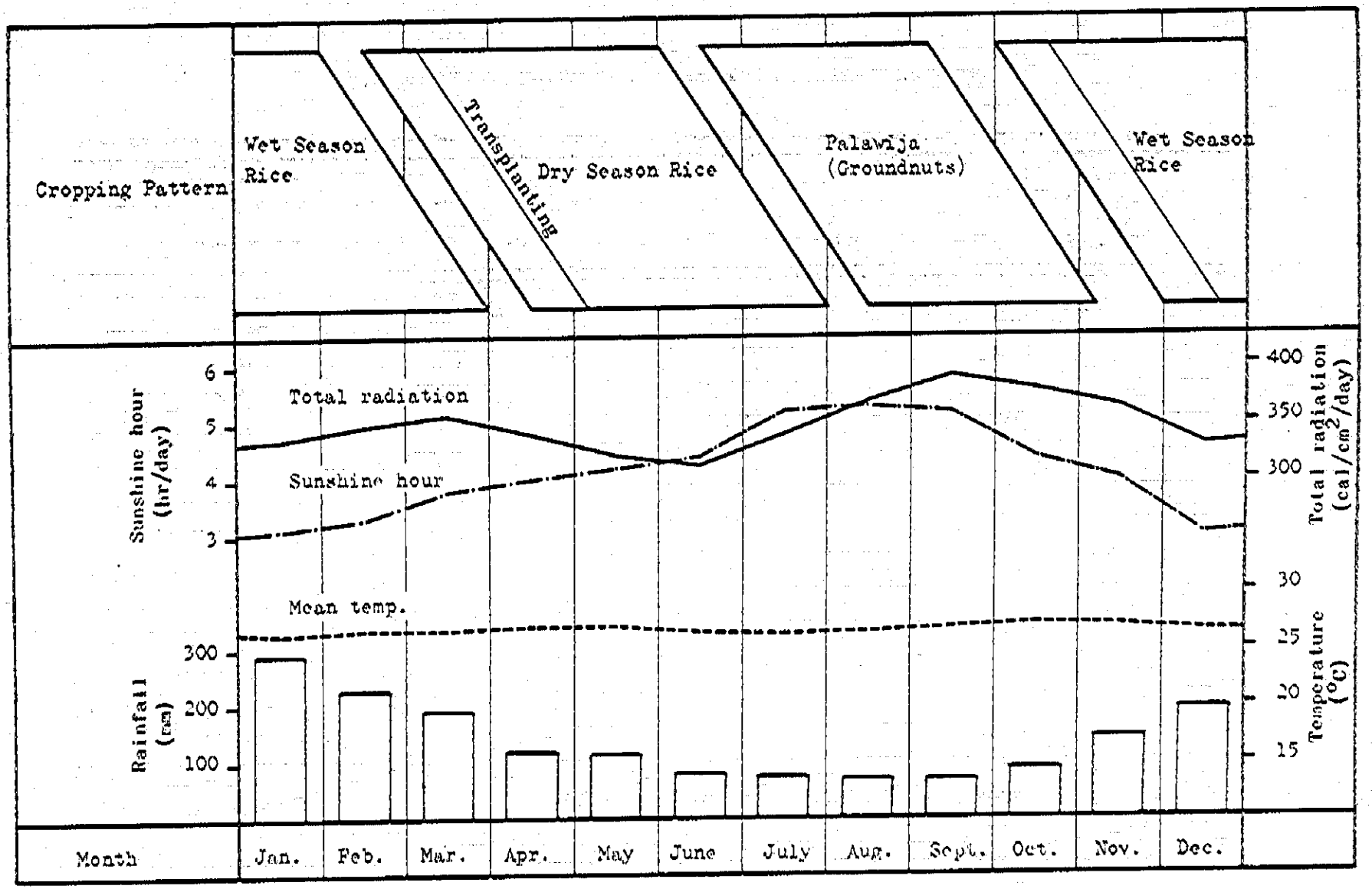
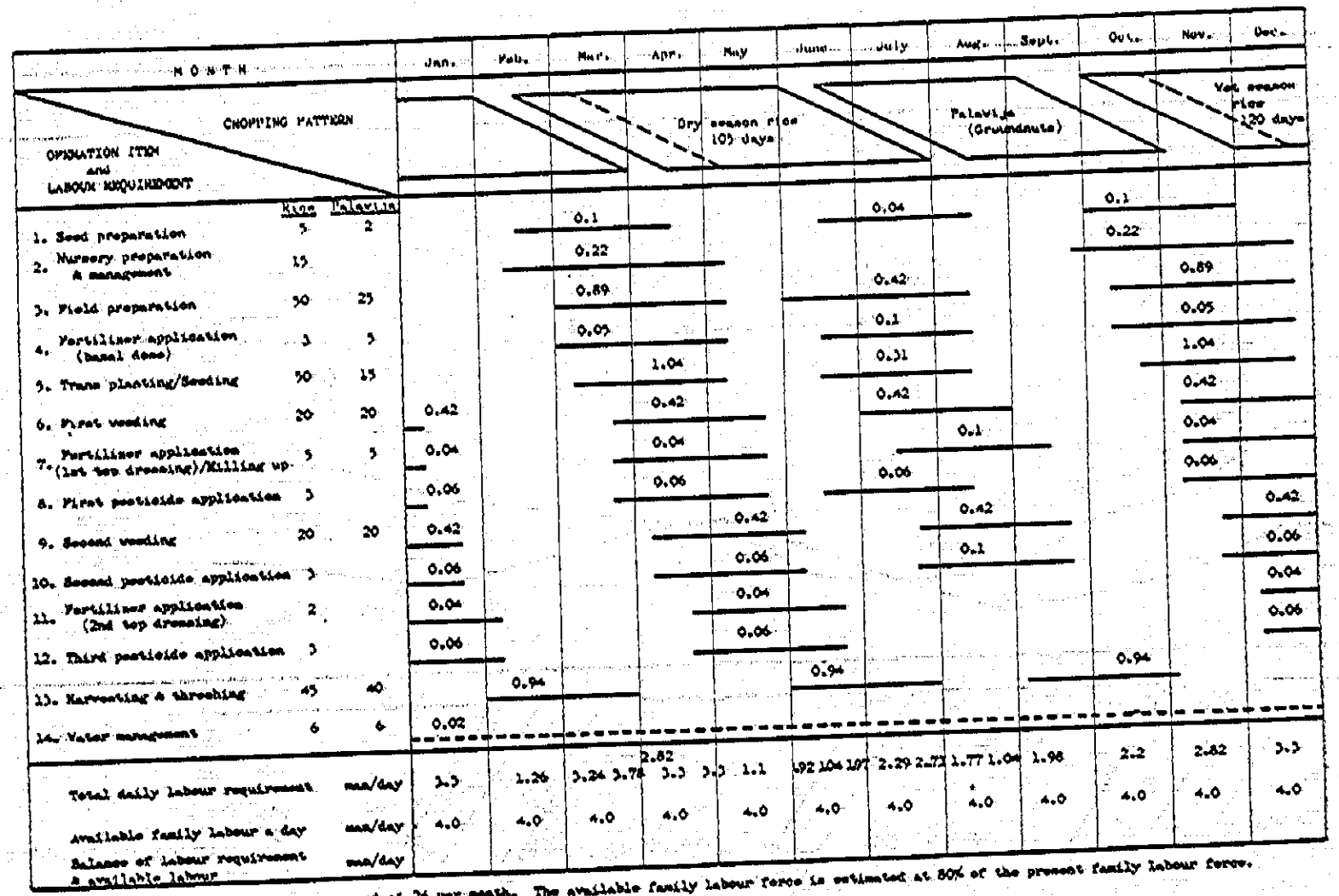


Fig. V-4 PROPOSED CROPPING PATTERN



Note: The number of workable days assumed at 24 per month. The available family labour force is estimated at 80% of the present family labour force.

Fig. V-5 UNIT LABOUR REQUIREMENT AND LABOUR BALANCE FOR PROPOSED CROPPING PATTERN PER HA

ANNEX - VI

AGRO - ECONOMY

ANNEX-VI AGRO-ECONOMY

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ANNEX - VI

AGRO - ECONOMY

1. BACKGROUND

1.1 Land and Population

Indonesia is an island nation situated at the southern extremity of Southeast Asia, straddling the equator for 2,000km from north to south and 5,000km from east to west. The nation comprises Sumatra, Kalimantan, Sulawesi, Java, Irian Jaya and other islands totalling some 13,700 in all and encompasses a land area of 191 million ha. This total land area in turn consists of 114 million ha of forest land (60% of the total), 16 million ha of agricultural land (8%), 13 million ha of waste land (7%) and 48 million ha of other various types of land (25%).

Population of Indonesia according to the result of 1980 Population Census was 147.5 million of which more than 60% live in Java with the land area of only 7% of the total area of Indonesia.

Population in West Java Province was 27.4 million in 1980 with the population density of 593 persons per km^2 and average annual growth rate of population is 2.66% during the past decade. Demographic conditions of Indonesia by island are presented in Table VI-1.

The Banten region, which occupies an area of 16% of the Province of West Java, is situated in the northwest corner of West Java and comprises the Kabupatens (Districts) of Serang, Lebak and Pandeglang. Population of these Kabupatens was 2.5 million in 1980 with average growth rate of 2.57% per annum in the past decade.

The land of Kabupaten Serang is 187,600ha, of which 133,000ha or 71% of the land are used for agriculture. Population in Kabupaten Serang was 1,109,186 in 1980 with population density of 591 persons per km^2 and average growth rate of 2.85% during the past decade.

Population and population growth rate in Indonesia between 1971-1980 are presented in Table VI-2, and population density in Indonesia is shown in Table VI-3.

1.2 National and Regional Economies

Gross Domestic Product (GDP) of Indonesia at constant 1973 market prices during 1978-1981 indicates the average economic growth rate of 7.9% per annum. The relative weight of the agricultural sector within the national economy has tendency to decrease as seen in Table VI-4. Nevertheless, the importance of the agricultural sector is characterized by its magnitude in the employed persons as indicated in Table VI-5.

The economic structure of West Java is similar to that of whole Indonesia. Summary of the regional economy of West Java is presented in Table VI-6 in comparison with that of whole Indonesia. As seen in the Table, the agricultural sector product in West Java accounts for about 32% in 1978. In agricultural sector, about 71% of the product is raised by farm food crops.

The gross regional domestic product (GRDP) in the Banten region was about Rp.320 billion in 1980. During the period of 1973 to 1980, the average annual growth rate of the GRDP was about 7%, which is similar, to that of West Java.

1.3 Balance of Trade

The amount of export in Indonesia has remarkably increased in the past years especially from 1975 to date, due mainly to the progress in the development of the petroleum industry (Table VI-7). Export structure of Indonesia is characterized by its heavy dependence on the products in the primary sectors such as mineral and agricultural sector. Particularly, petroleum and its products have become the most important export goods since 1974. While the share of agricultural products such as rubber, coffee, palm oil and wood is decreasing, the total amounts are increasing substantially (Table VI-8).

Meanwhile, imports of Indonesia has increased in relatively low pace compared with that of exports. Petroleum products, machinery for industrial and commercial use and rice are the major items of import. The import of rice had a tendency to increase annually during 1975-1980, but showed a substantial drop in 1981 supported by incremental production of food crops in 1980 (Table VI-9).

The balance of trade in recent years showed an increasing surplus from US$2,332 million in 1975 to US$11,076 million in 1980. The major factor affecting the improved balance was the increase in the oil price (Table VI-7).

1.4 The Third Five-Year Development Plan (REPELITA III)

Following the Second Five-Year Development Plan (REPELITA II), the Third Five-Year Development Plan (REPELITA III) was formulated for the period from 1979/80 to 1983/84 with the following three objectives:

1) Equitable distribution of development and its gains for the whole population,
2) A sufficiently high economic growth, and
3) A sound and dynamic national stability.

To achive the objectives, a variety of paths to reach the goal was laid, such as: 1) fulfillment of the basic needs, especially for food, clothing and housing; 2) equitable distribution of income and the increased opportunity to receive social welfare; and 3) increased employment and job opportunity.

Based on the policies mentioned above, the target of the plan was set at an average economic growth rate of 6.5% per annum with the assumption that population growth rate will be about 2% per annum during the years of REPELITA III.

As for the agricultural development sector, the principal policies are : 1) To achieve self-sufficiency in food production; b) To increase export of agricultural product; c) To increase agricultural products for industrial use; and d) To raise the living standard of farmers through the production increase.

In this context, the water resources development plays a key role in national economy with the reason that the irrigation farming is indispensable in Indonesia for raising of food production.

Under REPELITA III, there are three types of programs in the irrigation sub-sector, viz.:

1. Programs to improve irrigation network on about 536,000ha
2. Programs to construct new irrigation network on about 700,000ha; and
3. Programs to develop swamp areas on about 535,000ha (Tidal swamp irrigation on 400,000ha and swamp area reclamation on 135,000ha).

The water resources development as mentioned above is expected to support agricultural production, especially food production, transmigration programs and rural development in general.

1.5 Transportation

Total length of roads in Indonesia is 142,314km in 1980, including 11,533km in West Java. Road condition in West Java is fairly better than that of outer islands. While about 40% of roads are asphalt-paved in whole Indonesia, more than 70% are asphalted in West Java (Table VI-10).

In Kabupaten Serang, according to Annual Report by Agriculture Office, the state road (59.43km) and provincial road (61.03km) are well maintained, but Kabupaten road (569.5km) and Desa road (1,835km) are poorly maintained as shown on Table VI-11.

The trunk road linking Jakarta to the ferry terminal Merak is passing through the Desa Cikande, the market center in the K-C-C area. From this trunk road, some districts roads and rural roads are branching off to the Project area.

Agricultural products in the Project area are transported from the farm to village markets and rice mills through rural roads by carrying-pole, bicycle, motorcycle and taxis.

2. PRESENT SOCIO-ECONOMIC CONDITIONS

2.1 BIMAS/INMAS Program and Rural Society

To achieve the self-sufficiency in food production, especially rice production, a certain method of agricultural extension, known as BIMAS (Mass Guidance) has been developed. This agricultural intensification program has been introduced as one of the most successful approaches in agricultural extension, which is based on group-approach and service-approach by providing the farmers' need in the form of a package. Then INMAS (Mass Intensification) came into the scene. INMAS is supposed to be developed as a further stage of BIMAS, in which farmers have been assumed to reach a certain level of income that will allow them to be capable to provide the farm-input without any credit.

BIMAS program has provided several services for farmers at the village unit level, such as:

(1) credit services provided by Bank Rakyat Indonesia (BRI),
(2) Kios (retail shops) for supplying farm inputs such as fertilizer, pesticide, seed and others,
(3) one or more PPLs for agricultural extension, and
(4) processing and marketing facilities by BUUD/KUD (Village cooperatives).

The idea of having village unit (or WILUD) has been introduced since 1971 in the rural areas for the effective implementation of this program. Each village unit generally comprises 3 to 4 villages with 600 - 1,000ha of rice field.

In Kabupaten Serang, where the Project area is included, there are 26 Kecamatans with total of 360 villages (Desa).

In the K-C-C area, there are two BPP offices which cover the total area of 18 village units with 53 villages.

2.2 Demographic Conditions in and around the K-C-C Area

The boundary of the K-C-C area is shown on the Location Map. The area is situated in the eastern boundary of Kabupaten Serang, comprising four Kecamatans of Kopo, Pamarayan, Cikande and Carenang. Present general conditions of the area is summarized in Table VI-12 and Table VI-12A.

The study area with a gross land area of 11,500ha which includes 5,000ha of rice field and 1,000ha of dry land field has been selected from the K-C-C area for the field survey. The area comprises most part of the Kecamatans of Kopo and Pamarayan and small part of Kecamatan Cikande, having population of 59,784 in 1980. Out of total households of 13,080, about 97% are considered to be farm households. Average family size is estimated at 4.57, and 2.0 persons per farm household are available for farm labour force on an average.

Agriculture is the predominant economic activity in the area. More than 90% of the households in this area are engaged in agriculture and its related activities.

Present general conditions of the study area such as population, households, family size, etc. are summarized in Table VI-13.

3. PRESENT AGRO-ECONOMIC CONDITIONS

3.1 Land Tenure and Land Holding

According to 1973 Agricultural Census in Indonesia, 14.37 million farm families are holding 14.16 million ha of farm land, averaging 0.99ha per farm family. As for Java and Madura, each farm family is holding only 0.64ha on an average (Table VI-14).

In West Java, about 83% of the farmers own the cultivated land of less than 1.0ha and the number of the smallest land owner of less than 0.5ha occupies about 60% of the total farmers (Table VI-15).

Based on the data from field survey, total number of farm household in the study area is estimated at about 12,630 in 1980. In the study area, the size of farm averages about 0.386ha of rice field. Out of 12,630 farm households in this area, about 95% or 12,000 households are considered to hold their own farmlands. The distribution of land holding size is as follows:

Table VI-12B LAND HOLDING SIZE IN THE STUDY AREA

Land Holding Size (ha)	Farm Household	Percentage (%)
Less 0.25	5,305	44.21
0.25 - 0.50	3,178	26.48
0.50 - 1.00	1,957	16.31
1.00 - 3.00	1,099	9.16
3.00 - 5.00	364	3.03
5.00 over	97	0.81
Total	12,000	100.00

Source: Fakta dan Penjelasan, Land Use Office, Serang

The small farmers who own less than 0.50ha of farmland occupy about 70% of the total farmers. The crop income of these farmers under rainfed condition is insufficient to maintain the livelihood of farmers and most of these farmers are

engaged in various side business including seasonal work in Jakarta or in other urban areas.

3.2 Marketing and Prices

Main marketing farm output is rice in the study area. The surplus of paddy produced by the farmers is sold mainly through the channel of both KUD/DOLOG and the private traders. The collected rice by small rice traders and KUD is sold to large rice traders and DOLOG respectively after milling. DOLOG is a provincial branch office of BULOG (the National Food Logistics Agency) and has its Sub-DOLOG offices at Kabupaten level. Under the Rice Price Stabilization Program, domestic procurement of paddy and milled rice has been undertaken through the KUD (Village unit cooperatives). However, because of very limited storage capacity of Sub-DOLOG/KUD, only about 20% of paddy and milled rice marketed are handled through Sub-DOLOG/KUD in Kabupaten Serang. The remaining is handled by private traders. It is desired, therefore, that Sub-DOLOG and KUD would improve their storage capacity for the effective activities in domestic procurement.

The prices of farm output fluctuate by many factors which affect supply and demand. However, considering the importance of rice to both producers and consumers, the Government is always trying to stabilize the price of rice. Under the price stabilization policy, market injections are sometimes undertaken by DOLOG. DOLOG offices purchase rice when the market price become lower than the floor price and sell the rice when the market price become higher than the ceiling price.

The market prices of major food crops in the rural markets of Java in recent years are shown in Table VI-16. The seasonal fluctuation in local market price of farm products is relatively high due to inadequate marketing, poor transportation facilities and limited storage facilities.

3.3 Distribution of Agricultural Inputs

Fertilizer distribution is undertaken by P.T. Pusri (governmental enterprise) through KUD and retailers. P.T. Pusri is responsible for fertilizer distribution for BIMAS/INMAS to Line III (Kabupaten level) and with further responsibility to the farm level (Line IV) if no other distributors are available.

Distribution of agricultural chemicals and seed is channeled through P.T. Pertani (governmental enterprise)/KUD and private distributors. P.T. Pertani is responsible for pesticide distribution to Line III throughout the country, similar to Pusri's responsibility for fertilizer. Pesticide distribution to the farmers is made through KUD and other private retailers.

3.4 Agricultural Support Services

3.4.1 Research and Extension Services

The agricultural research work in Indonesia is undertaken by the Agency for Agricultural Research and Development (AARD) at Bogor in Java. There are 7 Central Institutes under the AARD. The Central Research Institute for Food Crops (CRIFC) is one of these institutes having 7 Research Institutes located in South Kalimantan, West Sumatra, South Sulawesi, East Java and West Java.

The Research Institute in Bogor (BORIF) has executed various experiments on food crop development. The institute has one of branch experimental stations at Singamarta in Kabupaten Serang, about 20km north-west of the study area. Most of the experimental works of this experimental station have been devoted to the experiment of breeding of rice, cultivation tests of strains, and experiment on the cropping pattern using about 10ha of experimental farm. This experimental station is playing an important role in technical aspect of increase of crop productivities not only in selecting suitable rice varieties in this region but also introducing new crops and varieties and cultivation technique in combination with the experiment on the cropping patterns.

Agricultural Extension Service is one of the main components to promote the sustained increase of agricultural products, especially of food crops. The Directorate General of Food Crops of Ministry of Agriculture is in charge of rural extension works on food production at national level.

Extension Service in West Java is undertaken by Provincial Office of Agriculture Service (Dinas Pertanian Propinsi) through Subject Matter Specialists (PPSs), Extension Officers (PPMs) and Field Extension Workers (PPLs). Personnel of Agricultural Extension Service in Wet java is summarized as follows:

- 5 PPSs at Provincial Office of Agriculture Service

- 4 PPSs at each Wilayah (or Regional) Office of Agriculture Service
- 1 PPS at each Kabupaten Office of Agriculture Service
- 2 PPMs at each Kabupaten Office of Agriculture Service
- 2 PPMs at each BPP (Rural Extension Center) Office
- 1 PPL per each WKPP (Rural Extension Working Area of 600-1,000ha)

There are 219 BPP offices in West Java, where 438 PPMs and 2,023 PPLs are working to provide extension service mainly for the farmers.

In Kabupaten Serang, there are 10 BPP offices including BPP Pamarayan and BPP Cikande, where each 2 PPMs and about 10 PPLs are serving. BPP Pamarayan is located at Desa Kopo (Kecamatan center) which covers Kecamatan Kopo and Kecamatan Pamarayan. BPP Cikande is located at Desa Cikande (Kecamatan center) which covers Kecamatan Cikande and Kecamatan Carenang.

10 PPLs serve in the area of BPP Pamarayan covering about 6,000ha of rice field with about 18,325 farm households. 9 PPLs serve in the area of BPP Cikande, covering about 8,800ha of rice field with about 14,843 farm households.

Agricultural extension service is provided by PPLs (Field Extension Workers), stationed in BPP offices, under supervision of PPSs and PPMs. A PPL visits 16 farmers' group area called WILKEL in every 2 weeks to transfer the new agricultural information and new farming technology and also to solve the problems, if any, in the fields as well as in farmers society.

3.4.2 Seed Multiplication and Distribution

Traditionally the farmers in Indonesia have used a part of their paddy production as seed for the next planting season. However, with the BIMAS program to help increase production through the use of new HYVs, the need for improved seed multiplication and distrubution became urgent. In 1971, the National Seed Corporation (Sang Hyang Sri) was established in Sukamandi, West Java to produce extension seed. The NSC has no problem in distributing its production but its production still remains far short of original plan.

There are three (3) seed multiplication farms in Kabupaten Serang. These farms produce about 90 tons of seed every year but this amount is very short to fill the requirement of 1,500 tons of seed in Kabupaten Serang every year. The shortage is mainly supplied by NSC and farmers' own produce.

Distribution of seed is channeled through P.T. Pertani (governmental enterprise)/KUD and private distributors.

3.4.3 Agricultural Cooperatives and Credit

Under the Agricultural Intensification Program called 'BIMAS", several kinds of services are provided to farmers at the village unit level, such as:

(1) Credit services provided by Bank Rakyat Indonesia (BRI);
(2) KIOS or retail shops for supplying agricultural inputs such as seed, fertilizer and pesticide;
(3) One or more PPLs for agricultural extension; and
(4) Processing and marketing facilities by BUUD/KUD (Village Unit Cooperative).

The idea of having village units (Wilayah Unit Desa or WILUD) has been introduced since 1971 to make farm-cooperatives' activities more effective. Before 1971, there were farm-cooperatives in mostly every Desa with the area of only 80-200ha rice field which did not allow the farmers' cooperatives to make effective function because of too small area. So some cooperatives were combined into a BUUD (Badan Usaha Unit Desa or Village Unit Enterprise Cooperative) to cover the area of 600-1,000ha (WILUD). BUUD is a temporary organization and all BUUDs are to be raised to the status of KUDs (Village Unit Cooperatives). There are one KUD in Kec. Pamarayan, two each in Kecamatans of Kopo and Cikande, and three in Kec. Carenang. Each KUD has 1 or 2 KIOS (retail shops) at Desa level to supply agricultural inputs for farmers.

BIMAS credit is financed by the Indonesian Peoples' Bank (BRI), the state bank specialized in agricultural credit. In order to provide loan service properly, the BRI began establishing their Unit Desa Banks (BRI Unit Desa) at the Kecamatan level.

In the K-C-C area, there are 6 Unit Desa Banks, one each at Kecamatans of Pamarayan and Kopo and two each at Kecamatans of Cikande and Carenang.

There are three kinds of loan for on-farm and off-farm loan, i.e. short-term, medium-term and long-term loans. The short-term credit is most frequently used by small-scale rice farmers. The Bimas credit is the short-term loan with the conditions of 7 months in loan term with 1% of monthly interest rate.

3.4.4 Water Management

According to the Indonesian criteria, there are three grades of irrigation classification, i.e. a) technical irrigation, b) semi-technical irrigation and c) non technical irrigation.

a) The technical irrigation works are designed and constructed by the DGWRD, Ministry of Public Works (DPU) up to the tertiary canals with facilities for quaternary canals. The construction of quaternary canals and land reclamation for rice field is carried out by farmers themselves under the guidance of the Irrigation Section of the Provincial Public Works and the Land Development Unit (UPP) of the Provincial Agricultural Services respectively.

   The operation and maintenance up to the secondary canals are managed by the Irrigation Section of the Provincial Public Works and tertiary canals down to the fields are managed by farmer's organization.

b) The semi-technical irrigation works cover relatively small area which may be limited to one District. In this case, only the head works are constructed by the Directorate of Irrigation, while the canals and their supervision of the head works are generally transferred to the Kecamatan authorities and water distribution below the tertiary canals is managed by the farmer's organization.

c) The non-technical irrigation works are relatively very small works and cover only one to two villages as they have limited water supply generally from a small stream. The execution of construction of the head works and canals is made mainly by the farmer's group. The maintenance of the structures and the distribution and management of irrigation water are entirely organized by the rural communities.

In the area where irrigation facilities are available, there exists the water users association (P3A). In the study area, however, no water-user group has been formed due to the absence of irrigation facilities.

4. PROPOSED AGRICULTURAL SUPPORT SERVICES

4.1 General

The Project area is not fully provided with the proper agricultural support services in view of the forthcoming new farming system of irrigated agriculture. The present management of agricultural support services under the rainfed condition should be improved before the implementation of the Project.

4.2 Research and Extension Services

In order to ensure the present crop development program and to provide for the successful implementation of the farming, a systematic program of adaptation test of agriculture in the Project area is indispensable. The research activities at the Singamaerta experimental station should carry out experiments on cropping patterns including rice and non-rice food crops such as groundnuts, soybeans and chillies. The location of experiments would be in the Project area.

Personnel of agricultural extension service in the Project area are considered to be enough in number (a PPL covers about 600ha of rice field), but the training program for PPMs and PPLs should be strengthened by the authorities concerned. It is also desired to provide some technical testing appratus and information instruments such as pH meter, soil auger, slide projector and motorcycle for effective activities of PPMs and PPLs.

4.3 Seed Multiplication and Its Distribution

When irrigation becomes available through the Project, the improvement and extension of the seed farm is necessary for the timely and sufficient supply of seed to the farmers. In this context, the staff members, facilities, fields and equipment should be strengthened before the completion of the Porject works. The required amount of rice seeds will be about 180 tons per year with the Project for about 7,000ha of planted area. Seed distribution system to the farmers through BUUD/KUD or seed growers should also be improved for smooth and wide distribution of seeds.

4.4 Agricultural Credit

Agricultural credit system in Indonesia is divided into two channels. One is under BIMAS program and the other is out of BIMAS program. For the

participation to the BIMAS program, one of the prerequisites is that the technical or semi-technical irrigation system is to be basically provided int he fields to be applied.

The BIMAS program area would be expanded and the farmers' demand for the credit would be increased with the provision of irrigation water in the Project area. It is desired, therefore, that the credit system under BIMAS program or out of BIMAS program would be strengthened by the proper guidance of the Government agencies concerned.

4.5 Farmers Cooperatives

Agricultural development in the country of very dense population and a very small farm holding size can not be very successful without cooperation of farmers concerned. A well organized farmers' organization can boperate as a very effective liaison between farmers and development agency.

In the Project area, there exists only three BUUD/KUD out of nine village units. It is anticipated, however, that some more BUUD/KUD will be organized with the increase of agricultural production in the Project area. In this context, it is desired that the Government agencies concerned would give the guidance, assistance and facilities for more effective function of these cooperatives in the area, viz. such as: provision of education and training of cooperative managers, credit facility, marketing and processing facilities, etc.

4.6 Water Management

According to present practices in Indonesia, operation and maintenanc eof irrigation and related facilities are the responsibility of the local (provincial) government. The operation and maintenance of irrigation works including main and secondary canals in the Project area would be the responsibility of Serang Irrigation Section of the Public Works of the Province of West Java.

The operation and maintenance of on-farm facilities including tertiary canals would be the responsibility of the farmers. It is desired, therefore, that the Government agencies concerned will make necessary arrangements to establish water users' associations in the Project area. The operation and maintenance of the village water supply facilities would be the responsibilities of users themselves under the supervision of village head and the sanitary staff in the area.

5. MARKETING AND PRICE PROSPECTS

5.1 Marketing Prospects of Rice

In spite of a remarkable increase in rice production in recent years, Indonesia has been importing about 4.5 million tons of rice during these 3 years mainly due to the population increase together with the increse in per capita consumption. It is reported that import of rice will be continued to a certain extent to cope with the increased consumption of rice and also to stabilize the price of rice.

West Java is the second largest rice producing province in Indonesia but little surplus is found in this region due to its high rate of per capita rice consumption.

Kabupaten Serang is one of 20 Kabupaten of the province of West Java and occupies about 3.5% of rice production of West Java. Having high potential for increase of rice production, Kab. Serang is expected to become the granary of rice for deficit regions by increasing its production.

The increased production of rice after implementation of the Project works will be marketed to the rice deficit regions in domestic market as the substitute of import rice.

5.2 Price Prospects

5.2.1 Economic Price of Rice

Economic farm gate price of dry paddy is estimated at Rp.180,000 per ton on the basis of the price projection by IBRD for the period of 1990 projected at 1981 dollars as shown in Table VI-17.

5.2.2 Economic and Financial Prices of Farm Inputs and Outputs

Economic farm gate prices of palawija crops are estimated at Rp.420,000/ton for groundnuts, Rp.105,000/ton for maize and Rp.259,000 for soybeans as shown in Table VI-18. The economic farm gate prices of farm inputs, i.e. fertilizers, agro-chemicals and others are presented in Table VI-19.

Financial farm gate prices of farm products and farm inputs are summarized in Table VI-20.

6. TYPICAL FARM BUDGET

In order to evaluate the feasibility of the Project, the typical farm budget of a farm household has been prepared under future "with project" and "without project" conditions on the basis of the data collected at the farm economy survey conducted in the study area. Farmers in the study area get their income from farming activities. Particularly, paddy is the most important income source for the farmers.

For estimating these farm budget, the average harvested area per farm household is assumed to be 1.2ha under "with project" condition and 0.44ha under "without project" condition.

In addition to the farm income, farmers also get their income from non-farm activities such as off-farm labor, trade, etc. This non-farm income accounts for about 20% of the gross income for the average farmer in the Project area under "without" project condition.

The result of calculation is presented in Table VI-21.