

APPENDIX IV  
AGRICULTURE AND AGRO-ECONOMY



## CHAPTER 1. GENERAL BACKGROUND

### 1.1 National Socio-Economy

#### 1.1.1 Land and Population

The Republic of Indonesia is basically an equatorial country lying between latitudes 6°N and 11°S. There are, however, significant climatic variations resulting both from differences in altitude, and in addition the island further to the east, in Nusa Tenggara, Barat and Timur, experience a progressively more tropical climate. The fact that the country is made up of 13,677 islands means that the surrounding sea has a major equalizing influence on climate. As a result the country as a whole exhibits a significant measure of climatic homogeneity for so extensive an area which stretches over a distance of about 5,200 km from east to west, and encompasses a total land area of about 1.92 million km<sup>2</sup>. However, variations in both temperature and rainfall can arise within even a relatively limited geographical area of the country as a result of local topographical features, may be far greater than those which can be attributed to differences of latitude and longitude over the archipelago as a whole.

The total population in 1988 was estimated at approximately 175 million. Currently Indonesia has the world's fifth largest population. The current average population density is 91 persons per square kilometer. This overall average figure, however, conceals huge regional variations in population densities. For example, Java and Bali exhibit very high population densities, for example, exceeding 950 persons per km<sup>2</sup> in Jogjakarta, while in East and Central Kalimantan, and Irian Jaya the comparable figures are less than 10 persons per km<sup>2</sup>. The average rate of population increase is currently 2.10 percent per annum, but this again conceals very large regional differences, with rates of increase of well below 2 percent in Java where the Government promoted family planning programmes have been most successful, to over 4 percent per annum in parts of Sumatra and Kalimantan. The national rate of population growth is expected to continue to decline over the next 5 years, and is projected to be only 1.8 percent per annum by 1995. Between 1965 and 1987 the national crude birth rate declined from 43 per 1,000 to 29 per 1,000. At the same time, the crude death rate has also declined dramatically from 20 to 9 per thousand. Life expectancy at birth has increased significantly over the same period, from 44 years in 1965 to 60 years in 1987.

The labour force (the proportion of those aged 10 and over considered to be economically active) was estimated at 72 million persons in 1987. 55 percents (or 39.6 million of these) were employed in the agricultural sector, although there was again wide variations between provinces. Of the remainder, 8 percents were employed in the manufacturing sector, 15 percents in trade, 16 percents were classified as service workers and the remaining

6 percents were engaged in a variety of other occupations. The labour force is projected to grow by 11.9 million persons during Repelita V (5th Five-Year Development Plan : 1989/90 - 1993/94) which means that the economy will have to generate additional employment for about 2.4 million new workers each year.

#### 1.1.2 National Economy

The Indonesian economy grew by nearly 6 percent in 1988 after a growth rate of 3.6 percent in 1987. The average annual growth rate in GDP (Gross Domestic Product) for the period 1980-87 was also 3.6 percent, and the economy should be able to easily sustain this figure for much of the 1990s. By 1987 per capita GDP had increased to US \$450 and is expected to continue its strong growth during Repelita V.

During the 1980s the Indonesian economy has undergone some major fundamental changes. Indonesia has always had a rich and diverse range of natural resources, but until the early 1980s the economy was very much dependent on its hydro-carbon resources to generate growth. In 1980 oil and gas contributed about 80 percent of export earnings and 60 percent of government revenues. By 1988 those figures had dropped to 40 percent and 30 percent respectively. At the same time the emphasis with respect to oil and gas exports has changed, with declining dependence on the export of crude oil and more emphasis on long-term contracts for the supply of gas, particularly to Japan. This will help to consolidate Indonesia's share of the world market for LNG (Liquefied Natural Gas), particularly as new fields are brought on stream. In 1987 for the first time oil and gas contributed less than 50 percent of foreign exchange earnings, with other exports bringing in US \$9.5 billion of Indonesia's total external earnings of US \$18.7 billion. Manufactured and processed goods now account for about 80 percent of the non-oil export sector. Oil and particularly gas, exports will continue to provide the foundations for the growth of the economy, but will no longer be its main driving force. This in turn will mean that the economy will be less vulnerable to sudden fluctuations in world oil prices.

Industry has played a relatively secondary role in the country's economic growth during the past 20 years but since the mid-1980s the pace of industrial development has quickened and in 1988 industry contributed 18.4 percent of gross domestic product, and by 1990 this should have increased to 20 percent or more of GDP. The continued growth of the industrial sector will be vital in providing the employment opportunities necessary to absorb the 2.4 million new workers entering the job market every year. Indonesia's traditional industries such as textiles and finished garments, are well suited to providing increased employment as they are labour intensive, and can be sited relatively easily in both urban and semi-rural communities where much of the new work force is found. Other industries based on Indonesia's natural resources such as pulp and plywood, are also showing rapid

growth, as are the tyre industry, other rubber derivatives, processed foods, beverages and tobacco products.

In recent years, foreign investment commitments have increased dramatically with US \$4.4 billion committed in 1988 alone. This followed the US \$1.5 billion committed in 1987. Given that a portion of these commitments will not result in actual investments, the amount likely to be invested is still very substantial. In fact the US \$4.4 billion committed is equivalent to 20 percent of the total foreign investment received by Indonesia between 1967 and 1988.

Indonesia's balance of payments position deteriorated rapidly during the early 1980s as a result of reduced oil exports denominated in lower value dollars. World Bank estimates indicate that in the period 1983-1988 the combined impact of these external factors resulted in an income loss to Indonesia equivalent to 9 percent of its gross national product. It also resulted in Indonesia's external debt burden increasing significantly, due to the depreciation of the dollar after 1985. Despite this increase in external debt, now estimated at US \$50 million, Indonesia has maintained its interest and repayment schedules and avoided any foreign exchange crisis. The economy is now in a much stronger position to weather any future oil.

### 1.1.3 Agriculture

The agricultural sector still plays a very important role in the country's economy, with approximately 55 percent of the national labour force employed in it. This figure varies widely by province, with a number of provinces having over 80 percent of their labour force in the agricultural sector.

Agriculture accounts for approximately 25 percent of GDP and a similar proportion of exports. During Repelita V agricultural production is projected to increase by 3.6 percent per year, and by 1993 it is still expected to account for 21 percent of gross domestic product.

The principal food crops produced in Indonesia are rice, maize, cassava, sweet potatoes, groundnuts and soybeans (Refer to Table IV-1). However, rice is by far the dominant food crop, with total paddy production currently exceeding 40 million tons per annum. Due to Government emphasis on rice production and the consequent large scale expenditures on the rehabilitation of existing irrigation scheme and the construction of new projects, Indonesia is now in practical terms self sufficient in rice. Imports by BULOG have declined from 2.5 million tons per annum at the beginning of Repelita III (1979/80), to just under 80,000 tons in 1987/88. There was an increase to 315,000 tons in 1988/89 but this is thought to be only a temporary increase rather than the start of an upward trend.

Over the period 1981-87, the average annual increase in

paddy production was 3.7 percent and it is anticipated that this upward trend will continue as new areas of technical irrigation come into production, and average yields continue to increase.

The production of palawija crops has also increased significantly with soybeans production, for example, up by 65 percent between 1981 and 1987. There is, however, a need to increase production in terms of both area and yield of all the major palawija crops, with the possible exception of cassava. (Indonesia is currently the world's fourth largest producer of cassava). Soybeans are still being imported in large quantities, with imports during Repelita IV (1984/85 - 1988/89) averaging 395,000 tons per annum, and reaching 530,000 tons in 1988-89. Indonesia is also a major producer of rubber, palm oil and coffee, all of which are important export crops bringing in substantial foreign exchange. Coconuts are an important crop throughout the country, but coconut products are mainly for domestic consumption, though there are limited exports of coconut oil, copra and copra cake. Indonesia is an important supplier of tea and is fast becoming a significant producer of cocoa.

The Government expect non-oil exports to grow by 15 percents per annum during Repelita V, and the estate and smallholder tree crop sectors are expected to play their part in this growth. They are also seen as a vital source of rural employment, helping to absorb substantial numbers of the 11.9 million workers who will be joining the labour force over the next five years.

After a number of years of low prices Indonesian plantation commodities are staging a strong recovery. Natural rubber prices have risen substantially, although there is a fear that with low oil prices natural rubber may lose market share to synthetic rubber products. In the vegetable oil market, palm oil is increasingly providing a cheap, versatile alternative to soybean oil, and prices are projected to increase in real terms over the next five years. Indonesia has the additional advantage that its very large domestic market cushions its cash crop sector to some extent against sharp fluctuations in world prices. The domestic demand for palm oil, for example, is a third of total production, and domestic demand is expected to grow by about 8 percent a year. There are also plans to expand domestic rubber manufacturing facilities in order for the country to benefit from the increased value added, and also to increase industrial employment. At present only about 10 percent of the rubber produced is processed into manufactured rubber products.

## 1.2 Regional Socio-Economy

### 1.2.1 Location

The Province of Bengkulu is situated on the south western coast of the island of Sumatra between latitudes 2° 50' South and longitudes 101° to 104° East. Most of the province lies in a narrow strip 400 km long located between the Indonesian Ocean the

west and the volcanic Barisan Mountain Range in the east.

The province covers an area of 19,784 km<sup>2</sup> and is bounded to the north by the Province of West Sumatra, to the east by Jambi and South Sumatra, and to the south by Lampung. The city of Bengkulu lies on the coast midway between the borders with West Sumatra and Lampung.

The project area lies 280 km north of the city of Bengkulu in Kecamatan Muko-Muko, the most northerly Kecamatan in Kabupaten Bengkulu Utara. The Kecamatan is bounded on the south by the Air Bantal river and in the north by the border with West Sumatra.

The Air Selagan river runs southwestwards across the Kecamatan, reaching the coast at Pasar Muko-Muko. There a coastal sand bar causes the river to turn northwards for several kilometers before joining the Air Manjuto river and entering the sea. The project area covering approximately 14,800 hectares stretches inland from Pasar Muko-Muko on both sides of the Air Selagan for approximately 25 km.

### 1.2.2 Population

The population of Bengkulu Province was 1,071,988 in 1988 projected to increase to 1,158,197 by the end of 1990 and 1,391,158 by 1995. The distribution of the population by kabupaten is shown as below.

#### Provincial Population 1988

Kabupaten	Population	Density(per km <sup>2</sup> )
Bengkulu Selatan	293,110	49
Rejang Lebong	247,435	84
Bengkulu Utara	295,883	31
Kotamadya Bengkulu	135,560	938
Province	1,071,988	54

Source : Central Bureau of Statistics, Jakarta

Between 1985 and 1990 the population was estimated to grow at an annual rate of 4.12 percent compared with the projected national average growth rate of 2.1 percent. The projected population growth rate for Bengkulu is expected to decline to 3.73 percent over the period 1990-95, but this is still much higher than the projected national average of 1.8 percent. This is due in part to a higher fertility rate in Bengkulu, 4.2 percent versus 2.5 percent for Indonesia as a whole, and partly

to a net annual immigration rate of 14.3 per 1,000 population.

Out of a working population (population 10 years of age and over) of just over 500,000 in 1988, over 81 percent were classified as being employed in agriculture. This compares with 55 percent of the working population for Indonesia as a whole.

### 1.2.3 Regional Economy

In terms of area cultivated, the most important crop in 1988 was rice, with 68,000 ha planted to lowland rice and 26,000 ha planted to upland rice (Refer to Table IV-2). Bengkulu, however, still imports rice with DOLOG importing over 30,000 tons from other regions of Indonesia in 1988 (The BULOG and DOLOG marketing channels are shown in Fig. IV-1). In terms of area, maize was the second most important food crop with 7.4 percent of the planted area, followed by groundnuts 5 percents, cassava 4.5 percents, sweet potatoes 3.2 percents and soybean 1.8 percents. All the major food crops are consumed locally.

In terms of their importance to the economy of Bengkulu the major cash crops are coffee and rubber, followed by cloves, coconut, oil palm and cocoa. With regard to area planted, production and exports, coffee is the most important cash crop with exports worth over US\$ 6.1 million in 1988. Rubber exports in the same year were valued at US\$ 1.9 million.

Agriculture dominates the provincial economy providing employment for over 81 percent of the work force in 1987. Agriculture was followed by the trade and service categories, each employing 6.4 percents of the working population, while manufacturing accounted for only 0.4 percents. The most important manufacturing enterprises are involved in the processing of agricultural raw materials and sawmilling.

The other major export commodities in terms of volume and value in 1988 were coal and sawn timber. Over 180,000 tons of coal and nearly 15,000 m<sup>3</sup> of sawn timber were exported.

The regional economy of Bengkulu Province is, therefore, heavily dependent on the production and processing of agricultural, mineral and forestry products.

### 1.2.4 Agriculture

Rice is the most important food crop grown in Bengkulu Province, with production reaching 269,000 tons in 1988. This represented an increase of 69 percent over the 1979 level of production (see Table IV-2). The crop was cultivated on 68,000 ha of lowland rice field and 26,000 ha of upland rice fields. It would appear from Table IV-3 that Bengkulu is now self-sufficient in rice production, assuming an annual per capita consumption figure of 149 kg. However, DOLOG still imports rice from surplus



provinces of Indonesia, such as South Sulawesi and East Java, with over 30,000 tons being imported in 1988, (Refer to Table IV-4), but this declined to 17,500 tons in 1989. In addition, a very little rice is purchased locally by DOLOG. However, this does not mean that significant quantities of local rice are not sold either directly through village markets, or to private dealers.

It has been suggested by DOLOG, among others, that a substantial proportion of the rice produced in Bengkulu is of the preferred local varieties which have a ready market in surrounding provinces. As a result, the preferred varieties of Bengkulu rice are exported from the province, while rice of the less popular, high yielding varieties, is imported from Java or South Sulawesi to meet the requirements of Government employees, the armed forces and other sections of the urban population. No data are available to indicate that substantial quantities of local rice varieties which are exported from the Province, but if this is the case, it would help to explain the anomaly between the apparent surplus rice production in Bengkulu and the continued imports of rice from elsewhere in Indonesia.

The other major food crops produced in the Province are maize, cassava, sweet potato, groundnuts and soybeans. However, total area planted to all these crops in 1987 was 29,000 hectares, or only 31 percent of the area planted to rice (Refer to Table IV-5 and IV-6). Per capita annual production of these crops is still low as shown in Table IV-7, but there have been sustained increases in maize and cassava production since 1984.

The major cash crops produced and exported from Bengkulu are coffee and rubber as shown in Table IV-8, but significant areas of oil palm and cocoa have been planted in recent years both as estate and smallholder crops. These are not yet in production, but will produce substantial quantities of palm oil and fermented cocoa beans for export once they reach maturity.

Other minor tree crops produced for export are cloves, Cassia Vera (cinnamon) and kapok, while substantial areas of coconut provide for domestic consumption within the Province.

#### 1.2.5 Future Demand and Supply for Rice

Based on the agricultural development plan of Bengkulu Province in line with National Development Plan, of Repelita V, the projection of the supply and demand of rice was estimated as shown in Table IV-3.

as shown in that table, the supply will overcome the demand in 1995 and the rice shortage of 1,900 tons occur in the Province. Furthermore, the rice shortage in 2000 would attain to 15,800 tons.

### 1.3 Agricultural Sector in the Fifth Five Year Development Plan

The objectives of the fifth Five-Year Development Plan focus on strengthening the agricultural sector in order to sustain the nation's drive to self sufficiency in food crops. Other priorities include the increased production and greater variety of cash and export crops in order to generate additional employment opportunities, and to increase the value added of Indonesian exports. An obvious adjunct to this policy is to improve the income and living standards of farmers, livestock producers and fishermen. It is also intended that the further development of the agricultural sector should stimulate regional development and provide additional opportunities for transmigration.

The development of cash crops will be export oriented, but will also provide the raw materials for domestic industries to process into finished goods for export. Smallholder production will be encouraged by linking smallholder schemes with nucleus estates developed either by the private sector, or by the state owned plantations.

In order to encourage increased production of food crops it is intended to rehabilitate existing irrigation facilities, and to construct new irrigation projects in areas with undeveloped irrigation potential. These new areas will, where possible, be linked to transmigration schemes. River rehabilitation and flood control will also be undertaken.

The major objective for the development of agriculture in Bengkulu during Repelita V will be, as for the national programme, achieving and maintaining self sufficiency in food crops and particularly in rice production. This will be achieved by expanding the areas under technical irrigation, and by encouraging the use of improved agricultural inputs. This will be coupled with the development of new areas for transmigration.

Intensification will be achieved through existing Government programmes, such as INSUS, the scope of which will be expanded to include both irrigated rice and irrigated and rainfed palawija crops. In addition the improved SUPRA INSUS programme will be introduced in Bengkulu during Repelita V. The areas targeted for crop intensification are given in following table.

Target Areas for Crop Intensification during Repelita V

(Unit : ha)

Commodity	Years					Total
	1989	1990	1991	1992	1993	
Rice	86,000	90,000	94,500	99,000	104,000	373,500
Maize	10,750	11,500	12,250	13,000	14,000	61,500
Soybean	9,500	10,250	11,000	11,750	12,500	55,000
Groundnut	4,250	4,750	5,250	5,750	6,500	26,500
Green Bean	2,000	2,250	2,500	2,750	3,000	12,500
Cassava	3,000	3,250	3,500	3,750	4,000	17,500
Sweet Potato	2,750	2,900	3,100	3,300	3,500	15,500

Source : Repelita V Pembangunan Pertanian Tanaman Pangan, Propinsi BENGKULU

Palawija crop production will be geared to increasing per capita consumption in order to improve the diet and nutritional levels of the people of Bengkulu. Consumption of the main palawija crops is still low, with annual per capita consumption of all palawija crops averaging only 65 kg. The target set for the end of Repelita V is 120 kg/capita/annum.

To encourage increased productivity agricultural inputs and credit will be made available in increased quantities to farmers throughout the province. In addition post harvest storage and processing facilities will be improved, and improved sources of information provided to farmers to assist them with the marketing of their surplus produce.

#### 1.4 Transmigration Programme

Since the early years of this century successive governments have encouraged the movement of agricultural populations from the densely settled areas of the Inner Islands, namely Java, Madura, Bali and Lombok to the sparsely populated Outer Islands. The stimulus for these programmes has been the very rapid increase in the population of Java and Madura, which rose from about 4.5 million in 1815 to 28 million by 1900. During this century it has continued to increase rapidly to its current level of almost 100 million. Accordingly, the main objectives of the programme have been:

- (1) to reduce population pressure in the rural areas of the inner islands, where the number of families with either no farm land of their own, or with plots too small to sustain themselves, has been increasing inexorably;
- (2) to raise the standard of living of the migrating families;

and

- (3) to encourage the development of the natural resources labour short areas of the outer islands.

The first resettlement scheme was established in Lampung in 1905, and the programme continued with varying rates of migration until the suspension of settlement in the early 1940s.

The transmigration programme resumed in the early 1950s. Initial targets were far too ambitious but the programme did succeed in moving an average of about 25,000 people per year up to 1965. Between 1965-1968 due to the political and economic situation in the country the annual rates dropped to less than 10,000 migrants per year.

With the initiation of the First Five-Year Development Plan (Repelita I 1969 to 1974) a target was set for moving 190,000 transmigrants over the 5 year period. By 1974 182,000 people had been moved. The target for Repelita II (1974-1979) was set at 250,000 families, or approximately 1.25 million transmigrants. This again proved to be an over ambitious target, and only 253,000 people were resettled during Repelita II.

For Repelita III a more vigorous approach was adopted and a target of 500,000 families (2.5 million people) was set. Initially the rate of settlement was slow but by 1981/82 the target was met and by the end of Repelita III in 1984 a total of about 380,000 families had been resettled.

The target for resettlement for Repelita IV was increased again to a total of 600,000 families (approximately 3.0 million people). The latest figures indicate that only 80,600 families had been resettled by the end of 1986/87. During Repelita V new programme was introduced known as the "Second Stage Development Programme" (SSDP). This is aimed at the upgrading of existing transmigration settlements as it is recognized that transmigrants require further assistance if they are to progress beyond the basic subsistence level into sustainable commercial agriculture. This will require the provision of physical infrastructure, (eg roads, irrigation facilities, drainage and flood protection), and the supply of training, lines of credit, and the strengthening of the organization and management of transmigration project.

The main task of the Ministry of Transmigration during Repelita V (1989-1994), will be to improve the physical conditions of existing transmigration settlements still under the administrative control of the Ministry, and to increase the settlers' income and welfare levels. The development of new settlement areas will also continue but the main emphasis will be on spontaneous transmigrants. Out of a planned total of 550,000 transmigrants families for Repelita V, 370,000 are expected to be spontaneous with only 180,000 families moved under the regular transmigration programme.

During Repelita II and III (1974-1984) almost 20,000 families, or 85,700 persons, were resettled in Bengkulu Province under the transmigration programme (see Table IV-9). This programme of resettlement resulted in significant areas of land being brought into agricultural production, both for food crops and commercial tree crops.

The transmigration programme for Bengkulu since 1985 is shown in Table IV-10. Number of settled families for four years are 3,591 in total. Out of figures, sixteen percent of the transmigrants were "local", originating from Bengkulu. The remainder originated from Java, with the largest group coming from Central Java.

So far, 3,025 families have been settled in Kabupaten Bengkulu Utara as shown in Table IV-11.

The planned transmigration programme for Kabupaten North Bengkulu Utara in Repelita V is presented in Table IV-12. During this period it is intended to resettle 6,700 transmigrant families with 2,570 or 30 percent being settled in Kecamatan Muko-Muko Utara.

For the province of Bengkulu as a whole, it is envisaged that 10,000 families will be resettled during Repelita V.

## CHAPTER 2. PRESENT CONDITIONS IN THE PROJECT AREA

### 2.1 Population and Labour Force

The population of Kecamatan Muko-Muko as of the end of July 1989 was 42,587 persons, living in 32 villages and 10 transmigration settlement units (SPs). The population of the Kecamatan grew rapidly between 1985 and 1989, largely as a result of the influx of transmigrants.

Total population increased by 12,015 between 1985 and 1989 (see Table IV-13) but 9,607 of these, or 80 percent, were transmigrants. The average annual rate of population increase during this period was 8.5 percent, but for the local population the rate of increase was only 2.8 percent per annum. Excluding the transmigration settlement, population density in the Kecamatan was 15.7 persons per km<sup>2</sup>. In 1985 transmigrants constituted approximately 32 percent of the population of the Kecamatan, but by 1989 they had increased to 45 percent of the population. The average family size in Kecamatan Muko-Muko is 4.48 persons with a range of 4.07 to 5.22. The families of the local population tend to be slightly larger than those of the transmigrants, but there is no significant difference between the two groups.

The age structure of the population of Kecamatan Muko-Muko is shown in Table IV-14. The working population in Indonesia is usually taken to be the total population aged 10 years and over. In Bengkulu in 1988 it was estimated that 63 percent of the population aged 10 and over were economically active, with the remainder attending school, keeping house or otherwise engaged.

The population aged 10 and over represents approximately 47 percent of the total population of Bengkulu Province. Applying these figures to Kecamatan Muko-Muko give a labour force in 1989 of approximately 20,000. Analyzing the work force by sex indicates that approximately 50 percent of the male population and 40 percent of the female population are economically active. Eighty-five percent of the work force is employed in agriculture.

Taking only the 7 villages and 4 transmigration SPs lying within the proposed Air Selagan Project area, the total population is 12,377 (see Table IV-15) giving a labour force of approximately 5,820.

There is reported to be a labour shortage in the Kecamatan, with both permanent and temporary spontaneous settlers moving to the area from Java, and North and West Sumatra. However, no official data was available on these spontaneous migrants, and the population data does not indicate any significant immigration apart from the officially sponsored transmigrants.

## 2.2 Climate

The annual rainfall is ranging between 2,500 mm and 3,800 mm, showing two peaks a year, of which one season extend from October to January and the other is March. Average temperature in the project area shows remarkable uniformity through the year. Variation in the monthly mean temperature is less than 1°C to the annual mean temperature which is approximately 31°C. The average annual solar radiation is 330 cal/cm<sup>2</sup>/day with monthly mean ranging 368 cal/cm<sup>2</sup>/day (February) to 312 cal/cm<sup>2</sup>/day (September).

Generally, the climatic condition in the study area doesn't have any limiting factors for profitable agricultural development.

## 2.3 Present Land Use

Present farm land area in the study area of 14,800 ha was estimated by the data obtained from extension and transmigration offices, interview survey to each village chief, land use survey, etc.

The farm land area has been varied year by year according to the rainfall pattern, marketability, shifting cultivation and the result of previous production.

The present land use is shown as follows:

Present Land Use (ha)

Crops	Total	Left bank	Right bank
Wetland Paddy	140	0	140
Dryland Paddy	950	650	300
Rubber	2,300	810	1,490
Garden	1,200	700	500
Natural Forest	8,620	2,480	6,140
Scrub land	1,040	570	470
Cleared Forest	250	0	250
Others	300		
Total	14,800		

## 2.4 Social Infrastructure

### 2.4.1 Electricity Supply

PLN, the national electricity authority, currently has only one 200 kW diesel generator located at Pasar Muko-Muko supplying 450 subscribers in Pasar Muko-Muko, Ujung Padang and Banda Ratu. However, work is currently under way to expand the distribution system to a further 14 villages and 6 SPs on the Air Manjuto Irrigation Scheme. The table below lists the villages to be supplied with electricity during 1991/92.

Villages to be Supplied with Electricity during 1991/92

Villages	Target Customers
1. Dusun Baru Pelokan	120
2. Lubuk Sanai	264
3. Kota Karya	75
4. Lubuk Pinang	362
5. Tanjung Alai	68
6. Lubuk Gedang	70
7. Arah Tiga	112
8. Suka Pindah	75
9. Pondok Panjang	107
10. Rasno	63
11. Lalang Luas	138
12. Talang Petai	180
13. Sungai Lintang	72
14. Pondok Tengah	66
15. LSPs I to VI Air Manjuto	1,000
Total	2,762

Source : Kantor PLN, Muko-Muko Utara, November 1989.

In order to supply these additional customers, a second 250 kW diesel generator will be installed at Muko-Muko during 1990/91. Electricity is supplied only between the hours of 6:00 PM to 6:00 AM. In addition to the PLN supply there are several small private generators supplying electricity to a limited number of customers. In Lubuk Pinang, for example, three small generators supply electricity to 15 consumers.

### 2.4.2 Water Supply

The only area with a piped water supply is Pasar Muko-Muko and the surrounding communities of Ujung Padang, Banda Ratu, Pasar Baru, Pasar Benteng, Jalan Kartini, Kampung Dalam and Pasar Belakang. There were originally 600 houses with connections but



currently only 236 customers are making use of the piped water supply. The treatment plant is operated by the Department of Public Works and water is pumped from the Air Selagan twice a day from 6:00 AM to 9:00 AM and 8:00 PM to 6:00 PM. The water is filtered and purified before distribution. There are currently no plans for extending the system.

All other residents of the Kecamatan obtained their water supplies either from rivers, wells or irrigation canals.

#### 2.4.3 Education

There are currently 52 primary schools (Sekolah Desa) within the Kecamatan providing educational facilities in 32 villages and 10 transmigrant SPs. Of the 52 schools, 51 are government schools and one private. Of the primary schools, 46 operate only one morning session, the other six (including the private school) operate both morning and afternoon sessions. Current enrollment is approximately 8,250 pupils taught in 6 grades by 315 teachers, giving a pupil/teacher ratio of 26:1.

There are 11 junior high schools (SMP) in the Kecamatan with enrollment of about 925 students. Ten schools are government schools and one private. Together they employ 141 teachers.

Finally there are 2 senior high schools (SMA), a government school with 217 students located in Pasar Muko-Muko, and a private school located at Ujung Padang with 40 pupils.

#### 2.4.4 Medical Facilities

The medical facilities of the Kecamatan include 3 health centers (Puskesmas) and 14 clinics (Puskesmas Pembantu). The health centers are each staffed by one doctor and several paramedics and the center at Pasar Muko-Muko also has a dentist and a midwife. Each of the clinics is staffed by a paramedic.

#### 2.4.5 Mail Facilities

There are two post offices in the Kecamatan located at Pasar Muko-Muko and Lubuk Pinang. From these offices mail is distributed to villages throughout the Kecamatan.

#### 2.5 Land Tenure

Most of the land farmed by the indigenous population in the project area is held under "adat" or customary rights. Rarely do the local people have "hak milik" or certified ownership to their land, and farm land in particular is held under customary law. A few landholders have full legal title to their house plots, mainly located in Pasar Muko-Muko.

Adat rights to land are established by clearing and cultivating the land. Even if the land is later abandoned when the farmer clears another piece of land to plant upland rice, he still retains rights to the land, particularly if fruit trees have been planted. Many farmers in the project area plant the seedling of rubber on these areas before abandoning them, thus establishing a long term claim to the land. The Government has the right to take adat land for development proposed if it requires it for a transmigration scheme, but this can lead to conflict between the indigenous population and the transmigrants, and cause delay development of the settlement.

The transmigrants, when they arrive at the settlement, are issued with a "hak pakai" or right of usage certificate which gives them the right to use the land for 5 years providing they develop it. At the end of the 5 year period the transmigrant is in theory issued with a "hak milik" certificate, but because of the backlog of work it often takes longer than 5 years for the certificate to be issued.

## 2.6 Cropping Pattern and Farming Practices

### 2.6.1 Cropping Pattern

All the farm field in the study area are categorized as a rainfed. The cropping pattern is generally affected by the seasonal distribution of labour force, rainfall, marketing condition, resulting the fluctuation of the cropping pattern and harvested area year by year.

Normally, cropping season of lowland rice is in the wet season (July/August to November/December), while, for upland rice, in dry season (August/September to December/January). Cropping of palawija is carried out throughout the year as shown in Fig. IV-2. Mixed cultivation among maize, peanuts, soybeans, cassava, etc. is normal in the study area. Present condition of the farm land is shown as follows:

Present Farm Land

Farm land	Area(ha)
Lowland Rice	140
Upland Rice	950
Palawija	1,080
Cassava	120
Rubber	2,300
Total	4,590

The annual harvested area of crops grown in the study area is estimated as follows, based on the land use survey and information collected from the rural extension centers (BPP : Balai Penyuluhan Pertanian), Ujung Padang and Sido Mulyo.

#### Annual Harvested Area

(Unit : ha)

	Dry season	Wet season	Total
Rice			
lowland rice	140	-	140
upland rice	950	-	950
Palawija			
Maize	220	410	630
peanuts	730	1,370	2,100
Soybeans	130	250	380
Cassava			120
Rubber			2,300
Total			6,620

Note) The period of wet season and dry season is assumed provisionally as follows (refer Fig. IV-2).

Wet season : January to June

Dry season : July to December

The harvested area of rice in the study area is estimated as about 140 ha for lowland rice and 950 ha for upland rice. These figures correspond to 3 % and 18 % of total harvested area, respectively. The palawija crops are about 1,860 ha, corresponding to 35 % of the total harvested area.

#### 2.6.2 Farming Practices

##### (1) Lowland rice

Seeds are generally sown at rate of 30 to 40 kg/ha in the nursery bed which is prepared in the size of about one (1) to five (5) % of the rice field, following seed selection by the fresh water. Seedling are transplanted to the field after around 25 days of sowing. Number of seedling per one (1) hill is approximately 5 seedlings. Seedlings are transplanted by the planting density of 30 cm x 30 cm, approximately. Depending on some case, farmers dig the holes for the transplanting of rice seedling.

Land preparation for the rice is kept down to the absolute minimum. Stubble is cut and ploughed in the field. Any conspicuous growth of the weeds is removed. All the land preparation is done by hand.

Application of fertilizer is not done in the project area. Weed control is carried out manually once or twice during one cropping season.

Important factors limiting yields of rice are high incidence of insect, e.g. Black bug, Narrow rice bug, Green rice leaf hopper, Mole cricket, etc. and ravages of Rats and Wild Pig.

Application of agro-chemicals is little used in the project area.

Harvesting practices take place in November and December, using ani-ani instead of the sickle, regularly. Following harvesting, the farmers carry the harvested grains to their home yard and dry them on mats.

## (2) Upland rice

Normal season for sowing of rice is almost in August and September. Following weeding and land preparation manually, direct seeding is done commonly by hand.

Rice seeds are dibbled into holes with around 3-5 cm deep by stick. Seeding rate is around 30 kg/ha. Spacing is approximately 30 x 30 cm. No fertilizer and insecticide are applied.

Land preparation for the rice is kept down to the absolute minimum as same as that for lowland rice. Stubble is cut and ploughed in the field. Any conspicuous growth of the weeds is removed. All the land preparation is done by hand.

Application of fertilizer is not done in the project area. Weed control is carried out manually once or twice during one cropping season.

Important factors limiting yields of rice are high incidence of insect, e.g. Black bug, Narrow rice bug, Green rice leaf hopper, Mole cricket, etc. and ravages of Rats and Wild Pig.

Application of agro-chemicals is little used in the project area.

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## (3) Palawija

Palawija is cultivated widely in the upland field of the project area. Of which, maize is the most dominant palawija and others are peanuts, soybeans and cassava. These crops are cultivated in both wet and dry seasons.

The traditional cultivation methods are primitive and mixed cultivation is usual practices. Following weeding and ploughing by hand, seeding is done manually. Most of the varieties used in the project area are local ones. Furthermore, seed multiplication is carried out by farmers themselves. Seeding rate ranges between 25 and 30 kg per ha.

No fertilizer and agro-chemicals are used in the study area. Weeding is done by hand two or three times. Harvesting is done by hand and processing and drying of harvested palawija are carried out in home yards of each farmer.

## 2.7 Agricultural Production

### 2.7.1 Crop Yield and Production

#### (1) Crop varieties and unit yield

Crop varieties in the project area are normally local varieties, which are multiplied by farmers themselves, although some high yield varieties are registered in Bengkulu Province.

Unit yield of each crops was estimated, according to the result of interview survey to Rural Extension Center (BPP) and chief of villages. Major varieties and unit yield of each crop are summarized as follows :

Crop	Varieties	Unit Yield (ten/ha)
Lowland rice	Sertani	1.5
	Pelita I	
	IR 64	
	IR 42	
	IR 36	
Upland rice	Kadubong	1.0
	Uchi	
	Gama	
Maize	Pelita I	1.5
	Arjuna	
Peanuts	Other varieties <sup>/1</sup>	0.8
	Macan	
Soybeans	Other varieties <sup>/1</sup>	0.5
	local varieties <sup>/1</sup>	
Cassava	local varieties <sup>/1</sup>	7.0

Note: <sup>/1</sup>: It is difficult to identify the name of varieties

The yield of crops is influenced by variety, rainfall, amount of fertilizer, control of disease and insects, etc.

In the project area, the farmers apply little fertilizers and agro-chemicals, then the condition of farm management could be more poor than in other part of Bengkulu province. These yields are still low as compared with the average yields in Bengkulu Province, Kabupaten Bengkulu Utara and Kecamatan Muko-Muko Utara, as shown in Table IV-5 and IV-16.

## (2) Crop Production

The annual amount of rice and palawija production in the study area is roughly estimated as follows, based on the result of land use survey and information from field extension workers and chief of each village. Present farm lands are located basically near each village. In general, shifting cultivation has been carried out. Accordingly, the area of present harvested area have been varied and the boundary of the farm land is not so clear.

Crop	Unit yield (ton/ha)	Harvested area (ha)	Production amount (ton)
Rice			
Upland rice	1.0	950	950
Lowland rice	1.5	140	210
Palawija			
Maize	1.5	630	945
Peanuts	0.8	2,100	1,680
Soybeans	0.5	380	190
Cassava	7.0	120	840

### 2.7.2 Livestock Production

Present livestock population in the project area is shown in Table IV-17. Population of cattle and water buffalo, which are important for the agricultural activities as a draught animal, has been increased gradually.

In order to execute the increment of livestock population, IFAD (International Funds for Agricultural Development) Project has been promoted continuously from 1982/83 in Bengkulu Province. 1st. IFAD project was carried out during the period from 1982/83 to 1986/87, second one is promoted during the period from 1987/88 to 1991/92. Third project will be planned during the period from 1992/93 to 1996/97.

This IFAD project aims at the promotion of the agricultural activities by means of utilization of cattle, the increment of beef meat production and livestock population and improvement of farm income of transmigrates.

Through the IFAD project in Bengkulu Province, approximately 500 heads of Bali female and 50 heads of Bali male (Bali variety is a suitable cattle as a draught animal) has been introduced from Nusa Tenggara Timur or Sulawesi Selatan for each project. Table IV-18 shows the situation of distribution of cattle through IFAD project so far. The farmers in each project which is distributed the cattle have to return back two heads of young cattle to IFAD project after 5 years of distribution. Generally, IFAD project divide one veterinarian and one extension worker to each unit in order to promote the proper management for cattle grazing. Furthermore, in April of this year, Air Manjuto ( SP III, SP V and SP VI ) and PIR SUS Ketahun were distributed 550 heads, respectively, while in 1991, it is scheduled to distribute 1,100 heads of cattle to Province Bengkulu.

According to necessity, training programme has been supplied to the farmers of each unit before the distribution of cattle. Usually, 10 % of farmers can train according to the training programme for about five days from PPL, PPS or officers from livestock office. Training programme has 11 subjects, e.g. operating method of cattle, farming practices on plowing /harrowing /leveling, feeding manner, etc. Actually, selected farmers of Air Manjuto and PIR SUS Ketahun, to which each 500 heads of cattle will be distributed in this April, have trained in this February.

### 2.7.3 Tree Crop Production

Major tree crop in the project area is rubber, which is mainly belong to the villages of Pondok Batu, Tanah Rekah, Pondok Kopi, Terasterunjam, etc. The total planted area is around 2,300 ha, according to the information of BPP Ujung Padang. The planted area of rubber tree is located far from each village. Farm management concerning weeding, protection, etc. for the rubber tree area has not been done sufficiently by farmers themselves.

## 2.8 Marketing and Prices

### 2.8.1 Marketing

Analysis of the farmer survey is still being undertaken, but initial results indicate that marketing channels are relatively straightforward. At present only small quantities of food crops are sold by farmers in Muko-Muko. Most indigenous farmers produce food crops for family consumption only, their cash crops being mainly rubber and coffee. Some of the longer established transmigrants sell rice immediately after the harvest. This is essentially the main source of cash available to them, although many have planted coffee, most of the area is not yet in production. Farmers sell milled rice rather than paddy, as the price of rice is less subject to large fluctuation due to the market stabilization operations of DOLOG. However, prices paid to

farmers for their rice following the harvest are significantly lower than at other times.

Rice is sold to both local traders and merchants from West Sumatra. It is moved out of the Kecamatan for sale either in West Sumatra or the city of Bengkulu. Rice shortages occur in Muko-Muko in the period prior to the harvest season, and at this time rice is imported into the Kecamatan, mainly from West Sumatra.

Sun-dried coffee beans and slab rubber are sold to dealers and, in the case of coffee, also to KUD Harapan. Coffee is then sold to exporters in Padang or Bengkulu where it is processed, sorted and graded prior to export. The slab rubber is also sold on to processors who convert it mainly to crumb rubber before it is exported.

The main activity of the provincial DOLOG office is to regulate the rice market. Its objectives are to stabilize the retail price of rice and to maintain a support price to the farmer. This is achieved by releasing rice stock on to the market when prices rise and purchasing rice for the provincial buffer stock when prices fall.

The activities of DOLOG are presented in schematic form in Fig. IV-1.

### 2.8.2 Present Situation of Demand for Principal Food Crops

Based on the population of 12,377 persons, related with the study area (see Table IV-15) and per capita consumption figures similar to those for Bengkulu Province as a whole, the estimated relation with current demand and crop production for the principal food crops is given in below table.

Current Demand for Principal Food Crops,  
Kecamatan Muko-Muko 1990

Crop	Estimated Per Capita Consumption (kg/year)	Total Demand (ton)	Crop Production (ton)
Rice	160	1,980	760 <sup>/1</sup>
Maize	24	29	945
Groundnuts	8	99	1,680
Soybeans	17	210	190
Cassava	68	842	840

Remarks : <sup>/1</sup> : This figures means the total amount of milled rice of wetland and upland paddy, applying the conversion factor of 0.65 to paddy.

Source : Pembangunan Pertanian Tanaman Pangan Propinsi Daerah Tingkat I, Bengkulu, Repelita V, Bengkulu 1988



As shown above table, the shortfall of the milled rice is obviously occurred in the study area. It is sounded that the farmers have gained the required amount of the milled rice by selling the other crop products, e.g. groundnuts, soybeans, maize, etc.

### 2.8.3 Prices of Farm Inputs and Outputs

The current farm gate prices of farm inputs and outputs in the study area is estimated on the basis of the collected data from agricultural office and interview survey to the farmers. The list of the prices is elaborated in Table IV-19.

Prices for other agricultural commodities are determined by market forces, with the prices of coffee and rubber being determined by world market prices. Furthermore, the price of oil palm has not been settled, because the oil palm has not been marketed in kecamatan Muko-Muko Utara so far.

### 2.9 Processing and Storage Facilities

Processing facilities within Kecamatan Muko-Muko are primarily limited to rice milling. There are reported to be 36 small private rice mills in the Kecamatan with an average throughput of 350 kg per hour, and 3 larger mills operated by the KUDs with a throughput of between 500-600 kg per hour. Most villages have at least one mill, but these tend to operate far below their capacity for most of the year, with throughput only approaching capacity immediately after the main harvest. Apart from the KUDs, the mills do not deal in rice, simply charging a milling fee of 10 percent of the rice out-turn. The millers sell the rice they obtain as fees either directly to consumer at the local markets, or to local traders who in turn sell the rice locally. The average output of milled rice to dry paddy from the village mills reportedly varies between 60 and 65 percent depending on the age and condition of the mill.

The only other recorded processing facilities within the Kecamatan are a few small scale operations processing soybeans into tahu and tempe, which are traditional food in Indonesia.

Facilities within the project area for storing large quantities of agricultural products are limited. The KUD's in Muko-Muko and Lubuk Pinang have warehouses for storing fertilizer and agricultural chemicals, and there are storage facilities in each of the four transmigration SPs, but these are used mainly for storing commodities for distribution to the settlers. The village rice mills also have limited storage capabilities, but in most cases these do not exceed 2-3 tons. The bulk of agricultural produce is still stored by individual farm families until such time as it is sold or consumed.

## 2.10 Profitability of Crops and Farmers' Economy

### 2.10.1 Profitability of Crops - Present Situation

Representative crop budgets have been prepared for the major food crops produced in the project area. These are based on published agricultural data for Kecamatan Muko-Muko, on interviews with staff of the Department of Agriculture, and on farmer interviews. The full crop budgets are presented in Table IV-20, while a summary is presented below.

#### Crop Budgets - Present Situation

(Rp/ha)

Crop	Gross Income	Production Cost <sup>/1</sup>	Net Income
Wetland Paddy	375,000	11,000	364,000
Dryland Paddy	250,000	14,000	236,000
Maize	225,000	14,000	211,000
Groundnuts	400,000	50,000	350,000
Soybeans	300,000	20,000	280,000
Cassava	700,000	7,000	693,000

Remark) /1 : Excluding labour costs

These budgets indicate that cassava gives the highest net return per hectare, followed by wetland rice and groundnuts, with maize and upland rice being the least profitable crops. This result is, however, rather misleading because cassava is grown over relatively limited areas and is mostly grown for domestic consumption with very little wet root actually being sold. The market for fresh cassava is very limited as there are no facilities in the project area for processing the root into chips or pellets for livestock feed. If in fact farmers planted substantial areas to cassava they would have considerable difficulty in disposing of their surplus production. In practice only limited quantities of food crops are grown for sale. Some transmigrants sell rice and other food crops as this is the only source of cash income open to them, but the majority of local farmers grow rubber and/or coffee as cash crops, and only cultivate sufficient food crops to meet their own requirements.

This situation is exacerbated by the low yields and poor returns per man day that farmers obtain from the cultivation of food crops.

### 2.10.2 Farm Budgets

In order to clarify the economic activities and living

standards of settled farmers (transmigrants) and local farmer in the study area, a farm budget analysis was made on the basis of a crop budget analysis and the farm interview survey. The results of the analysis are shown in Table IV-21 and summarized as follows:

#### Farm Budget under Present Condition

(Unit: Rp 10 )

Item	Transmigrants	Local farmer
Farm Sizes (ha/family)	1.25	2.5
I. Gross Income		
- Farm Income	780	1,139
- Off-farm Income	96	96
II. Gross Outgoings		
- Production Cost	72	55
- Living Expenses	739	739
III. Net Reserve	65	442

Major farm income for local farmer is obtained from the products from rubber. The farm income of the local farmer is about five times of transmigrant's one.

According to the transmigration income survey by the world bank, the subsistence level as of 1985 is Rp.50,000/month. The farm income of transmigrants in the project area is estimated at Rp.70,000/month. This level is barely over Rp.50,000/month, about equal to the poverty level.

## 2.11 Agricultural Support Services

### 2.11.1 Agricultural Research

Research in agriculture, especially food crops, is centralized and undertaken by the Central Research Institute for Food Crops (CRIFC) at Bogor in West Java. Under supervision of CRIFC, there are 6 branch research stations for food crops as shown below :

- 1) Bogor Research Institute of Food Crops (BORIF)
- 2) Sukarami Research Institute of Food Crops (SARIF)
- 3) Sukamandi Research Institute of Food Crops (SURIF)
- 4) Malang Research Institute of Food Crops (MARIF)
- 5) Banjarbaru Research Institute of Food Crops (BARIF)
- 6) Maros Research Institute of Food Crops (MORIF)

In Bengkulu Province, there is no agricultural research station. Agricultural research in this province is covered by the West Sumatra Branch Research Station, Sukarami (SARIF). The main activities of this station are to execute experimental work under the instruction and supervision of the Central Station at Bogor and to collect information from extension services on the technical problems associated with the farming practices of local farmers.

## 2.11.2 Extension Services

### (1) Agricultural extension work

The agricultural extension in Indonesia is the most important activities to improve the existing technique of farming practices and promote the advanced techniques.

In order to support the extension services, the steering committee, which is called FKPP 1, has been established in each province. This FKPP 1 consists of the members from Provincial agricultural office, Provincial estate office, Provincial livestock office, Provincial fishery office, etc., in order to promote the policy of the national extension services to the provincial activities. Activities decided by FKPP 1 are expanded to the farmers through BPP (Balai Penyuluhan Pertanian), which is the rural extension center in Kecamatan level.

Agricultural extension services in the study area is carried out by two agricultural extension centers (BPP : Balai Penyuluhan Pertanian), e.g. BPP Ujung Padang and BPP Sido Mulyo. Each BPP has several Working Area of a field Extension Worker (WKPP : Wilaya Kerja Balai Penyuluhan Pertanian) which covers several villages. There are some senior extension workers (PPUPs : Penyuluhan Pertanian Urusan Program) in charge of each section for agriculture, forest, estate crops and fishery, who supervises the activities of some junior extension workers (PPLs : Penyuluhan Pertanian Lapangan) who are stationed at BPP and control the WKPP.

PPLs in the study area have the responsibility to provide the extension services to the farmers' group (Kelompok Tani), as for the improvement of agricultural technique and the protection of crops and livestock from some damages, etc.

The farmers' group has been categorized as shown in Table IV-22, according to the standard criteria. Extension services have been spread, depending on the level of farmers' group.

Each PPL is required to visit more than 2 farmers' group in each extension area a day, which is called System Kerja Latihan and Kunjungan (Training and Visiting System).

In Bengkulu Province, the total number of staffs for

agricultural extension services are 515, out of which PPSs are 33, PPUPs are 120 and PPLs are 362, respectively.

In Kabupaten Bengkulu Utara, there are 5 PPSs, 51 PPUPs and 161 PPLs. Out of these staffs, 51 PPUPs and 181 PPLs belong to 14 BPPs as shown in Table IV-23. In the survey area, two BPP, i.e. Ujung Padang and Sido Mulyo, have managed the whole area. Number of PPL is 11 staffs there, who have inspected 12 WKPP as shown in Table IV-24 and IV-25.

## (2) Pest control work

DGFA ( Director General for Food Crops Agriculture ) has established the food crop protection center (BPTP) in order to monitor the occurrence of the pest damage and advise the proper protection ways to the farmers in 1978. At present, ten of the food crop protection center have monitored the provinces concerned. Bengkulu Province is belong to the Food Crop Protection Center III which is located at Palembang. This Palembang BPTP provides technical services for the provinces of Lampung, South Sumatra and Bengkulu. Furthermore, each province has established Satgas BPTP ( Regional BPTP ) in order to carry out the support services to combat crop pest and disease outbreaks on pest control, smoothly. Regional BPTP has settled some PHPs in each BPP, who is responsible for monitoring and warning of pests and diseases, assessing crop damage, providing technical recommendations and guidance to PPL/PPUPs and alerting the pest ravages on timing and on required action. Present situation on PHP is shown in Table IV-23

### 2.11.3 Seed Multiplication

Seed quality control is regulated by the seed section of the food crops production division under the Ministry of Agriculture. A programme of seed certification laboratory testing and marketing supervision determines standard for production and sale of each class of seed.

The development of seed varieties begins at the center research institute for food crops at Bogor where the first step is the production of Breeder seed, this materials passed on to branches of the central research Institute for multiplication and selection of Foundation seed.

The Foundation seed is distributed to the provincial central seed farm where it is put under testing and field trial programme. The seed produced is classified as stock seed.

The stock seed is received at the Kabupaten seed centers where further multiplication and trials are continued to produced Extension seed.

If plot space is not adequate for multiplication to extension seed at the center, the stock seed sold to selected

farmers seed growers who are authorized to multiply it. The extension seed goes through one more multiplication stage by farmers seed growers who then sell to the ultimate rice producing farmer directly or to the village unit cooperative(KUD) for resale.

There are 14 provinces in Indonesia which have appointed to produced and multiplication of Foundation seed including Bengkulu Province.

In order to produce foundation seed, Bengkulu Province central seed farm are distributed for stock seed to the Kabupaten seed farm, Kabupaten sub-seed farm and others.

Certificated seed which has to be marketed in Bengkulu Province is controlled by Agriculture office, Bengkulu Province. In Bengkulu Province, the foundation seed, stock seed and extension seed are produced in each following center :

#### Seed multiplication

Seed Center	No.	Crops controlled	Seed farm (ha)
BBI	2	Rice	23
		Palawija	60
BBU	2	Rice	7
		Palawija	6
BBP	3	Rice	25
		Palawija	9
Contract farmer	L.S	Rice	3,850
		Palawija	

Provincial Seed Center, which is called BBI (Balai Benih Induk) multiplies foundation seed on the basis of breeders seed which is delivered from Agricultural Research Center.

Kabupaten Seed Center, which is called BBU (Balai Benih Utama) carries out the production of stock seed, while Kabupaten Sub-seed Center, which is named BPP (Balai Benih Pembantu), multiplies the extension seed. The seed produced in each center is inspected as for the seed quality by Provincial Seed Certification Center, which is called BPSB (Balai Pengawasan dan Sertifikasi Benih). Extension seed inspected by BPSB is delivered to the farmers as a certificated seed, through KUD or KIDS.

Certificated seeds are produced by the farmer contracted with BBI, usually. In Kabupaten Bengkulu Utara, the certificated seeds are produced mainly in Arga Makmur. Provincial agricultural office has proposed that the certificated seeds should be used by three cropping seasons interval. According to this proposal,

certificated seed for paddy will be multiplied under following seed multiplication schedule yearly in Bengkulu Province.

Year	Certificated Seed
1989/90	IR 48, Cisadane, IR 54, Cikapundung, IR 36, Citandui, IR 46
1990	IR 48, IR 36, Cisadane, IR 64, Ciliwung
1990/91	IR 48, IR 64, Cisadane, Ciliwung, Cisanggerung, Krueng Ache
1991	IR 36, Cikapundung, Batang Pane, Ciliwung, Poso

In the case of palawija crops, rotation of certificated seed like paddy has not been carried out in Bengkulu Province, seed multiplication has been constantly done every year. Certificated seed for palawija crops are shown as follows:

Crop	Certificated Seed
Maize	Arjuna, Metro, Harapan, Hibrida, Genjah Kertas
Soybean	Orba, Ringgit, Lokon, Galung Gung, Willis, Dempo
Peanuts	Macan, Gajah, Kidang, Banteng, Kietang
Mang Bean	Terak, No. 129, Bakti, Swalik

#### 2.11.4 Agricultural Credit Availability

The major source of credit traditionally available to farmers within the project area was the extended family group, or possibly their neighbors in the village. In the main this situation still persists. The other source of available credit is from merchants, but this again is limited and although detailed information is not available, it is understood that interest rates are very high.

Furthermore, there is the credit system through Bank Rakyat Indonesia (BRI) in Bengkulu Province. In the credit system, Kredit Usaha Tani (KUT), i.e. Bimas credit, is most available one in the Bengkulu Province.

Bimas credit at 1 percent per month for the purchase of agricultural inputs is theoretically available to farmers in the Kecamatan through the KUDs. However, it appears that farmers have never made use of this source of credit. It is also possible for

farmers to apply for credit from the Bank Rakyat Indonesia (BRI) through the KUDs. However, BRI generally requires that the farmer have legal title to his land before credit will be advanced and, as most farmers in the project area do not have a "hak milik" certificate, only limited amounts of credit have been obtained.

The KUDs themselves have some funds available for loans to farmers but it was reported by KUD Harapan that these loans were restricted to a maximum of Rp 50,000 and that interest rates were higher than those charged by BRI. The KUDs themselves purchase fertilizer and other agro-chemicals through credit supplied by BRI in Arga Makmur. The KUD applies for credit through the Kabupaten office of the Department of Co-operatives in Arga Makmur. If the application is approved it is forwarded to the BRI for action. Credit is disbursed directly to PUSRI or PT Pertani for the purchase of fertilizer and agro-chemicals.

At present there is no BRI sub-branch office in Kecamatan Muko-Muko. In the past an office was opened to provide farmers with credit for the Bimas programme, but it subsequently closed due. Then, the farmers in the project area has not applied the credit so far.

Arga Makmur is investigating the possibility of re-opening the Muko-Muko office. If there is judged to be sufficient business to justify the re-opening, the office could be in operation by 1991. If business is considered to still be insufficient to warrant a permanent office, a mobile banking service may be introduced. This would operate out of Arga Makmur and provide banking services in the Kecamatan on two to three days each week.

It appears that at present farmers in the project area utilize a very limited amount of credit obtained through institutional channels, and the credit they do obtain is mainly from traditional sources. For the transmigrants, the availability of credit through the traditional family and village sources is also very limited.

#### 2.11.5 Agricultural Cooperative

The existing cooperative system (Koerasi Unit Desa : KUD) was established in accordance with Presidential Decree No. 4, 1984. The members of the cooperative consist of individual persons or small group. More than 20 persons are required in order to formulate the cooperative. The activities of KUD are as follows :

- 1) To channel agricultural credit from BRI to farmers
- 2) To control the credits, e.g. the credit for the wholesaler (KCK), farming credit (KUT), etc.
- 3) To supply farm inputs such as seeds, fertilizer, agro-chemicals, etc.
- 4) To manage the post-harvest facilities, e.g. rice mill



unit, warehouse, transportation, shop, etc.

In Bengkulu Province, there are 186 units of village cooperative unit (Koperasi Unit Desa : KUD) as shown in Table IV-26. Namely, out of total farm household, approximately 30 % of farm household is belong to the KUD. There are 70 units of KUD in Kabupaten Bengkulu Utara, about 30 % of farm household is registered as the KUD member as shown in Table IV-27. In Kecamatan Muko-Muko Utara, there are eight of KUD, for which the number of members are 2,096, or about 58 % of total household, as shown in Table IV-27.

In the study area, there are four KUDs, i.e. KUD Harapan, KUD Maja Makmur as shown in Table IV-27. However, there is no active function in those KUDs.

#### 2.11.6 Availability and Distribution of Agricultural Inputs

Farmers in the project area do not use substantial quantities of farm inputs. Some farmers use fertilizer on their food crops, but the amounts are small and generally well below the quantities recommended by the Department of Agriculture. The transmigrants receive significant quantities of fertilizer, seed and pesticides during the first three years of settlement, provided as Packets A, B and C. Packet A, supplied in the first year of settlement, consists of 20 kg of rice seed, 10 kg maize seed, 10 kg soybean seed and 5 kg of green bean (kacang hijau) seed. In addition, they receive cassava cuttings, 5 fruit tree seedlings and one packet of vegetable seed. 200 kg of fertilizer (Urea and/or TSP), and 3 kg of pesticide are also supplied.

During the 2nd year, Packet B is supplied, consisting of 20 kg rice seed, 10 kg palawija seed, 150 kg of fertilizer and 4 kg of pesticide. In the third year of settlement only fertilizer (200 kg) and insecticide (4 kg) is supplied. Once the transmigrant no longer receives agricultural inputs from the Department of Transmigration, it appears that his use of fertilizer declines substantially, dropping to levels similar to those applied by the local farmers.

Fertilizer and pesticides are available in the Kecamatan through KUDs Harapan and Manjuto Jaya. KUD Harapan purchased in total about 160 tons of Urea, TSP and KCI from the PUSRI depot at Arga Makmur during the past year, and part of this was disposed of through KUD Manjuto Jaya. Fertilizer is currently sold at the recommended price of Rp 210/kg for TSP and KCI and Rp 185/kg for Urea. Insecticides, rodenticides and fungicides are obtained from PT Pertani in Arga Makmur, and are again sold on to farmers at the government recommended prices.

If farmers want to use fertilizer or other agro-chemicals, they must purchase them at the KUDs and arrange for transportation to the village themselves. Estimates of these transportation costs range between Rp 5 and Rp 10 per kilogram.

### 2.11.7 Land Reclamation

To date very little land clearing and land leveling has been carried out in the project area. A new programme is being introduced during Repelita V to increase the speed of development of sawah areas. The programme is known as the Assisted Selfhelp Land Development system and will provide for land clearing and land leveling by contractors, the cost to be borne by the Government. The remaining land development activities such as bunding, construction of farm roads etc. will be the responsibility of the farmer.

The national programme has a target of 375,000 ha to be developed during Repelita V. The annual targets are given below.

Land Development Targets for REPELITA V

Year	National Target (ha)	Bengkulu Target (ha)	
		Original	Revised
1989 / 90	100,000	5,312	3,000
1990 / 91	75,000	3,976	5,000
1991 / 92	75,000	3,976	3,976
1992 / 93	75,000	3,976	3,976
1993 / 94	50,000	1,558	1,558
Total	375,000	18,798	17,570

Source:

- (1) Directorate General of Food Crop Agriculture, Jakarta 1989.
- (2) Land Development Directorate, Dinas Pertanian Tanaman Pangan Bengkulu, March 1990.

The budgets allocated for land clearing and land leveling vary with the vegetation cover. For heavy forest the budget is Rp 850,000/ha; for light forest, Rp 550,000/ha; for brush Rp 400,000/ha; and for upland already cleared for cultivation Rp 300,000/ha. These figures apply nationally, except for the figure for heavy forest where other provinces' cost estimates for land clearing and land leveling in Bengkulu indicate that these sums will be inadequate and that it will be difficult to find contractors willing to undertake land clearing and land leveling for these sums.

Estimated from two other sources of the cost of land clearing and land leveling are given in Table IV-28. It is understood that these figures were arrived at independently, and both indicate that the proposed levels of government assistance

are less than half the required amounts. Due to this shortfall in funds available for land clearing and leveling, it is expected that it will be necessary to reduce the specifications required of the land clearing contractors. It is proposed that contractors should not now be required to remove tree stumps from the cleared area, and tree trunks, branches etc. need only be removed from 75 percent of the area. Land leveling would not be carried out by the contractors on slopes of less than 20 percent; this would now be left to the farmer. However, check bunds would be constructed at specified intervals depending upon the angle of slope.

This programme, however, would appear to suffer from many of the constraints faced by new irrigation projects in the past. The experience from previous projects is that it takes an unacceptably long period for full production to be achieved. This has been attributed to a number of factors, including difficulties farmers have in leveling and cultivating their rice fields while large stumps and tree trunks remain in the field; the difficulty of removing these stumps by hand; the problems of leveling rice fields by hand on steep slopes; poor water management on uneven fields, etc. It would appear that the proposed land clearing and land leveling programme, at least in Bengkulu province, will not overcome these problems.

The construction of terraces puts great pressure on the transmigrant available labour supplies. This is particularly the case in the early years of settlement when many transmigrants have young families with the children making only a minor contribution to the family labour supply. It has been estimated that, on average, 380 man-days are required to construct one hectare of irrigated rice terraces by hand. This is often beyond the capabilities of the transmigrant.

## 2.12 Related Project

### 2.12.1 Existing Transmigration Scheme

Existing transmigration settlements in the Kecamatan fall into two groups. Firstly there are the settlements at Lubuk Mukti, Suka Maju, Penarik and Tunggal Jaya established on upland areas prior to 1985. These settlements have approximately 2,260 families, or 52 percent of the total transmigration population in the Kecamatan. They are based on the cultivation of upland rice and other food crops and considerable areas of coffee have also been planted. The agricultural system adopted by the transmigrants is thus similar to the indigenous farmers living in the area.

The second group of transmigrants consists of those settled in the Air Manjuto Irrigation area. These settlements have been developed since 1985 and were designed to have, in addition to the house plot, an area of irrigated sawah and area devoted to upland crops. In most of the transmigration villages, much of the planned irrigated area has not yet been developed, although where

there is suitable land the transmigrants are cultivating rainfed paddy field. On the upland areas a variety of food crops are being cultivated, the most significant in terms of area being upland rice. In the more established transmigration villages, significant areas of coffee have been planted although most of it is not yet in production.

The number of transmigrants in the study area is 5,213 persons, comprising 1,206 families (see Table IV-32). SP's II and IV have been settled for 3 to 4 years, but in SP's III and VI the transmigrants have been resident for less than a year.

Each family is allocated 2 ha of land comprising 0.25 ha for the house plot and garden, and 1.75 ha for crop production. Until 1989/90 the transmigrant received 1 hectare of cleared land, known as Lahan Usaha I, to be used for the cultivation of arable crops. If possible this land is provided with irrigation facilities, but the construction of the quaternary canals, and the leveling and bunding of the rice fields, is the responsibility of the transmigrant. Since 1989/90 the transmigrants in the project area have only received 0.75 ha of cleared Lahan Usaha I. The remaining land, 1.00 ha, is known as Lahan Usaha II. This land is allocated to the transmigrant but it is not cleared by the Department of Transmigration. This second plot, once cleared by the farmer, may be used either for food crop production or tree crops.

In the project area 2,412 ha have been allocated to transmigrants of which 1,368 ha were cleared by the Department of Transmigration. Farmers in SP's II and IV have subsequently cleared substantial areas of their Lahan Usaha II, for tree crop production, but in SP's III and VI the transmigrants have not had time to clear any significant areas of their LU II land. (Break down: 650 families with 1.25 ha cleared and 556 families with 1.0 ha cleared.)

#### 2.12.2 Plantation Scheme

PT Tolan Tiga, a joint venture estate company, has two concession areas of approximately 10,000 ha and 6,000 ha in Kecamatan Muko-Muko, the larger of which borders the project area. The two areas are in the process of being developed and are currently being planted with oil palm, rubber and cocoa. In the larger concession area, 6,000 ha are being planted with oil palm, 2,000 with rubber and up to 1,000 with cocoa. In the second area it is planned to plant 3,500 - 4,000 ha of oil palm, 1,000 ha of rubber and over 500 ha of cocoa.

Once the estates are in production, it is planned to construct a rubber factory to produce ribbed smoked sheet (RSS) and two oil palm factories to produce refined palm oil for bulk shipment to Europe. The estates and processing factories will become major employers in the Kecamatan once they reach full production. It is estimated that one harvester is required for

every 10 ha of oil palm and one tapper for every 3 ha of rubber. Thus the area planted to oil palm would generate employment for about 1,000 harvesters and the rubber areas work for 1,000 tappers. Together with the factories, maintenance workers and other estate workers, approximately 4,000 full-time jobs are likely to be created. Those workers and their families are estimated to total about 20,000 people, and this large increase in employment and population will have a major impact on the development of Kecamatan Muko-Muko. In terms of rice consumption alone, a population of this size would require around 3,000 tons of rice per year assuming a per capita consumption figure of 150 kg per year.

It is anticipated that if the proposed Air Selagan project is implemented PT Tolan Tiga will become involved in the development of the proposed 1,200 ha of smallholder oil palm. The settlers will require technical assistance with the planting and maintenance of the oil palm until it comes into production. The high yielding clonal planting material would also be supplied by the estate company. The supply of planting material and technical assistance would be supplied under contract by the estate company. Once the oil palms come into production the estate would purchase the smallholder FFB for processing in their factory. The factory would be responsible for organizing harvesting rounds, FFB collection, etc. The smallholders would be paid on the basis of the quantity and quality of the oil obtained from their fruit. Organizational details will need to be worked out prior to the development of the smallholder oil palm holdings. At full production the smallholders would be producing about 25,000 tons of FFB per annum. The harvesting and collection of this quantity of FFB will require considerable organization and management.

## CHAPTER 3. AGRICULTURAL DEVELOPMENT PLAN

### 3.1 Objective and Basic Concepts for Agricultural Development Project

#### 3.1.1 General

The major active industry in Bengkulu Province is the agriculture which occupies about 50 % of the total Gross Regional Domestic Products (GRDP).

As for the agricultural development in Bengkulu Province, the fifth Five-Year Development Plan (1989/90 - 1994/95) has been conducted in order to sustain the nation's drive to self-sufficiency in food crops, aiming at strengthening the agricultural sector. An obvious adjunct to this policy is to improve the income and living standards of farmers, livestock producers and fishermen. It is also intended that the further development of the agricultural sector should stimulate regional development and provide additional opportunities for transmigration.

For agricultural development, one of the key factors is to improve the physical conditions of existing transmigration settlements still under the administrative control of the Ministry of Transmigration, and to improve the self-support and self-sufficiency, resulting the increment of the settlers' income and welfare levels.

According to the planned transmigration programme for Kabupaten North Bengkulu in Repelita V, it is intended to resettle 6,700 transmigrant families with 2,570 or 30 percent being settled in Kecamatan Muko-muko Utara, while for the province of Bengkulu as a whole, it is envisaged that 10,000 families will be resettled during Repelita V.

Bengkulu Province has limited land for rice cultivation because of few flat lands and a lot of the land with poor soil condition. Therefore, to promote the agricultural development in the northern part of Bengkulu Province, in which the Provincial Government has conceived the agricultural development, will result in contribution to the economic improvement and promotion of the living standard for local people and new transmigrants

#### 3.1.2 Objectives

Taking the situation described above into the consideration, objectives of the agricultural development plan is mentioned as follows :

- a) Maximum development of agricultural potential area under irrigation and drainage system

- b) Increment of rice production due to improvement of the self-support and self-sufficiency of foodstuff in the project area
- c) Improvement and promotion of living standard on existing transmigrants
- d) Equalization and promotion of living standard in and around the project

### 3.1.3 Basic Concepts

In order to attain the objectives of the project, the basic concepts are formulated as follows:

- a) First development priorities is derived from the existing transmigration area, in which the farmers desired to carry out the active agriculture under irrigation system and improve the living standard
- b) Present agricultural situation under rainfed should be improved to irrigation system as much as possible, resulting the stabilization and increment of yield and production of proposed crops.
- c) Double cropping rice cultivation with high cropping intensity should be introduced under the irrigation system.
- d) High productivity should be established by means of the higher application of fertilizer and agro-chemicals
- e) The proposed crops and cropping pattern must conform with the existing social and natural condition and be acceptable to the farmers as a useful proposal.

Based on the suitability of the land for development on various crops, three development plans have been considered. These are :

- a) The areas most suitable for wetland rice cultivation, including areas already allocated to transmigrants, will be developed for the irrigated rice.
- b) All potentially irrigable land will be developed excluding the areas of deep peat.
- c) As for b) above, but with drainage of areas of peat land not suitable for rice cultivation which instead will be planted to oil palm.

In this project, oil palm was proposed as a promising crop for the peat land. In the survey area, P.T.Tolan Tiga which is a joint venture estate company has the concession areas for oil

palm rubber and cocoa. Especially, in his peat land of 4,000 ha, it has been commenced to cultivate the oil palm and planned to establish the oil palm factories. It is anticipated that if the proposed Air Selagan project is implemented P.T.Tolan Tiga will become involved in the development of the 2,500 ha of small holder oil palm. The transmigrants would be supported the technical assistance with the planting and maintenance of the oil palm throughout the implementation of oil palm cultivation by that company.

### 3.2 Proposed Land Use

Of the original 22,400 hectares designated as the survey area, 7,600 hectares have been allocated for development of estate crops by P.T. Tolantiga which is the private estate company. Out of the remaining 14,800 ha, only 4,700 ha are considered to have potential for irrigated rice production. Peat land covers a further 4,440 ha with the depth of peat ranging from one meter to well over three meters.

Based on the suitability of the land for development for various crops three development options have been considered. These are:

- (1) The areas most suitable for wetland rice cultivation, including areas already allocated to transmigrants, will be developed for irrigated rice.
- (2) All potentially irrigable land will be developed, excluding the areas of deep peat.
- (3) As for ii) above, but with drainage of areas of peat land not suitable for rice cultivation which instead will be planted to oil palm.

Development areas for the three development options are given below.

Development Areas (ha)

Land Use	Plan 1	Plan 2	Plan 3
Gross Paddy Field	2,420	4,700	4,700
(Net Paddy Field)	(2,180)	(4,200)	(4,200)
Upland Crop Field	270	530	800
Oil Palm	-		2,500
House lot	270	530	810
Public Land	270	540	830
Total	3,230	6,300	9,640



Taking maximum development of agricultural potential area into consideration, the agricultural development plan of 9,640 ha for plan 3 is primarily conceived in this project, including the irrigated rice field of 4,700 ha. The proposed future land use is elaborated in Table IV-29 and summarized as follows :

Proposed Land Use						
(Unit: ha)						
Land use	Ric	Upland crop	Oil palm	House lot	Public land	Total
Right bank	2,000	500	2,500	510	530	6,040
Left bank	2,700	300	0	300	300	3,600
Total	4,700	800	2,500	810	830	9,640

Furthermore, on the basis of the result from the development alternative study (APPENDIX V), distribution of the farm land to the farmers in the Project area is shown as follows:

(Unit : ha)		
	Rice farmers	Oil palm farmers
LU I	1.00	2.00
LU II	0.75	-
Home yard	0.25	0.50
Total	2.00	2.50

### 3.3 Proposed Crops

In order to attain the objectives of the project, paddy as a staple crop is proposed to cultivate in the suitable land of the project area. Because, production of the staple food should be self-sufficient in the area, in order to improve the levels of the living standard and farmers' income. Following that, the cultivation of the cash crop should be introduced to grade them up. While, in the area which is impossible to execute the irrigated farming, the cultivation of oil palm is proposed under the drainage system.

### 3.4 Proposed Cropping Pattern

#### 3.4.1 Basic Principle

Following the completion of the Air Selagan Irrigation Development Project, most of the existing rainfed rice fields will be up-graded to the technical irrigation rice fields and

more intensive use of the farmland will become possible. The adequate supply of irrigation water will lead to certain changes of crops and cropping patterns within the project area. It is difficult, however, to forecast how the farmers will change their cultivation pattern of crops. The crops and cropping patterns under the project, have been selected, considering the following basic principles:

- a) Maximum cropping intensity should be adopted in the project area, based on the present situation of the project area and other project which is closed to the project.
- b) Considering maximum benefits for the farmers, proposed crop under irrigation is rice, while palawija will be adopted for rainfed, provisionally.
- c) The cropping pattern must make optimum utilization of water to be supplied by the project.
- d) The crops and cropping pattern should be practical with the limited number of family labour, and
- e) The crops and cropping pattern must conform with the existing social custom which is acceptable to the farmers.

#### 3.4.2 Selection of Crops

##### a) Rice

Rice is the most profitable crop among the crops grown possibly under the present economic situation and important for the foodstuffs of farmers. Rice production will contribute to supply the constant amount of foodstuffs to the transmigrants.

##### b) Palawija Crops

Palawija crops are the dominant upland crops in the project area. They are for the subsidiary dish as well as the marketed crops to the local market. Generally, groundnuts is the profitable in the palawija crops. Even if the project will be completed, the palawija crops will be grown under rainfed condition.

#### 3.4.3 Basic Condition for Settlement of Alternative Cropping Pattern

The major basic conditions on formulating the alternative cropping patterns are working day, cropping intensity and cropping rotation. The alternative cropping patterns in order to settle the basic condition are formulated, provisionally, as shown in Fig. IV-3.

Following points were paid attention, in order to formulate the alternative cropping pattern.

- a) The period without irrigation water in the whole area should be considered as far as possible, in order to maintain the canal.
- b) Following period, which there are no rice plants in the entire paddy field, should be considered as much as possible, in order to cut off the life cycle of disease and insect pests and protect the rice plant from the disease and insect damage.
- c) It should be considered not to overlap each cropping season as far as possible, in order to avoid to meet the period of peak labour requirement.

On formulating the alternative cropping pattern, groundnuts will be proposed as the dominated one of palawija crops, considering the profitability.

The result of the comparison study on alternative cropping pattern from the viewpoint of the labour requirement and revenue is given in Table IV-30 to IV-33 and summarized as follows:

Alternative cropping pattern	Peak labour requirement (man-day per ha)	Revenue (Rp.1,000 per ha)
Alternative 1	2.50	1,747
Alternative 2	2.30	1,747
Alternative 3	2.08	1,747
Alternative 4	2.28	1,749
Alternative 5	1.91	1,749
Alternative 6	1.53	1,749

Note) The condition of each cropping pattern is summarized as follows(see Fig. IV-3):

Pattern	Working day	Cropping Intensity	Crop
Alternative 1	1 month	250 %	R/P/ <u>1</u>
Alternative 2	1.5 months	250 %	R/P/ <u>1</u>
Alternative 3	2 months	250 %	R/P/ <u>1</u>
Alternative 4	1 months	200 %	R/R/ <u>2</u>
Alternative 5	1.5 months	200 %	R/R/ <u>2</u>
Alternative 6	2 months	200 %	R/R/ <u>2</u>

1 : R/P means three cropping of rice and two cropping of palawija for two years.

2 : R/R means two cropping of rice for one year.

As cleared above, alternative 6 is the most convenient pattern, in which working day is 2 months, it is contrived for the project that the cropping intensity is 200 % and proposed crops under irrigated condition are rice which will be grown in double cropping a year.

Through Alternative 6 selected above, furthermore, the cropping season should be adjusted properly from the view point of water requirement, productivity of rice and labour requirement. For the adjustment, three cases of cropping pattern were prepared provisionally, according to the view point of productivity of rice and the periods for harvesting work and preparation of nursery bed and their cropping seasons are summarized as follows :

Cropping pattern	Wet season		Dry season	
	Nursery	Harvesting	Nursery	Harvesting
Case 1	Oct to Dec	Feb to Apr	Apr to Jun	Aug to Oct
Case 2	Jan to Feb	May to Jun	Jul to Aug	Nov to Dec
Case 3	Oct to Nov	Feb to Mar	Apr to Jun	Aug to Oct

Remarks) Points for formulation of each cropping pattern are as follows:

- Case 1 : Productivity of rice
- Case 2 : Period for harvesting work
- Case 3 : Period for preparation of nursery bed

Considering the base cropping patterns mentioned above, following six cases were formulated in order to select the promising proposed cropping pattern and illustrated in Fig. IV-4.

Case	Cropping season	Nursery	Harvesting
Case 1-1	Wet	Oct 11 to Dec 11	Feb 10 to Apr 10
	Dry	Mar 26 to May 26	Jul 25 to Sep 25
Case 1-2	Wet	Oct 11 to Dec 11	Feb 10 to Apr 10
	Dry	Apr 26 to Jun 26	Aug 25 to Oct 25
Case 2-1	Wet	Jan 1 to Mar 1	Apr 30 to Jun 30
	Dry	Jun 16 to Aug 16	Oct 15 to Dec 15
Case 2-2	Wet	Jan 1 to Mar 1	Apr 30 to Jun 30
	Dry	Jul 16 to Sep 16	Nov 15 to Jan 15
Case 3-1	Wet	Oct 1 to Dec 1	Jan 31 to Mar 31
	Dry	Mar 16 to May 16	Jul 15 to Sep 15
Case 3-2	Wet	Oct 1 to Dec 1	Jan 31 to Mar 31
	Dry	Apr 16 to Jun 16	Aug 15 to Oct 15

Basic concept of formulating them are summarized as follows:

(a) Case 1-1 and 1-2

These cropping patterns were settled, based on the following comparison study considering the productivity of rice.

It is generally conceived that the yield is positively correlated with daily solar radiation and negatively with the daily mean temperature during the 25 day period before flowering. The International Rice Research Institute (IRRI) in the Philippines made a series of rice experiments in this respects and reported the following empirical formula for estimation of " potential maximum number of grain per  $m^2$  ", using climatic data. Actually, it may not be proper to apply this theory to the case of rice in our project area from the view point of the different climatic condition, different rice variety, etc. However, this empirical formulation is advantageous to compare with the productivity of rice in different cropping seasons. Applying the actual climatic records for solar radiation and temperature in the Project area, the potential maximum yield is estimated at the level of 4.0 ton/ha, as shown in Table IV-34. Especially, the potential maximum yield is obtained during February. In result, wet season of Case 1-1 and 1-2 was fixed as shown in Fig. IV-4. Furthermore, considering the period with non-irrigation in order to maintain the canal, fallow period were settled during the period from 26th of September to 10th of October for Case 1-1 and 10th to 15 of April for Case 1-2. Following that, dry cropping season of Case 1-1 and 1-2 are fixed.

(b) Case 2-1 and 2-2

Wet cropping season was fixed firstly, based on the harvesting period and amount of the rainfall. Following that, considering the period with non-irrigation in order to maintain the canal, fallow period were settled during the period from 16th 31st of December for Case 2-1 and 1st to 15 of July for Case 2-2 in order to formulate dry cropping season of both case.

(c) Case 3-1 and 3-2

Wet cropping season was fixed firstly, based on the period for preparation of nursery bed and amount of the rainfall. Following that, considering the period with non-irrigation in order to maintain the canal, fallow period were settled during the period from 16th to 31st of September for Case 3-1 and 1st to 15 of April for Case 3-2 in order to formulate dry cropping season of both case.

The result of comparison study for six cases mentioned above are given as follows:

Alternative cropping pattern	Potential maximum yield (ton/ha)	Peak labour requirement (man-day per ha)	Peak water requirement (lit/sec per ha)
Case 1-1 Wet	4.68	1.53	0.97
Case 1-1 Dry	4.06		1.69
Case 1-2 Wet	4.68	1.53	0.97
Case 1-2 Dry	4.13		1.72
Case 2-1 Wet	4.27	1.53	1.36
Case 2-1 Dry	4.57		1.53
Case 2-2 Wet	4.27	1.53	1.36
Case 2-2 Dry	4.59		1.53
Case 3-1 Wet	4.63	1.53	1.14
Case 3-1 Dry	4.08		1.46
Case 3-2 Wet	4.63	1.53	1.14
Case 3-2 Dry	4.08		1.72

Note) Refer Fig. IV-4.

As the result of the comparison study, it was cleared that Case 2-2 is the promising cropping pattern, from the viewpoint of the maximum productivity.

#### 3.4.4 Proposed Cropping Pattern

Through the alternative study, the cropping pattern for rice in Case 2-2 was decided as the proposed one for implementation of the project. Furthermore, taking the information from the field, the cropping season of the palawija was decided as shown in Fig. IV-5.

### 3.5 Proposed Farming Practices and Farm Inputs

#### 3.5.1 Proposed Farming Practices

As mentioned in Sub-section 2.6.2, the limiting factor on generating the high agricultural production is low amount of farm inputs and no irrigation. Accordingly, taking the guideline of government's agricultural extension and existing farming practices in the area where has attained high productivity, following proposed farming practices will be proposed for the project area .

The seed requirement will be 30 kg per ha. The paddy seeds to be used in the area should have to be the certificated extension seeds and be selected by using a solution of 1.13 specific gravity before pre-germination. The selected seeds will

also have to be disinfected by using an adequate seed disinfectant like Benlate. Pre-germination practice is recommendable for increasing the germination percentage.

The nursery has to be prepared as flat as possible. The size of nursery should be about 5 percents of the paddy field to be transplanted. Fertilization to nursery bed is essential for healthy growth of seedlings. The recommendable dosage of fertilizer is 5 kg/ha of urea. The nursery period is approximately 20 days after seeding.

Plowing is carried out by animal power, before 7 days of transplanting. After plowing, harrowing and puddling are required for land leveling. These works are recommended to be carried out by using animal power.

According the guideline of the extension services, the spacing of transplanting is set to be 30 cm x 10 cm with 3 seedlings per hill. Considering the soil condition in the project area, the suitable fertilizers are urea, triple superphosphate (T.S.P) and potassium chloride (KCl). The total fertilizer requirement for sustaining the target yields would be 250 kg/ha of urea, 100 kg/ha of TSP and 75 kg/ha of KCl. The dosage of basic fertilizer application is a third of urea, T.S.P. and KCl after land preparation. Top dressing is done twice at the initial tillering stage about 25 days after transplanting and at the reduction division stage about 7 days before heading. The amount of top dressing to be applied per ha is a third of urea and KCl of total amount each time.

It is proposed that weeding should be done by manually. After transplanting, weeding is carried out manually several times, depending on the condition of weed growth. As it is too hard to stamp out the weed from the paddy field, it is important to manage the field in order to minimize the damage by weed, not perfectly eradicated. Herbicides have been useful for weeding purposes, and their efficiency is acceptable, particularly for saving labor requirement for the weeding work. However, as some kinds of chemicals are harmful for not only human beings but also livestock husbandry and the natural environment, careful selection and usage of these chemicals should be done.

As regards plant protection, ecological control will be proposed in the area. But application of some insecticides, e.g. Indobast or Mipcin, is required for the control of brown plant hoppers, black bug, narrow rice bug, rat, etc. In case of the plant protection also, to say nothing of minimum usage, it is proposed to apply the agro-chemicals when the damage is in prospect, not periodically.

Rats are already of significant importance in the project area and cause damage to present paddy production in the field and after harvest. The use of the standard allocation of 2 kg of zinc phosphide per ha is proposed.

Harvesting and threshing are carried out by manual labor. The harvested paddy will be dried on the paddy field or home yard. Moreover, it will be recommended that harvested paddy is dried on a sun-drying floor, in order to maintain the quality of the rice.

### 3.5.2 Proposed Farm Inputs and Labor Requirement

The proposed farm inputs and labor requirement under the with project condition are presented in Tables IV-35 and IV-36. These were basically designed on the basis of recommendations of the Directorate General of Food Crops Agriculture, Ministry of Agriculture. As for farm inputs and labor requirement under the without project condition, it is forecasted that there would be no substantial changes and still remain at present levels.

The labor requirement for crop production under the proposed cropping pattern is presented for plan-3 as shown in Table IV-37. The family labor force will be mainly used for farming throughout the year. Temporary laborer (seasonal laborer) will also be used during the peak times of transplanting and harvesting of crops.

### 3.6 Anticipated Crop Yields and Production

Certificated seed for promising varieties has been replaced for every four years in order to protect pest and disease as shown in Table IV-39. The anticipated yields of paddy and palawija are summarized as follows. Under the without-project condition, no drastic change of land use, crop production, etc. can be expected. The yield under the future without-project condition are estimated to be equal to them under the present condition.

#### Unit Yield of Major Crops

(Unit : ton/ha)

Crop	without project	with project
Paddy under irrigation system		
1st cropping	-	5.0
2nd cropping	-	5.0
paddy in the rainfed		
Lowland paddy	1.5	-
Upland paddy	1.0	-
Maize	1.5	3.0
Groundnuts	0.8	1.2
Soybeans	0.5	1.0
Cassava	7.0	-



The trend of the dry paddy production in Bengkulu Province is shown in Table IV-2. During past 20 years, the unit yield has been almost constant, in spite of gradual increase of harvested area. The unit yield of lowland paddy in 1988 is 3.3 ton/ha and 1.6 ton/ha for upland paddy. Table IV-6 shows the production, harvested area and unit yield for each kabupaten. Kabupaten Bengkulu Utara is in the low level for the paddy production. The unit yield of dry paddy in Kabupaten Bengkulu Utara is 2.9 ton/ha for wetland paddy and 1.6 ton/ha for upland paddy in 1988. Furthermore, the situation of the dry paddy production in Kabupaten Bengkulu Utara is given in Table IV-16. The unit yield of wetland paddy is ranging between 2.57 ton/ha in Kecamatan Enggano and 4.50 ton/ha in Kecamatan Arga Makmur. The unit yield in Muko-Muko Utara is above the average in Kabupaten Muko-Muko Utara. In Kecamatan Arga Makmur, high yield has been obtained under the improved irrigation system and promoted agricultural supporting services, based on much experience of about 10 years.

The average yield per ha in the irrigated paddy field of Arga Makmur is more than around 5.0 ton, describing in the following table.

(Unit : ton/ha)

WKPP	Year				
	1985	1986	1987	1988	1988
Batu Roto	5.2	5.3	5.3	6.2	n.a
Sp.Ketemong	5.0	5.1	5.3	6.0	6.5
Lb.Duriam	5.0	5.0	5.1	6.0	6.5
Perbo	4.6	5.0	5.1	5.9	6.8
Tb.Agung	5.0	5.1	5.0	6.1	6.6
Dn.Curup	n.a	5.0	n.a	n.a	n.a
Ps.Kerkap	n.a	n.a	n.a	n.a	n.a
Ps.Palik	4.9	n.a	5.0	5.3	n.a
Kota Agung	4.9	n.a	6.4	n.a	6.5
Kemumu	5.9	6.2	6.5	7.1	7.2
Sumber Agung	5.1	5.3	6.8	6.5	6.8
Sido Urip	n.a	5.3	n.a	6.9	6.8
Arga Makmur	5.0	5.0	6.8	6.5	6.7
Air Merah	n.a	5.0	6.1	6.7	6.5
Gunung Agung	4.9	5.0	6.2	6.2	n.a

Judging from the above situation, the higher fertility level as well as the supply of the irrigation water will undoubtedly give rise to higher yield levels than at present condition, under

the significant agricultural extension support services. Accordingly, the yield of 5.0 ton/ha of dry paddy for both of dry and wet seasons in the project area will be anticipated under the with-project condition.

The palawija crops also will be expected to be cultivated in cooperation with the agricultural extension services. It is expected that the yields of those crops is in higher level under the with-project condition.

In order to attain the anticipated unit yield for paddy and palawija (under with-project condition), the optimum amount of farm inputs as well as proper water management must be required together with effective agricultural support services. With advance and extension of these conditions, the unit yields will increase gradually from the present level to the anticipated yield in the 5th year after implementation of the project.

The annual crop production in the project area of 9,640 ha under the with-project condition is estimated follows :

#### Annual Crop Production

Crop	Harvested area (ha)	Unit yield (ton/ha)	Production (ton)
Dry paddy			
Wet season	4,200	5.0	21,000
Dry season	4,200	5.0	21,000
Maize	1,080	3.0	3,240
Groundnuts	1,080	1.2	1,296
Soybeans	1,060	1.0	1,060

### 3.7 Processing and Storage

There are reported to be 39 rice mills in the Kecamatan capable of milling about 3 tons per day if fully utilized for 8 hours per day. Assuming 200 milling days per year this gives an installed capacity of 23,500 tons. Most of this installed capacity is at present seriously under utilized, with many of the small village mills only operating for a few hours each day. They are only utilized at anything approaching capacity for a few weeks following the main rice harvest. This is to be expected, as total paddy production in the Kecamatan was only 10,682 tons in 1987.

The need for increased milling capacity will depend very much upon which development option is adopted, and the cropping intensities achieved on irrigated paddy field. Assuming that the maximum area of 4,200 ha is developed for irrigated rice, and that double cropping is adopted over the entire area the maximum estimated production would be 33,600 tons. The build up in yields and intensities will occur over five years, so it is assumed that installed milling facilities would gradually increase to keep pace with increased production. There will also be a considerable increase in rice produced on the Air Manjuto irrigation scheme, but again this will build up over a number of years, and it is not envisaged that a shortfall in installed milling capacity will be a constraint on increased rice production.

Adequate storage facilities may be more of a problem, and there will certainly be a need for the KUD's to expand their rice storage facilities to ensure that rice is stored under optimum conditions thus reducing post harvest losses to acceptable levels.

With the anticipated increase in rice production following the development of the Air Selagan irrigation project and the introduction of double cropping of rice, greatly increased drying facilities will be required. It is suggested that probably the most cost effective way of providing the necessary drying facilities would be the construction of concrete drying floors with movable covers. These could possibly be constructed and operated by the KUDs. Farmers could be charged a small fee to cover operation and maintenance costs. Ideally each village in the project area would be supplied with drying facilities.

### 3.8 Marketing of Agricultural Products

It is expected that future rice demand in 2005 is 1.8 times of projected demand in 1990 as shown in Table IV-3. As a result, it is straightforward that the deficit of 15,800 tons occurs from 2005 in Bengkulu Province.

If the maximum rice production is expected in 4,200 ha of irrigated rice double cropped, the production of dry paddy in 2000 and 2005 would increase respectively to about 38,860 and 42,000 tons per annum. Considering the amount for seeds/waste and milling rate, this would produce the equivalent of about 22,700 and 24,600 tons of milled rice, respectively. With an annual consumption figure of 160 kg per capita in the project area, local consumption in 2000 would be 4,500 tons leaving about 18,200 tons to be marketed outside the project area (see Table IV-38). Furthermore, in 2005, 6,700 tons for total demand in the

project area and 17,900 tons for surplus to be marketed outside the project area.

Rice surpluses of this magnitude will not be absorbed within Kecamatan Mukomuko; although the estates being developed by PT Tolan Tiga could create demand from their workers for an additional 3,000 tons of milled rice per annum once they reach full development. However, most of the rice supplies will be marketed outside the Kecamatan. It is not envisaged that this will cause any difficulties. A market for surplus rice apparently exists in Bengkulu City, based on DOLOG's continued rice imports. As for the future surplus rice in Bengkulu Province, there will still be a substantial market for surplus rice in Riau, Jambi and South Sumatra provinces, which are projected to remain rice deficit areas for the foreseeable future. Recent BULOG imports into, and exports from, South Sumatra, Jambi and Riau are shown in the tables below.

#### Bulog Rice Imports

(Unit : ton)

Province	1985	1986	1987	1988
South Sumatra	2,900	51,246	21,611	66,052
Jambi	4,972	48,061	20,984	30,585
Riau	29,380	56,850	48,834	88,731
<b>TOTAL</b>	<b>37,052</b>	<b>156,157</b>	<b>91,429</b>	<b>185,368</b>

Source: BULOG, Jakarta, 1989

#### Bulog Rice Exports

(Unit : ton)

Province	1985	1986	1987	1988
South Sumatra	12,000	1,000	-	-
Jambi	-	-	-	-
Riau	-	-	-	-
<b>Total</b>	<b>12,000</b>	<b>1,000</b>	<b>-</b>	<b>-</b>

Source: BULOG, Jakarta, 1989

In combination the three provinces have been importing rice in very substantial quantities during the last three years and all indications are that imports will be required in the future. Tables IV-39, IV-40 and IV-41 indicate that based on projected population increases, per capita rice consumption and anticipated increases in rice production, in total the three provinces, will continue to require significant rice imports until 1993 and most probably for many years beyond that.

Rice would be exported via West Sumatra to Riau and Jambi, and via Bengkulu and Curup to South Sumatra and Jambi.

It is unlikely that any surplus palawija crops will be produced within the project area, particularly if it is assumed that the target consumption figure for Repelita V of 120 kg per capita per annum is achieved. There will be some marketing of palawija crops between farmers in the project area, but these will not necessarily be through formal marketing channels. Any surplus produced will be absorbed within Kecamatan Muko-Muko.

It is anticipated that settlers will not be involved in the marketing of palm oil. Smallholders will sell their fresh fruit bunches to the estate factory for processing and the oil will be marketed by the company together with their own production. It is envisaged that refined oil will be shipped either by road tanker or coastal vessels to a bulk storage facility at Bengkulu port from where it will be exported in bulk to Western Europe.

### 3.9 Proposed Transmigration Programme

#### 3.9.1 Standard Transmigration Models

##### (1) Rice farmer

The Department of Transmigration has developed a series of standard settlement models based on land suitability for various crops, namely paddy, upland palawija crops and tree crops. The standard food crop models are :

(a) The Dryland Model which currently consists of

0.75 ha of LU I	(cleared land for food crops)
0.25 ha of Houselot	
1.00 ha of LU II	(land not cleared, suitable for food crops or tree crops)

(b) The Wetland Model which consists of :

1.00 ha of LU I	(cleared land suitable for rainfed sawah )
0.25 ha of Houselot	
1.00 ha of LU II	(Land not cleared, suitable for rainfed sawah, palawija or tree crops)

Together with his land allocation, the transmigrant receives a standard transmigration house, food supplies (rice, cooking oil, dried fish, etc.) for the first 12 months of settlement, clothing and household utensils, and standard package of agricultural tools (Refer to Table IV-42). In addition, for the first three years of settlement he receives an agricultural package consisting of fertilizers, pesticides and improved seeds as Package A for 1st year, Package B for 2nd year and Package C for 3rd year (Refer to Table IV-43). These packages are standard for both the dryland and wetland models.

In addition to the above facilities, the Department of Transmigration also provides roads and bridges on the settlement, plus other public facilities such as schools, clinics, facilities for the Koperasi Unit Desa (KUD). All these facilities are provided by the Department of Transmigration either directly or through contractors working for the Department.

On some transmigration settlement irrigation and drainage facilities are provided so the transmigrants can develop irrigated paddy field. These facilities down to the tertiary level are provided by the Department of Public Works, but the farmers are responsible for the development of the quaternary system and for land clearing and field development where the land has not already been cleared (See Table IV-44).

These are the standard models which have been used for developing the majority of transmigration settlements. At present, there is apparently no standard model for transmigration settlements where the irrigation system is constructed and the land cleared prior to the arrival of the transmigrants. This is what is being suggested for new settlers on the proposed Air Selagan Irrigation Project, and it may be necessary to derive a new irrigation model, based on the assumed double cropping of paddy, for this type of development.

Taking consideration of the settlement model mentioned above, the settled farmers in the project area will be provided

the farm land as follows :

LU I : 1.00 ha  
LU II : 0.75 ha  
House lot : 0.25 ha

In the project area, the rice farmers will be recommended to cultivate their field as follows :

Paddy field : 1.50 ha  
Upland field : 0.25 ha  
Home yard : 0.25 ha

## (2) Tree Crops

### (1) PIR-Trans

In addition to the standard food crop models discussed above, the Department of Transmigration also has a tree crop model which it has developed in conjunction with the Department of Estate Crops. The current model for one household is referred to as PIR-Trans and consists of the following :

2.00 ha of the tree crops  
0.50 ha of house plot/upland crop  
0.25 ha of public facilities

Under the PIR-Trans model, the area of tree crops is developed and managed by the Department of Estate Crops until the crop starts producing, at which time each transmigrant is allocated his two hectares of tree crops. The Department of Estate Crops will continue to provide management advice and extension support to the farmer once he has taken over the management of his 2 ha of tree crops and if the smallholder area (of "plasma") is linked to a nucleus estate ("inti") managed by the Department of Estate Crops or one of the PLP's, the nucleus estate will continue to process and market the smallholders output. This is particularly the case with oil palm and rubber projects.

Under the PIR-Trans programme, the construction of the transmigrants house and the clearing of the 0.5 ha house lot/upland crops area remains the responsibility of the Department of Transmigration, as is the construction of public facilities. The Department of Estate Crops is responsible for the construction of roads and other infrastructure, and for the clearing of all land, apart from the house lot.

During the first year on the settlement the transmigrant receives from the Department of Transmigration up to 50 kg of rice per month to feed himself and his family. He is also employed as a labour on the development and maintenance of the tree crop area, receiving a daily wage to supplement the income derived from his 0.5 ha house plot/upland crops area.

The cost of developing the tree crop area is provided as a loan, either through BRI or other Government Banks. The farmers assume responsibility for repayment of the loan on receiving his allocated tree crop area. The repayment period for the loan varies with the tree crop planted, but in the case of oil palm the loan is repaid over 20 years, including a 4 year grace period. The interest rate charged varies with the type of development, but the farmer is usually charged a subsidized interest rate. For transmigrants the house and the cleared 0.5 ha house plot/upland crops area are provided free of charge

## (2) PIR-Khusus and PIR-Lokal

Other PIR programs utilized in the development of tree crop projects are PIR-Khusus and PIR-Lokal (See Table IV-45).

PIR-Khusus is very similar to PIR-Trans with a nucleus estate supporting surrounding small holder areas. However, the farm size allocated to smallholder in the past was larger than that currently provided under the Trans programme. The farmer received 2.00 ha of crops, 0.75 ha of land for upland crops and a 0.2 ha house plot. All other facilities are the same as for PIR-Trans, but Perkebunan is responsible for providing all the infrastructure, including the house and the cleared area for upland crops. The Department of Transmigration involvement with the programme is the selection transportation of the transmigrant families and the provision of the monthly rice ration during the first year of settlement.

The cost of developing the project is also treated as a loan, but for PIR-Khusus projects the cost of constructing the transmigrant house, and of clearing the area for upland crops, is also included as part of the loan. Repayment terms are the same as those for PIR-Trans.

The Third PIR programme is PIR-Lokal. This programme was designed to enable local people to develop their land for tree crops with the assistance of Perkebunan and



utilizing bank loans. Under the PIR-Lokal programme farmers apply to Perkebunan to be included in a tree crop development scheme. There is no limit on the size of an individual holding that can be included under the scheme, provided the land is suitable for the proposed tree crop, and the farmer has full legal title (hak milik) to the land, as the land title is used as collateral for the loan. Once accepted into the scheme the farmer receives a loan for land clearing and tree crop development. This is carried by, or under the supervision of, Perkebunan. The terms of the loan are the same as for PIR-Trans or PIR-Khusus projects, i.e. the length of the loan period depends on the crop grown, with repayments not coming due until the crop is in production, and with a grace period usually included. Apart from land clearing and land development farmers participating in a PIR-Lokal project receive no other assistance, that is no housing or infrastructure is provided, neither are they supplied with food or other forms of support. The scheme is aimed at established farmers who wish to obtain credit to develop additional tree crop areas, but who are able to support their families from their existing farms.

According to these models for tree crops mentioned above, proposed model of oil palm farmer for the project was settled as follows :

Oil Palm field	: 1.50 ha
Upland field	: 0.25 ha
Home yard	: 0.25 ha

### 3.9.2 Number of Transmigrants

The number of new transmigrants and settlers who have the irrigated paddy field of 1.5 ha of paddy field, each 0.25 ha of homeyard and upland field and 0.25 ha of public facilities are estimated at 1,350 families, while the settled farmer for oil palm is 1,100 families. Furthermore, 700 families out of existing farmers will be settled in the project area as local transmigrants, for which the paddy field only will be prepared.

The settlement of new transmigrants could be implemented during seven years along with the progress of land clearing for proposed irrigated paddy field. The annual number of families to be settled in the area is estimated as follows:

Year	New transmigrants for paddy (families)	New transmigrants for oil palm (families)	Total (families)
1991/92	340		340
1992/93	300		300
1993/94	300		300
1994/95	200		200
1995/96	210		210
1996/97		550	550
1997/98		550	550
Total	1,350	1,100	2,450

### 3.9.3 Community Development

In the new transmigration area, the houses and shallow wells adequate to the transmigrants are constructed before the settlement. The number of these facilities are 2,450 houses and 613 wells in total. In addition, the public facilities such as school, clinic and market will also be constructed by the Government authorities concerned. In the light of the present conditions in existing transmigration areas and the standard of the Transmigration Office, necessary public facilities in new villages would be estimated as shown in Table IV-42.

### 3.8.4 Government Support

The Government has given considerable subsidies to transmigrants, which consist of foods, clothes, farm tools and equipment, during the initial period of 12 months after settlement (see Table IV-42) and farm inputs during the initial three years after settlement (see Table IV-43). After implementation of the Project, the new transmigrants and resettlers to be settled in the project area could receive fully these subsidies from the Government.

## 3.10 Crop and Farm Budgets

### 3.10.1 Crop Budgets

Crop budgets for the 'with project' situation have been prepared and are presented in Table IV-46 and summarized as follows :

(Unit : 1,000 Rp./ha)

Crop	Gross production value	Production cost	Net production value
Paddy	1,250	209	1,041
Maize	450	143	307
Groundnuts	600	173	427
Soybeans	600	157	443

It can be seen that irrigated paddy on the suitable soils gives by far the greatest net return per hectare and per man day, when full production is achieved. Consequently it is anticipated that farmers will concentrate on the production of irrigated rice.

### 3.10.2 Farm Budgets

Typical farm budgets for the two farm models are given in Table IV-47. Income from upland crop production is based on a mixture of palawija crops being planted on 0.25 ha allocated for upland crops. The house plot will be planted to a similar mixture of upland crops plus fruit trees, spices, etc.

For the oil palm farmers similar incomes from the upland crop and house plots have been assumed. The income from oil palm given in the table is for full production from Year 7 onwards. In the first 3 years following planting there is a net loss to the farmer, and loan facilities will be required to support the transmigrant and his family through these early years. However, once the crop is in full production net incomes are high, comparable to those of rice farmers who double crop their 1.5 ha of irrigated paddy field.

Farm incomes for both rice and oil palm farmers in the 'with project' situation will be far higher than the without-project incomes. The result is summarized as follows :

### Farm Budget

Item	Rice farmer	Oil palm farmer
Farm size (ha)		
Paddy field	1.50	
Oil palm field		2.00
Upland crop field	0.25	0.25
Home yard	0.25	0.25
Total	2.00	2.50
 I. Gross Income (1,000 Rp.)		
1) Farm income	3,750	3,700
2) Off-farm income	0	0
Total	3,750	3,700
 II. Gross Outgo (1,000 Rp.)		
1) Production cost	786	558
2) Living expenses	739	739
Total	1,525	1,297
 III. Net reserve (1,000 Rp.)	2,775	2,403
 IV. Disposal income (1,000 Rp.)	3,514	3,212

#### 3.11 Agricultural Support Services

The major objectives of the Project are to increase agricultural production and to improve and stabilize the farmers' economy through the irrigation development. For these objectives, the Project will provide the necessary infrastructures such as irrigation and drainage facilities. In order to realize the objectives, however, there would remain various ancillary works which would be carried out by the governmental authorities concerned and the farmers themselves. These are agricultural support services such as extension, credit and farmers cooperatives.

The following are recommendations for improvement and strengthening of agricultural support services related to the Project. It is expected that improvements and strengthening of these would be carried out in parallel with the construction of Project facilities.

(1) Extension Services

- a) Conducting training courses for extension personnel, especially about irrigation farming in order to enable them to carry out their duties effectively.
- b) Introducing improved cultivation and management techniques to farmers such as use of High Yielding varieties (HYV), practice of new cropping patterns and calendars with project, and operation of field water management for the proper supply of irrigation water management and draining off excessive water.
- c) Assisting in production of seed multiplication of HYV for farmers' use
- d) Field trials should be carried out for paddy. The field trials would include fertilizer trials, variety tests and adaptation tests.
- e) Improvement of the prevailing training and visit system of extension work held by PPL to be more effective in activity.
- f) Strengthening the expansion of BIMAS/INMAS programs and helping to solve the problem of poor loan repayment by some of the farmers.
- g) Supply of a motor cycle for each PPL to ensure adequate mobility and effectiveness of the services.

(2) Agricultural Credit

- a) BRI sub-branch office should be established in the project area in order to cooperate more with the agricultural services and cooperative offices and work out a loaning plan based on the total acreage of paddy field to be cultivated by the irrigation project.
- b) The procedure for credit application should be simplified as much as possible both for individuals and groups of farmers, so that realization of BIMAS/INMAS credit will meet the needs of farmers in time. Provision of simplified application form with an easy procedure and readiness of farmers' background data are necessary in making rapid procedure for credit application.
- c) To develop advanced agriculture in an integrated way is feasible only with the strengthening of all activities

of BRI, PPL and KUD in good coordination and function. By means of linking up all these activities, the farmers will become more capable and effective in performing the BIMAS program with confidence.

(3) Agricultural Cooperative

- 1) In meeting the needs of the new irrigation scheme in expansion of irrigation area, the role of KUDs will become increasingly important. The existing KUDs have to expand their businesses in order to provide better service to farmers in the project area.
- 2) With realization of the irrigation project, it is certain that crop production will be greatly increased and the requirements of input supply also. In order to meet the new situation, improvement of and additions to KUD facilities will be indispensable. This means that each KUD should have an adequate rice mill, storage facilities and sun-drying floor.
- 3) To enable the agricultural cooperatives (KUD) become viable organizations for agricultural and rural development, and to make them self-sustaining in business activity, the full support of members as well as Government is needed. The Government's support may be provided either through policy measures or in the form of financial help as subsidies or low-interest loans. However, government financial assistance to KUD should be given on an annual decreasing basis to help them become self-sustaining.

3.12 Pilot Farm

Although the pilot farm has been operated in the study area in order to promote the advanced technology for rice cultivation, it has not been rewarded with anticipated fruits.

This reason is derived from not only the shortage of the budget and stuff, but site selection of the pilot farm.

In order to complete the project smoothly and improve the self-support and self-sufficiency of settled farmers, it would be necessary to establish the pilot farm for the landmark of the agricultural development in the project area.

The functions of the pilot farm are summarized as follows :

- a) Demonstration of proper rice cultivation with double cropping.
- b) Experimental research on quality improvement and reduction of production costs for paddy and palawija crops.
- c) Seed multiplication of certified seeds for the farmers in and around the project area.
- d) Execution of the short courses for the farmers in the guidance of advanced farming practices.

As mentioned above, the objectives of this pilot farm will be to conduct research not only for improvement of farming practices under irrigation but also for their improvement without irrigation, in order to promote further development in and around the project area.

It is recommended that the pilot farm be organized under the Government authority concerned. The area required for the experimental farm is estimated at around 5 ha.

Table IV-1 HARVESTED AREA AND PRODUCTION OF MAJOR FOOD CROPS

Crops	1984	1985	1986	1987	1988
<b>Paddy</b>					
Harvested area (1,000 ha)	9764	9902	9989	9923	8251
Production (1,000 ton)	38136	39033	39727	40078	35921
<b>Maize</b>					
Harvested area (1,000 ha)	3086	2440	3143	2626	2675
Production (1,000 ton)	5288	4330	5920	5155	5480
<b>Cassava</b>					
Harvested area (1,000 ha)	1350	1292	1170	1222	809
Production (1,000 ton)	14167	14057	13312	14356	9811
<b>Potatoes</b>					
Harvested area (1,000 ha)	264	256	253	229	144
Production (1,000 ton)	2157	2162	2091	2013	1320
<b>Groundnuts</b>					
Harvested area (1,000 ha)	538	510	601	551	447
Production (1,000 ton)	535	528	642	533	443
<b>Soybeans</b>					
Harvested area (1,000 ha)	859	896	1254	1101	811
Production (1,000 ton)	769	870	1227	1101	903



Table IV-2 PRODUCTION, HARVESTED AREA AND UNIT YIELD OF RICE  
(Bengkulu Province)

Year	Lowland Rice		Upland Rice		Total	
	Production (1,000ton)	Unit Yield (ton/ha)	Harvested Area (1,000ha)	Production (1,000ton)	Unit Yield (ton/ha)	Harvested Area (1,000ha)
1969	148	3.4	44	63	1.8	211
1970	159	3.5	45	60	2.1	219
1971	164	3.5	47	62	1.9	226
1972	159	3.5	46	53	1.9	212
1973	162	3.3	49	35	1.8	197
1974	175	3.4	51	33	1.7	208
1975	173	3.3	52	33	1.8	206
1976	188	3.5	54	35	1.9	223
1977	137	2.7	51	19	1.5	156
1978	136	2.7	51	32	1.5	168
1979	129	2.6	49	30	1.3	159
1980	141	2.9	48	31	1.4	172
1981	134	2.9	46	35	1.6	169
1982	171	3.4	51	43	1.7	214
1983	203	3.6	57	48	1.7	251
1984	212	3.5	61	35	1.5	247
1985	212	3.4	62	29	1.5	241
1986	232	3.5	66	30	1.7	262
1987	211	3.1	68	37	1.7	248
1988	223	3.3	68	46	1.8	269

Source ) Dinas Pertanian Tanaman Pangan Bengkulu Province, 1990

Table IV-3 FUTURE DEMAND AND SUPPLY OF RICE IN BENGKULU PROVINCE

Year	Supply										Demand		
	Harvested Area of Lowland (ha)	Unit Yield of Lowland (ton/ha)	Harvested Area of Upland (ha)	Unit Yield of Upland (ton/ha)	Production of Paddy (ton)	Feed, Waste and Seed*1 (ton)	Supply of Rice*2 (ton)	Waste #3 (ton)	Total Supply (ton)	Population*4 (Nos.)	Per capita Consumption*5 (kg)	Total Demand (ton)	Balance (ton)
<b>Actual</b>													
1985	62,300	3.4	19,200	1.5	240,800	21,200	142,700	3,600	139,200	953,700	149	142,100	-2,900
1986	67,700	3.5	18,100	1.7	265,100	23,300	157,100	3,900	153,200	982,900	149	146,400	6,700
1987	69,500	3.5	18,500	1.7	273,300	24,100	162,000	4,100	158,000	1,015,100	149	151,200	6,800
<b>Forecasted</b>													
1988	72,100 *6	3.5 *9	18,500 *6	1.7 *10	283,800	25,000	168,200	4,200	164,000	1,043,000	149	155,400	8,600
1989	74,700 *6	3.5 *9	18,600 *6	1.6 *10	291,300	25,600	172,700	4,300	168,400	1,086,000	149	161,800	6,600
1990	77,500 *6	3.5 *9	18,600 *6	1.6 *10	301,000	26,500	178,500	4,500	174,000	1,158,200	149	172,600	1,400
1993	86,400 *6	3.5 *9	18,700 *6	1.6 *10	332,500	29,300	197,100	4,900	192,200	1,259,400	149	187,600	4,600
1995	92,900 *7	3.5 *9	18,800 *8	1.6 *10	355,400	31,300	210,700	5,300	205,400	1,391,200	149	207,300	-1,900
2000	111,500 *7	3.5 *9	19,000 *8	1.6 *10	420,500	37,000	249,300	6,200	243,000	1,684,400	149	251,000	-8,000
2005	135,700 *7	3.5 *9	19,200 *8	1.6 *10	498,500	43,900	295,500	7,400	288,100	2,039,500	149	303,900	-15,800

Remarks

\*1 Amount of feed, waste and seeds of paddy are estimated at 8.8% of total production on the basis of Repelita V, Bengkulu 1988

\*2 Milling recovery rate: 65%

\*3 Wasted amount of rice is estimated at 2.5% of domestic supply on the basis of Repelita V, Bengkulu 1988

\*4 Repelita V, Bengkulu 1988

\*5 Repelita V, Bengkulu 1988

\*6 Repelita V, Bengkulu 1988

\*7 The growth rate of harvested area for wetland paddy between 1977 to 1988 was estimated at 3.7%.

\*8 The growth rate of harvested area for upland paddy between 1977 to 1988 was estimated at 0.2%.

\*9 The unit yield of lowland paddy between 1984 to 1988 was estimated at 3.5ton/ha.

\*10 The unit yield of upland paddy between 1984 to 1988 was estimated at 1.6ton/ha.

Table IV-4 RICE IMPORT BY DOLOG BENGKULU

Month	(Unit : ton)				
	1984	1985	1986	1987	1988
Jan.	2,163	2,600	-	5,752	3,967
Feb.	-	-	-	-	-
Mar.	3,298	997	-	-	4,214
Apr.	-	-	2,278	1,025	-
May	1,000	1,499	-	970	3,015
Jun.	496	-	2,265	865	-
Jul.	3,396	997	234	215	4,462
Aug.	-	998	2,478	1,086	-
Sep.	500	-	-	3,268	-
Oct.	2,999	499	-	1,530	6,432
Nov.	2,568	891	5,957	-	-
Dec.	-	-	-	-	8,322
Total	16,420	8,481	13,212	14,711	30,412

Source) DOLOG Bengkulu, 1990

Table IV-5 (1/3) PRODUCTION, HARVESTED AREA AND UNIT YIELD OF PALAWIJA IN BENGKULU PROVINCE

Year	Riang Lebong		Bengkulu Utara		Bengkulu Selatan		Kodva Bengkulu		Bengkulu Province					
	ton	ha	ton/ha	ha	ton	ha	ton/ha	ton	ha	ton/ha				
1979	1,655	1,419	1.2	911	1.1	231	211	1.1	26	23	1.1	2,823	2,453	1.2
1980	1,475	1,226	1.2	876	1.2	157	131	1.2	14	11	1.3	2,522	2,095	1.2
1981	2,264	1,985	1.1	1,442	1.1	367	331	1.1	43	40	1.1	4,116	3,636	1.1
1982	3,578	2,493	1.4	837	1.1	543	448	1.2	10	8	1.3	4,968	3,692	1.3
1983	3,788	2,488	1.5	1,384	1.0	1,002	993	1.0	6	4	1.5	6,180	4,511	1.4
1984	5,073	3,424	1.5	1,489	1.3	179	194	0.9	4	3	1.3	6,745	4,797	1.4
1985	9,980	5,842	1.7	2,300	1.6	1,716	1,020	1.7	25	16	1.6	14,021	8,336	1.7
1986	12,367	7,120	1.7	1,699	1.5	1,315	873	1.5	58	44	1.3	15,439	9,152	1.7
1987	16,161	8,882	1.8	2,228	1.6	1,718	1,089	1.6	76	55	1.4	20,183	11,416	1.8
1988	15,007	8,042	1.9	2,528	1.6	905	555	1.6	63	40	1.6	18,503	10,172	1.8

Note) ton : Production

ha : Harvested area

ton/ha : Unit yield

Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Year	Riang Lebong		Bengkulu Utara		Bengkulu Selatan		Kodva Bengkulu		Bengkulu Province					
	ton	ha	ton/ha	ha	ton	ha	ton/ha	ton	ha	ton/ha				
1979	3,726	413	9.0	5,754	7.6	948	114	8.3	483	62	7.8	10,911	1,347	8.1
1980	4,115	478	8.6	10,118	8.6	3,052	355	8.6	354	42	8.4	17,639	2,051	8.6
1981	4,514	523	8.6	6,349	8.18	1,315	175	7.5	198	31	6.4	12,376	1,547	8.0
1982	9,765	1,031	9.5	14,648	8.9	5,031	632	8.0	148	21	7.0	29,592	3,325	8.9
1983	9,542	917	10.4	12,888	1,392	6,921	748	9.3	44	5	8.8	29,395	3,062	9.6
1984	12,361	1,133	10.9	13,459	1,377	8,110	816	9.9	26	3	8.7	33,956	3,329	10.2
1985	17,472	1,508	11.6	17,188	1,722	8,504	910	9.3	422	51	8.3	43,586	4,191	10.4
1986	26,878	2,142	12.5	17,076	1,982	8,016	815	9.8	320	41	7.8	52,290	4,980	10.5
1987	24,773	1,870	13.2	20,801	2,162	9,116	858	10.6	724	91	8.0	55,414	4,981	11.1
1988	29,157	2,140	13.6	33,013	3,172	7,699	685	11.2	467	53	8.8	70,336	6,050	11.6

Note) ton : Production

ha : Harvested area

ton/ha : Unit yield

Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Table IV-5 (2/3) PRODUCTION, HARVESTED AREA AND UNIT YIELD OF PALAWIJA IN BENGKULU PROVINCE

Year	Riang Lebong		Bengkulu Utara		Bengkulu Selatan		Kodya Bengkulu		Bengkulu Province				
	ton	ha	ton/ha	ha	ton	ha	ton/ha	ha	ton	ha	ton/ha		
1979	5,689	830	6.9	72	660	98	6.7	111	17	6.5	6,916	1,017	6.8
1980	7,257	953	7.6	72	511	68	7.5	43	6	7.2	8,352	1,099	7.6
1981	12,362	1,736	7.1	145	1,332	207	6.4	148	27	5.5	14,805	2,115	7.0
1982	15,633	2,187	7.1	1,197	929	152	6.1	-	-	-	17,759	2,537	7.0
1983	22,518	2,783	8.1	2,018	1,476	258	5.7	29	4	7.3	26,041	3,382	7.7
1984	29,076	3,394	8.6	2,288	1,686	279	6.0	17	2	8.5	33,067	3,984	8.3
1985	19,384	2,204	8.8	1,428	794	98	7.9	66	9	7.3	21,672	2,491	8.7
1986	23,848	2,554	9.3	3,207	1,483	201	7.4	37	5	7.4	28,575	3,175	9.0
1987	34,703	3,801	9.1	4,689	1,752	246	7.1	126	18	7.0	41,270	4,713	8.8
1988	32,218	3,275	9.8	6,901	2,557	317	8.1	127	14	9.1	41,803	4,452	9.4

Note) ton : Production

ha : Harvested area

ton/ha : Unit yield

Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Year	Riang Lebong		Bengkulu Utara		Bengkulu Selatan		Kodya Bengkulu		Bengkulu Province				
	ton	ha	ton/ha	ha	ton	ha	ton/ha	ha	ton	ha	ton/ha		
1979	583	692	0.8	203	345	434	0.8	29	32	0.9	1,160	1,420	0.8
1980	822	825	1.0	251	227	229	1.0	15	15	1.0	1,315	1,322	1.0
1981	1,249	1,019	1.2	440	1,131	1,167	1.0	30	27	1.1	2,850	2,600	1.1
1982	2,156	1,904	1.1	945	385	357	1.1	14	12	1.2	3,500	3,156	1.1
1983	2,409	2,030	1.2	857	601	489	1.2	5	4	1.3	3,872	3,295	1.2
1984	1,582	1,255	1.3	2,055	1,764	620	1.1	7	6	1.2	4,308	3,645	1.2
1985	1,907	1,454	1.3	984	823	902	0.9	26	22	1.2	3,740	3,151	1.2
1986	2,130	1,490	1.4	1,810	1,481	764	1.3	31	32	1.0	4,980	3,767	1.3
1987	1,864	1,503	1.2	1,580	884	772	1.1	27	32	0.8	4,355	3,798	1.1
1988	2,218	1,740	1.3	1,710	1,549	1,596	1.2	27	29	0.9	5,818	4,914	1.2

Note) ton : Production

ha : Harvested area

ton/ha : Unit yield

Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Table IV-5 (3/3) PRODUCTION, HARVESTED AREA AND UNIT YIELD OF PALAWIJA IN BENGKULU PROVINCE

Year	Riang Lebong		Bengkulu Utara		Bengkulu Selatan		Kodya Bengkulu		Bengkulu Province	
	ton	ha	ton/ha	ton	ha	ton/ha	ton	ha	ton/ha	ton
1979	389	551	0.7	120	176	0.7	31	44	0.7	540
1980	680	727	0.9	166	178	0.9	108	116	0.9	954
1981	775	851	0.9	307	372	0.8	178	212	0.8	1,260
1982	1,449	1,726	0.8	338	404	0.8	149	180	0.8	1,936
1983	844	1,019	0.8	353	540	0.7	202	336	0.7	1,399
1984	453	458	1.0	993	1,194	0.8	298	414	0.7	1,744
1985	365	357	1.0	912	948	1.0	331	419	0.8	1,608
1986	2,843	2,505	1.1	1,011	1,007	1.0	515	594	0.9	4,369
1987	2,970	2,755	1.1	1,242	1,261	1.0	522	670	0.8	4,734
1988	738	647	1.1	1,108	1,103	1.0	380	409	0.9	2,231

Note) ton : Production

ha : Harvested area

ton/ha : Unit yield

Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Year	Riang Lebong		Bengkulu Utara		Bengkulu Selatan		Kodya Bengkulu		Bengkulu Province	
	ton	ha	ton/ha	ton	ha	ton/ha	ton	ha	ton/ha	ton
1979	-	-	-	61	86	0.7	62	86	0.7	123
1980	6	9	0.7	50	72	0.7	64	91	0.7	120
1981	6	10	0.6	57	90	0.6	60	95	0.6	123
1982	42	57	0.7	234	332	0.7	164	231	0.7	440
1983	15	19	0.8	204	290	0.7	115	167	0.7	334
1984	63	79	0.8	687	934	0.7	113	185	0.6	863
1985	15	20	0.8	526	661	0.8	194	279	0.7	743
1986	278	327	0.9	125	178	0.7	230	341	0.7	634
1987	205	236	0.9	378	480	0.8	321	423	0.8	904
1988	211	248	0.9	444	575	0.8	499	658	0.8	1,157

Note) ton : Production

ha : Harvested area

ton/ha : Unit yield

Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Table IV-6 PRODUCTION, HARVESTED AREA AND UNIT YIELD OF PADDY IN BENGKULU PROVINCE

(1) Production		Bengkulu Utara			Bengkulu Selatan			Kodva Bengkulu			(Unit : ton)		
Year	Wetland	Dryland	total	Wetland	Dryland	total	Wetland	Dryland	total	Wetland	Dryland	total	
1983	80,143	12,958	93,101	36,825	28,738	65,563	84,933	5,962	90,895	994	202,895	47,658	250,553
1984	78,750	5,769	84,519	33,346	24,221	57,567	99,106	4,785	103,891	1,061	212,263	34,775	247,038
1985	79,904	4,937	84,841	35,865	15,338	51,203	95,223	8,804	104,027	792	211,784	29,079	240,863
1986	86,273	5,621	91,894	27,282	18,293	45,575	117,733	5,973	123,706	1,007	232,295	29,897	262,192
1987	87,231	7,759	94,990	35,244	23,138	58,382	88,099	6,184	94,283	802	211,376	37,081	248,457
1988	85,123	6,771	91,894	40,137	26,716	66,853	95,165	8,586	103,751	2,093	222,518	42,091	264,609

(Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

(1) Harvested area		Bengkulu Utara			Bengkulu Selatan			Kodva Bengkulu			(Unit : ha)		
Year	Wetland	Dryland	total	Wetland	Dryland	total	Wetland	Dryland	total	Wetland	Dryland	total	
1983	20,485	8,499	28,984	10,425	15,089	25,514	25,882	4,479	30,361	268	57,060	28,067	85,127
1984	20,026	3,617	23,643	9,796	15,957	25,753	30,809	3,687	34,496	329	60,960	23,261	84,221
1985	22,673	3,112	25,785	10,462	10,099	20,561	28,897	5,958	34,855	239	62,271	19,169	81,440
1986	21,739	3,161	24,900	9,115	11,579	20,694	34,617	3,681	38,298	281	65,752	18,421	84,173
1987	26,423	4,496	30,919	12,358	13,889	26,347	29,168	3,753	32,921	267	68,216	22,238	90,454
1988	23,743	3,939	27,682	13,708	17,008	30,716	29,822	5,391	35,213	661	67,934	26,350	94,284

(Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

(1) Unit yield		Bengkulu Utara			Bengkulu Selatan			Kodva Bengkulu			(Unit : ton/ha)		
Year	Wetland	Dryland	total	Wetland	Dryland	total	Wetland	Dryland	total	Wetland	Dryland	total	
1983	3.9	1.5	3.2	3.5	1.9	2.6	3.3	1.3	3.0	3.7	3.6	1.7	2.9
1984	3.9	1.6	3.6	3.4	1.5	2.2	3.2	1.3	3.0	3.2	3.5	1.5	2.9
1985	3.5	1.6	3.3	3.4	1.5	2.5	3.3	1.5	3.0	3.3	3.4	1.5	3.0
1986	4.0	1.8	3.7	3.0	1.6	2.2	3.4	1.6	3.2	3.6	3.5	1.6	3.1
1987	3.3	1.7	3.1	2.9	1.7	2.2	3.0	1.6	2.9	3.0	3.1	1.7	2.7
1988	3.6	1.7	3.3	2.9	1.6	2.2	3.2	1.6	2.9	3.2	3.3	1.6	2.8

(Source) Internal data of Dinas Pertanian Tanaman Pangan in Bengkulu Province, 1990

Table IV-7 PALAWIJA PRODUCTION PER CAPITA IN BENGKULU, 1984-88

(Unit : kg per capita)

	1984	1985	1986	1987	1988	Average
Population	920,820	953,655	982,764	1,015,078	1,043,015	
Maize	7.3	14.7	15.7	19.9	19.5	15.4
Cassava	36.9	45.7	53.2	54.6	72.6	52.6
Sweet Potato	35.9	22.7	29.1	40.7	44.7	34.6
Soybeans	1.9	1.7	4.4	4.7	2.9	3.1
Groundnuts	4.7	3.9	5.1	4.3	5.6	4.7
Green Beans	0.9	0.8	0.6	0.9	1.1	0.9

Source: Perkembangan Pembangunan Pert. Tan. Pangan Prop. Dati I, Bengkulu Dipeta 1989.