

The Governments of Malaysia & the State of

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Johor tenggara

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part one



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THE GOVERNMENT OF MALAYSIA AND THE STATE OF JOHOR

**JOHOR TENGAH AND TANJONG PENGGERANG
REGIONAL MASTER PLAN**

SUPPORTING VOLUME 6

AGRICULTURE

PART I

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C O N T E N T S

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THE PLANNING ENVIRONMENT.1.1 The Physical Environment

The climate, topography, geology and soils of the Project Area are fully described in Supporting Volume 2; their important features are summarised in this Chapter and discussed in relation to the land use and agricultural potential of the Area.

1.1.1 The climate

Briefly the Project Area enjoys a typical tropical wet climate, with high relative humidities and temperatures throughout the year. Although subject to a monsoon regime of winds, there is no distinct dry season. Indeed there are no clearly definable seasons, and the diurnal variations in some of the important elements, for example, temperature and relative humidity are greater than the variations between mean daily or mean monthly values.

Rainfall: the mean annual rainfall ranges between 90 inches near Kluang and 140 inches in the mountainous areas of Johor Tengah and perhaps on part of the Tanjong Penggerang coast. The distribution of this rainfall was examined at six selected stations in or near the Project Area; in the drier months (June-July) of the South-west monsoon the average rainfall at these stations is between 5 and 7 inches per month, and there are usually between 9 and 13 wet days in each month. November to January are usually the wettest months, with rainfall of between 8 inches and 16 inches in any one month. In these months rain probably falls on one day in two. In general terms, therefore, the rainfall can be considered to be well distributed.

However, defining a dry day as one with 0.2 inches or less of rain, dry periods of up to 10 days are likely to occur between January and March and again in June and July. Particularly between January and March the dry periods may extend to between two and three weeks in one year out of four. The intensity of the rainfall is often high; daily falls of exceeding one inch can occur in any month; only between November and February have falls of over 8 inches in a dry been recorded. A fall of 14.3 inches on a December day was once recorded from Nam Heng Estate, near Kota Tinggi. These high precipitations are often the result of a single storm, lasting two or three hours or less; during these storms the intensity can exceed 3 inches an hour.

Wind: monsoon winds prevail for about seven months in a year, the north-east monsoon usually being from December to March and the south-west monsoon from May-September (wind squalls in excess of 40 m.p.h. are most likely to occur on the east coast in January and February and in the north of the Project Area in January, February and May). Destruction of crops inland by wind is not extensive but local damage, particularly to tree crops, is common, particularly to those planted on peat, which are easily uprooted.

Temperature: the variation in mean temperature from month to month and between locations in and near the Project Area is small, ranging from a low of 24.6°C (76°F) at Kluang in January to 27.4°C (81°F) at Singapore in June. The diurnal range is greater, these usually being about 7 or 8 degrees C (15°F) difference between the minimum night and

maximum day temperatures.

Relative humidity: mean relative humidity is about 85 percent, with a variation of about 3 percent above and below between November and February. As with temperature the diurnal range is considerable, typically reaching nearly 90 percent at 6 a.m., and falling to about 75 percent at 1 p.m.

Sunshine: Kluang and Singapore enjoy an average of about five and a half hours bright sunshine per day; November, with 4 and 4½ hours per day respectively, and February, with 7 and 6½ hours, are the months with least and most sunshine.

1.1.2 Topography

Johor Tengah: this region is mainly, rolling and undulating country, the steepland being confined to large tracts along the north-eastern boundary. In the north and south-east the terrain is broken, but in the west there are extensive areas of regular landscape. Several slow flowing rivers dissect the region, forming narrow flood plains which are liable to frequent inundation.

Tanjong Penggerang: much of this region is level or nearly level with very little steep-land. In the west and north-west and in the central part of the area the terrain is a complex of undulating and hilly classes, in which valley incision is sometimes severe. Along the south and east coast are extensive swamps, lying in general between 5 and 30 feet above sea level. A central spinal ridge runs from the north of the region south-east to the coast.

Except for three major river systems, the valleys are generally narrow belts liable to frequent flooding.

1.1.3 Soils

Johor Tengah: Rengam and Harimau Series are the most commonly occurring soils in this region. These are deep, moderately friable soils with physical characteristics that make them suitable for a wide variety of crops. The next most common soil series is Durian, a class III soil suitable for rubber but only marginal for oil palms. The Yong Peng Series, a heavy textured, rather compacted, moderately deep to deep soil, also occurs quite widely.

Riverine and local alluvia, found in river valleys, vary considerably in their textures and drainage characteristics. They are often liable to flooding, and until more is known about the depth, time, and frequency of these floods, must be judged to have only a restricted potential, mainly for certain grasses.

Tanjong Penggerang: the number of soil series found in this region is more than in Johor Tengah and their distribution is more complex. The predominant series, Rengam, is mainly found in the north, and the Yong Peng Series is concentrated along the western boundary.

A large numbers of soils, derived from sand-

stones, shales and metasediments are located in small areas throughout the peninsular.

The Marang Series occur along the east coast and in the headwaters of the S. Papan. This series has a fine sandy loam friable topsoil overlying a firm, compacted sandy clay loam, in which vein quartz fragments occur and restrict rooting. Where the soil is deep over the compacted layer the series is suitable for a wide range of crops, but the shallow phases are of limited usefulness.

Two large areas of peat occur along the east coast. In some places the depth of peat, which overlies sand, is more than ten feet. This peat is poorly humified, woody and very acid (pH 2.5). In the present state of knowledge it is unsuitable for a commercial farming. Associated with the edges of the peat swamp and with the river valleys are Riverine and Local Alluvia and Organic Clays and Mucks.

1.1.4 Present land use

The gross extend of the Project Area is 742,200 acres, of which 218,200 acres have been already alienated or earmarked for development, and either have been or are in the process of being developed. Most of this land has been or will be used for agriculture. Some 60,000 acres chiefly for rubber and oil palm estates lie round the north and west perimeters of Johor Tengah. In Tanjong Penggerang there are some 70,000 acres (mostly rubber estates) on the west coast facing the S. Johor, and between 40,000 and 50,000 acres are being developed by the Federal Land Development Authority (FLDA) south-east of Kota Tinggi. These lands are being planted to oil palms and rubber. The remaining 40,000 acres of developed land are used for mining. Scattered through the developed area are kampongs round which various crops are usually grown, among them coconuts, tapioca, fruit and vegetables.

Among the mining alienations is one in Tanjong Penggerang for silica sand extraction. Of this alienated area a part, amounting to 7,400 acres is suitable for an extensive system of grassland farming for beef production, and since only small tracts are likely to contain silica sand, these 7,400 acres have been included in the land to be developed to agriculture in the Master Plan.

1.1.5 Availability of the present undeveloped land

There are 524,000 acres (gross) of unalienated land in the Project Area. Not all of this is available for development. Some 45,500 acres are already reserved as mangrove forest and, for example, for Malays and Aborigines. There is also a need to consider the future water requirements for drinking and industrial purposes and it has been recommended (SV3) that 43,900 acres of land should be reserved as water catchment to meet the estimated future demands.

1.1.6 Future land use

After deduction of the unavailable alienated and reserved land, a total of 442,000 acres of land are available for development. Not all of this is suitable for agriculture. A number of constraints are imposed by the physical environment. The high, often intense, rainfall, combined with the generally undulating to rolling, and sometimes steep terrain, dictate that forms of land use must be adopted that will protect the soils from erosion. Because of this hazard the Department of Agriculture has designated land of above 20 degrees slope as unsuitable for agriculture, and this limitation is accepted.

Some 74,000 acres in the Project Area, mostly in Johor Tengah, have been excluded on grounds of steepness, and it is recommended that they remain under forest.

There are also some soil constraints, notably in Tanjong Penggerang, where the extensive peat swamps are considered to be unsuitable for agriculture in the light of existing knowledge. These raw peats are different from the peats of the west coast. Before their suitability can be accepted an experimental programme is required to ascertain the best methods of drainage. Drain depth and spacing trials must be carried out to establish the best way to control the water-table at the desired depth. Amelioration of the soil acidity will be necessary, and the economics of liming to raise the pH to the right level for the crops to be tried will need to be ascertained. A suitable sequence of cropping should be investigated, beginning with acid tolerant crops. It is the Consultants view that the most likely outcome of any research programme will be to show that these soils will not be profitable to develop. MARDI should consider carefully what priority this work deserves in their programme, given the availability of known suitable mineral soils.

There are some 36,000 acres of peat swamp in Tanjong Penggerang which are not considered to be fit for agriculture. This leaves a balance of 334,500 acres available but some of this land, though of suitable quality, lies in valleys subject to flooding and cannot be recommended for development until investigations have been made to ascertain the frequency, extent and depth of this flooding. There are also several inaccessible areas including a strip of coastal beach sands in Tanjong Penggerang which is also of low quality. Further areas have been recommended for urban developments.

Therefore a further 53,000 acres have not been included in the agricultural development proposals which cover the remaining 281,500 acres.

TABLE 1.1 Land Use in the Project Area (Gross Acres)

	Available & suitable for agricultural development.	Not Available or not suitable for agricultural development	Total
Alienated	5,700	22,500	218,200
Reserved land	-	45,500	45,500
Water catchments	-	39,600	39,600
Excluded -			
above 20° slopes	-	74,100	74,100
Peat	-	36,000	36,000
Other land excluded for agricultural development	-	53,000	53,000
Unalienated & included	275,800	-	275,800
	281,500	460,700	742,200

1.1.7 Potential agricultural activities

Under the rainfall, terrain and soil conditions in the Project area the erosion hazard is as great as anywhere in the world, (R1) and it will become greater still when the forest cover is removed for agricultural development (SV3). The magnitude of the hazard is directly related to the steepness of the terrain and the density or ground cover. Thus the steeper the slopes the more important it becomes to reduce soil disturbance and to maintain a standing cover.

Criteria for crop selection in relation to the physical environment have been laid down and a land use potential classification devised (SV2). The result of applying this classification to the lands of the Project Area is illustrated in Figure 1.1 and summarised in Table 1.2.

area:- grass, pineapples, fruit trees, coconuts and tea. Root crops, such as tapioca, and grain crops might also be grown successfully, though less extensively and with more difficulty than the perennial and semi-perennial crops.

The particular suitability of the environment for grass production is worthy of emphasis. The plentiful and well distributed rainfall, together with an average of about five and a half hours sunshine per day, provide excellent conditions for rapid and luxuriant all the year round growth of grass. Such an environment offers attractive opportunities for the development of cattle enterprises, though temperate breeds may suffer from heat stress unless grazing is restricted to night time. Other livestock activities that are being, or might be developed, successfully in the project area are the production

TABLE 1.2 Crop Suitability of Project Area Lands

Crop Group	Tanjong Penggerang		Johor Tengah		Total	
	Suitable Percent	Marginally suitable Percent	Suitable Percent	Marginally suitable Percent	Suitable Percent	Marginally suitable Percent
1. Rice	1	15	-	10	1	12
2. Vegetables etc.	5	20	-	60	2	49
3. Tapioca	30	-	38	-	35	-
4. Grains	20	8	35	-	29	3
5. Grass	95	-	90	-	92	-
6. Bananas	5	60	-	62	2	61
7. Pineapples	71	5	90	-	83	2
8. Cocoa	10	60	-	60	4	60
9. Oil palms	64	6	80	7	74	7
10. Rubber	90	-	93	-	92	-

Crops were grouped by treating crops known or thought likely to have generally similar agricultural demands as a single unit. The ten agricultural groups fall under three main heads, (1) annual crops, (2) semi-perennial crops, (3) perennial crops, as follows:-

	Crop Group	Crops
Annual crops	1	Rice
	2	Groundnuts, vegetables, tobacco
	3	Tapioca, Chinese yams, sweet potatoes
	4	Pulses, maize, sorghum
Semi-perennial crops	5	Grass
	6	Bananas, sugar cane, ramie, papaya
	7	Pineapples
Perennial crops	8	Cocoa, coffee, citrus avocado, pepper, gambier
	9	Oil palm, rambutan, arecanut, mangosteen
	10	Rubber, coconuts, durian, tea, guava, brazil nuts, cinnamon, bamboo

Table 1.2 gives a broad indication of the suitability of the environment for diversification of agriculture. Besides rubber and oil palms the following crops could be widely cultivated in the

of poultry, pigs, goats and fish.

Although the physical environment is suitable for considerable agricultural diversification, there are constraints imposed by the existing social organisation of the industry, by market and technical factors and by institutional shortcomings, all of which must be taken into account in planning future development.

1.2 The Social Environment

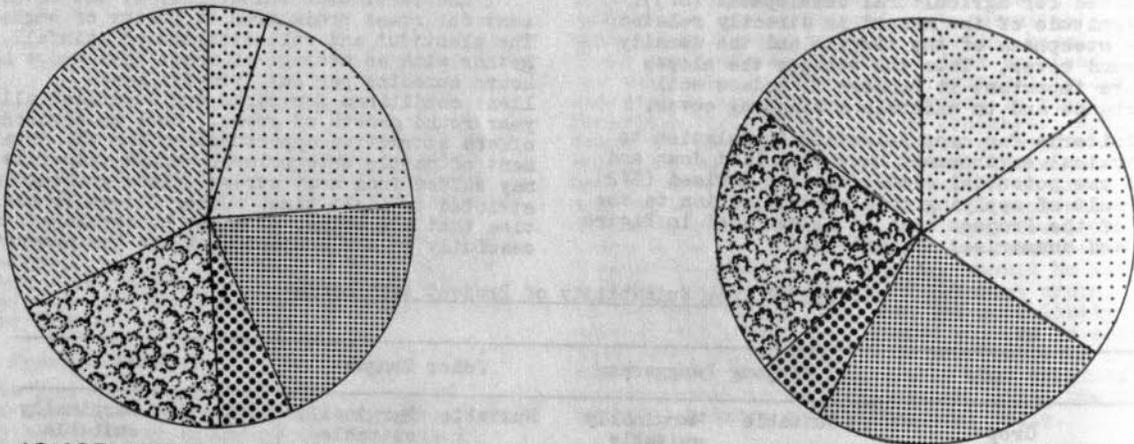
The agricultural industry is divided mainly into two distinct production sectors, the large scale, monocrop, estate sector and the small semi-subsistence farmer, who usually grows a variety of crops, some for sale and some for subsistence. The absence of a middle income group economically independent, larger farmers is not able and acts as a constraint upon diversification because (a) the small farmer has neither the means nor the technical knowledge to branch out into new and unknown activities, his chief preoccupation being to wrest from the land at least the minimum living requirements of himself and his family; and (b) the large monocrop estates concentrate more research and effort upon improving the production of their chosen specialised enterprise than upon diversification into new activities.

FLIDA in its new settlement aims to improve the lot of the small farmer, and to raise the family income to a higher level. This is a start, but the target income (\$300 per month) will not provide the size of surplus that is required for a settler to advance into the middle class;

*Small scale - subsistence
market garden
medium scale - cash crops
private holdy
Sofflane
cash crop
- shared
arvidis. h
Estate
Nucleus estate
into capital*

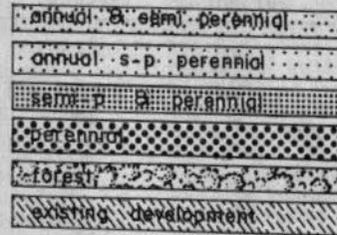
FIGURE 1.1

LAND USE POTENTIAL



JOHOR TENGAH REGION

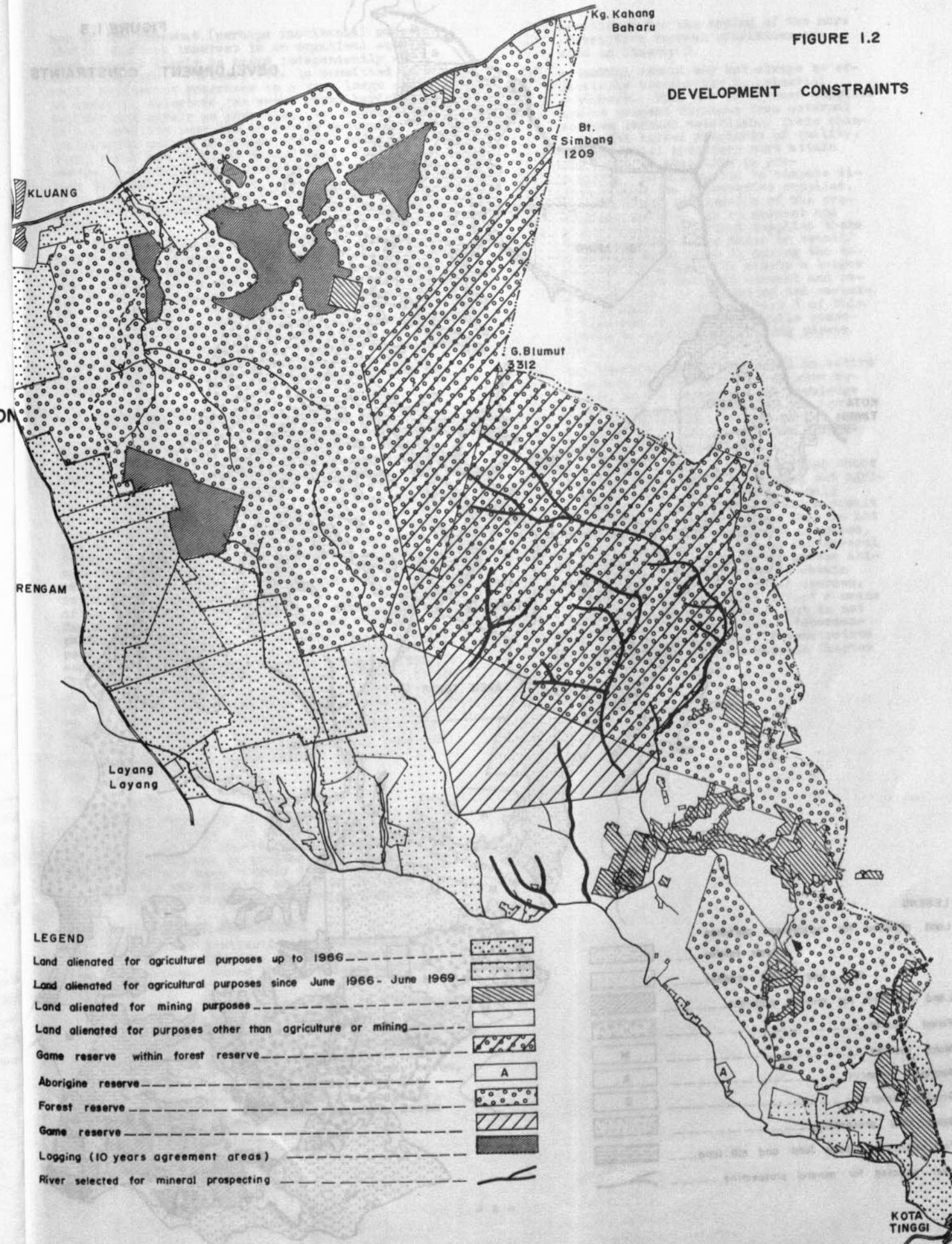
TANJONG PENGERANG REGION



Base on acreages taken from the 1:63,360 Land Use Potential maps

FIGURE 1.2

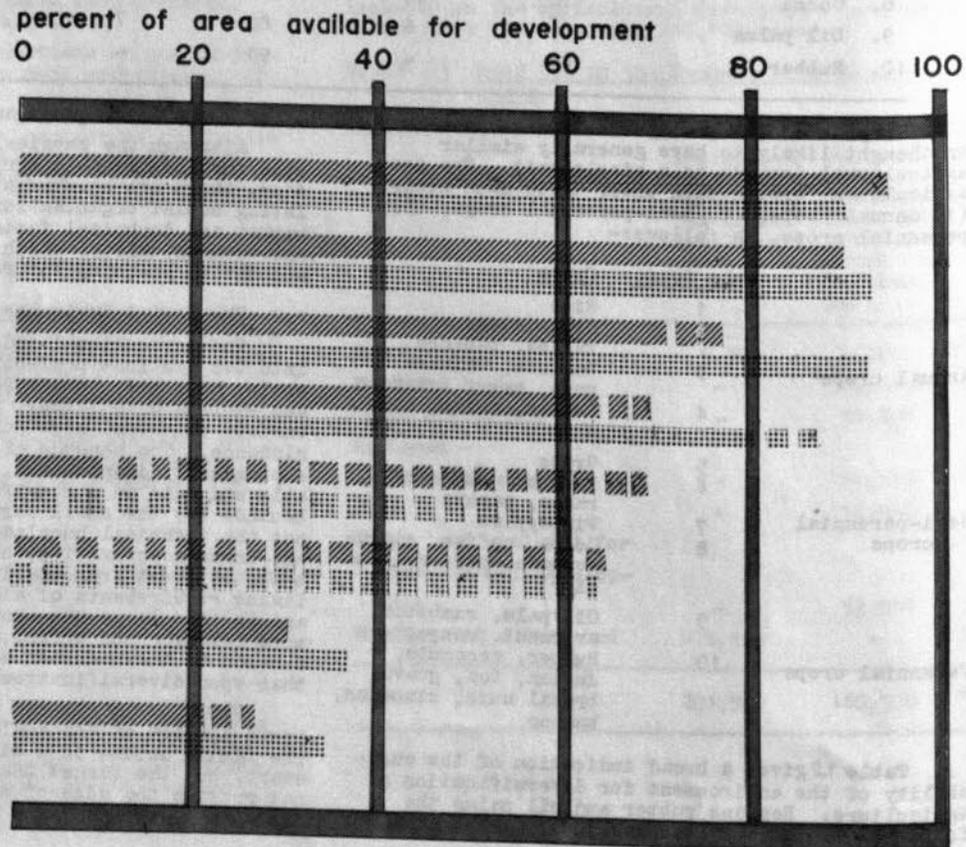
DEVELOPMENT CONSTRAINTS



LEGEND

- Land alienated for agricultural purposes up to 1966
- Land alienated for agricultural purposes since June 1966 - June 1969
- Land alienated for mining purposes
- Land alienated for purposes other than agriculture or mining
- Game reserve within forest reserve
- Aborigine reserve
- Forest reserve
- Game reserve
- Logging (10 years agreement areas)
- River selected for mineral prospecting

CROP POTENTIAL

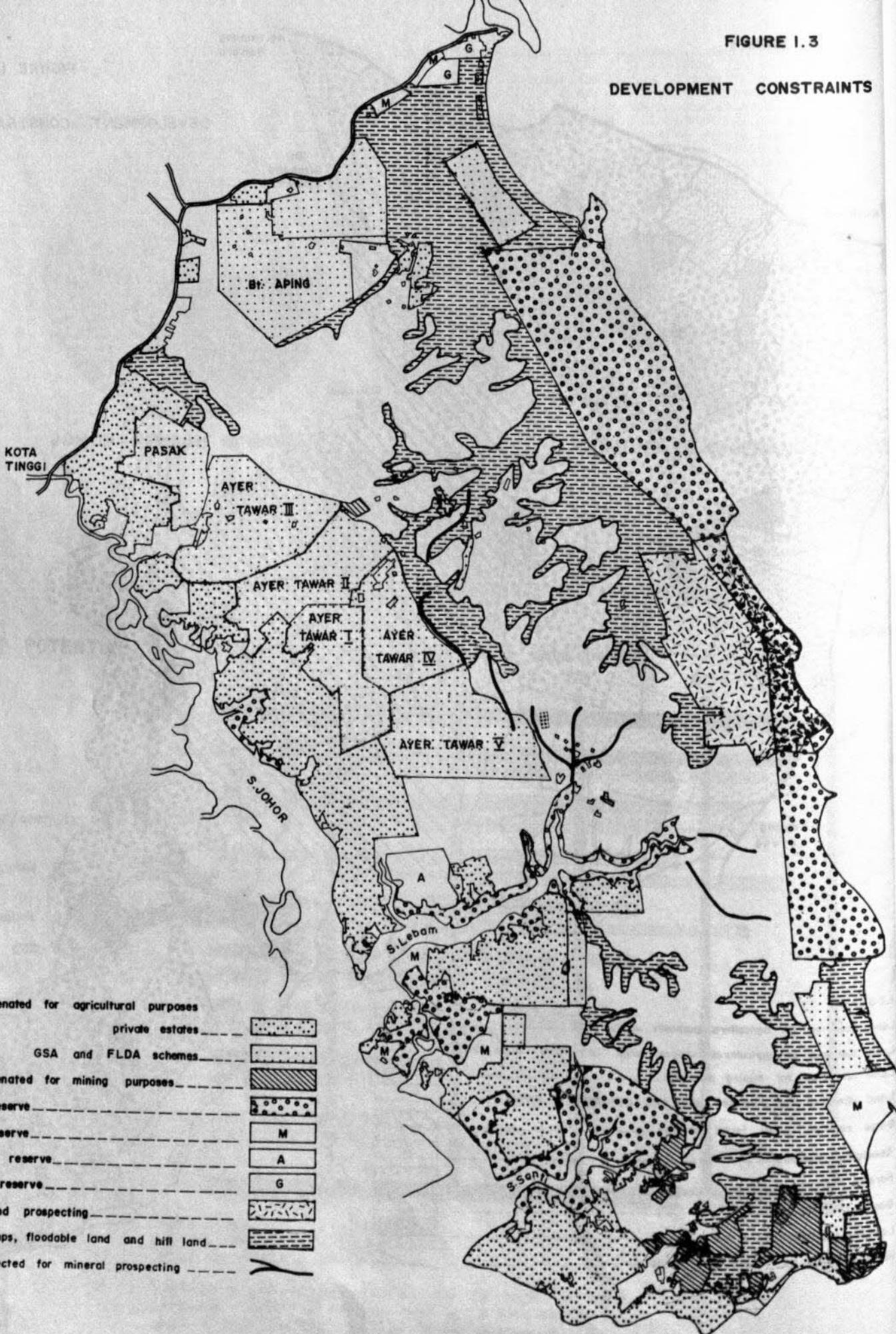


JOHOR TENGAH
TANJONG PENGERANG
broken line indicates marginal potential

Crops are a representative selection only and cover the main groupings. Figures in brackets refer to the crop codings used for the 1:63,360 Land Use Potential map series

FIGURE 1.3

DEVELOPMENT CONSTRAINTS



LEGEND

- Land alienated for agricultural purposes
 - private estates
 - GSA and FLDA schemes
- Land alienated for mining purposes
- Forest reserve
- Malay reserve
- Aborigine reserve
- Grazing reserve
- Silica sand prospecting
- Peat swamps, floodable land and hill land
- River selected for mineral prospecting

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nor is the somewhat (perhaps inevitable) paternalistic approach inherent in an organised settlement concept likely to breed independently-minded farmers. Further, FLDA is committed to a rapid settlement programme on a very large scale, in order to alleviate the worst rural hardship as rapidly and widely as possible; to ensure that it achieves its task the Authority naturally must concentrate mainly on rubber and oil palm production, which are familiar activities. FLDA is not averse to undertaking alternative activities once they have been shown to be feasible, but cannot be expected to jeopardise its main objectives by any great dissipation of its energies in unproven fields.

The emergence of an economically independent, middle income group of larger farmers would broaden employment opportunities and make it possible for young men to make a career in agriculture with prospects for advancement. In the Project Area the cost to Government of developing new land would also be reduced and the requirement of trained public sector agricultural managers, who are in short supply, would be less. Measures for tapping existing initiative and creating a new group of farmers with initiative have been recommended in Chapter 3.

1.3 Technical Environment

It is broadly true that a great deal is known in Malaysia about the large scale production of rubber and oil palms, and virtually nothing about most of the other activities that could be best suited to south Johor. Except for the Central Animal Husbandry Research Station between Ayer Hitam and Kluang, both the research effort and also attempts at commercial production, for example of cocoa and sugar, have been concentrated further north, outside the equatorial climatic zone that distinguishes south Johor from other parts of West Malaysia. The acquisition of basic technical information must precede the initiation of any large scale new commercial enterprises. The starting time and the subsequent rate and pattern of development of new activities will depend on the effectiveness of a well planned research programme and the results obtained from it. The technical constraints surrounding the various potential activities are discussed in Chapter 2 and recommendations have been made in section 2.9 on the main lines of research that should be pursued by the staff of the research station which the newly formed Malaysian Agricultural Research and Development Institute (MARDI) proposes to open in Johor Tengah.

1.4 Markets

Before embarking on new activities it is essential to examine the market prospects, both internally and for export, of the commodities that it is proposed to produce. The results of market analyses will largely determine the scale to which any new activity should be developed. Market constraints are considered in Chapter 2.

1.5 Institutional Environment

A number of institutional constraints at present act as deterrents on the production of new commodities. Among the more important of these are:-

- (a) the imposition, when land is alienated of very restrictive limitations on permissible enterprises. Land is alienated for specific activities, for example, rubber and cannot be used for other purposes, for example oil palms, cocoa, fruits, without the sanction of the State Lands Office and the possible payment of additional premia. Recom-

mendations for the easing of the more restrictive express conditions are made in Chapter 3.

- (b) potential demand may not always be effectively transmitted to potential producers. This may be because supplies are at present obtained from external sources through established trade channels with agreed standards of quality. Any potential producers must attain the level of expertise in production, packaging etc to compete directly with the alternative supplies. Alternatively consumption of the product may be very low at present and given uncertainty about supplies there is no interest among those in retail/wholesale activities in making the necessary investments to create a larger market. More detailed comment and recommendations on processing and marketing of milk are made in Part 3 of this volume and of other perishable commodities in appropriate working papers (R4,6,10,14).
- (c) the absence, inevitable until an active research programme begins to show results, of the necessary new knowledge and practical experience in the agricultural advisory services of the problems to be overcome by those initiating the new activities.
- (d) the general lack of capital among those who are interested in carrying out agricultural development. While small amounts of short-term production credit is available from retailers this is not suitable for most investment purposes, when loans will be required for several years. Lacking security or proven ability most individuals cannot obtain funds from normal commercial sources. The FLDA programme is in effect a means of overcoming this problem but is not suitable for all purposes. Recommendations for the removal of constraints under (c) and (d) are made in Chapter 4.

SELECTION OF ACTIVITIES2.1 Introduction

The rate of development and ultimate scale of any activity are not determined by natural factors only. Two important constraints that require analysis are market prospects and the availability of basic technical knowledge. To facilitate their examination the list of environmentally suitable activities was divided into the following four groups, each of which is considered in this chapter.

- (1) Activities known to be commercially exploitable immediately and on a large scale. Rubber, oil palms.
- (2) Activities known to be commercially exploitable immediately but on a restricted scale. Pineapples (by hand methods), pepper, coconuts (from local selected seed), fruits and vegetables (fresh), pork, poultry, fish, tea.
- (3) Activities thought to give promise of commercial exploitation, but requiring a period of commercial scale testing. Dairy and beef cattle, goats, annual grain and legume pulses and groundnuts, cocoa, sugar cane, coffee, starchy root crops, coconuts (from hybrids), pineapples (mechanised) fruit and vegetables (canning).
- (4) Activities possibly suitable to the environment, but requiring research and experimentation before development, for example avocado pears, seedless limes, ramie, gambier, bananas, (for export for human consumption), essential oils, brazil nuts, cinnamon.

Broadly speaking the main constraint for the activities in groups 1 and 2, which are known to be commercially exploitable, is likely to be the size and profitability of the market.

For activities in groups 3 and 4 the qualifications about their commercial potential spring primarily from a lack of proven technical information. Some data are available for those in group 3, but not enough to warrant immediate full scale development; almost nothing is known about the agronomic requirements of the crops in group 4 in the south-east Johor environment. Research is obviously highly desirable.

2.2 Criteria for Evaluation and Selection

- a) The internal rate of return worked at three levels for activities beginning in 1972. The commercial rate of return results from the evaluation of all inputs and outputs at market prices. It is, however, calculated before deduction of income or corporation taxes as the effect of these will vary according to the type of investor. The government financial rate of return represents the return to a government investment after adding back export taxes and land rents, but still with all costs at market prices. The social rate of return indicates the return to the West Malaysian economy, after applying to the government financial rate of return a shadow wage of \$40 per month, which is assumed to reflect the real value of unskilled labour to the economy at the present time.
- b) Net present value per acre is the capitalised value when all income and expenditure streams are discounted at 15 percent.

- c) Capital costs per acre are presented as the financial expenditure to the year of first net receipt. This is the total amount that would have to be borrowed by the activity, but excludes interest charges as these will vary considerably between investors.
 - d) Employment criteria are shown in acres per worker at maturity on a 300 work day/year basis. The capital cost per job is obtained by applying the undiscounted capital cost per acre to acres per worker.
 - e) The product price levels used in the calculation are the farm gate or 'free on board' (fob) prices thought most likely to prevail.
 - f) The comparative advantage of the project area for an activity is indicated by a subjectively assessed star grading system.
- ++++ The activity developed in the project area has a distinct advantage compared with the same activity in other new areas in West Malaysia by reason of physical environment or market proximity.
- +++ The activity is expected to do at least as well in the area as anywhere else in West Malaysia.
- ++ There is no particular reason for choosing the project area and other areas may be better.
- + Indicates that the activity may be at a positive disadvantage in the project area compared with other areas in West Malaysia.

2.3 Group 1 Activities (Table 2.2)2.3.1 Rubber (R11)

There is enough technical knowledge and practical experience of rubber production to allow it to be expanded rapidly. Malaysia is well served by its rubber research service - indeed the Rubber Research Institute may fairly be said to be leading the world in research on rubber and has regularly introduced improved and ever higher yielding clones. Peak yields of 2000 pounds or rubber in the 14th year of tapping can reasonably be expected from current plantings, and even higher yields (up to 3000 pounds) from plantings after 1975. Recent work with the new yield stimulant, Ethrel, could raise productivity per unit of land or labour even further and possible effects have been examined (R11). At present the long term effects must be regarded as speculative, and the use of new stimulants has not been taken into account in evaluation in this report.

World-wide production of natural rubber has expanded at a rate of about 3 percent per annum during the 1960's. During the same period the total world consumption of elastomers has increased at almost 7 percent per annum. The rapidly expanding synthetic rubber industry has increased its share of the total elastomer market from 40 percent in the late fifties to over 60 percent at the present time. At the same time the price of natural rubber has fallen almost by half from just over \$1.00 per pound in 1960 to an average of 50-60 cents in 1970. The price is likely to continue to fall until the mid-seventies as Malaysian production expands rapidly and the synthetic plants now planned come on stream. As crumb and other special rubbers, manufactured to more stringent specifications, take up a greater share of Malaysian production, and as the rate of growth of Malaysian output slows towards the end of the decade, the price drop may be

arrested. There may also be a chance to exploit the relationship between natural and synthetic rubber by combining the materials at source if a petrochemical industry is established in Malaysia. For purposes of evaluation a constant price 50 cents per pound has been assumed to prevail throughout the planning period.

2.3.2 Oil palms (R12)

Research on oil palms is conducted by the private sector and by the Department of Agriculture, and is providing an adequate technical base from which to launch an expanded planting programme. Yields of ten tons ffb per acre in the seventh year from planting out have been assumed in the evaluation of current plantings. Later plantings may give up to twelve tons per acre from the sixth year and sustain this yield for nine years. The effects of these more speculative yield projections are examined in the supplementary paper (R12).

The oil palm yields two types of oil: palm oil and palm kernel oil. The oils and fats market, on which they are sold, is extremely complex and comprises about 15 different animal, vegetable and marine products produced in all parts of the world. The world-wide prospect is for increasing supplies of these products as a whole, coupled with attempts by many importing countries to support home producers. In this situation a steady fall in price of palm oil must be expected. However, if an oil fractionation process, at present under investigation, can be introduced commercially, such a decline in price might be arrested, since each fraction might be sold on a specific market. Palm kernel oil is rather more specialised in use, having similar characteristics to coconut oil, and will be discussed later in connection with that crop.

The assumed prices for palm oil and kernels are shown in Table 2.1.

TABLE 2.1 Major Commodity Price Projections (fob Singapore/Johor Bahru)

Commodity	Units	1975	1980	1985	1990
Palm oil	\$/ton	420	380	361	344
Palm kernels	\$/ton	370	360	351	343

2.4 Group 2 Activities (Table 2.4)

Most of the activities in this group are already carried on commercially in or near the project area, but only coconuts and pineapples cover more than a small area. Both these crops are supported by commodity research stations. There is also a Government poultry breeding station in Johor Bahru.

2.4.1 Pineapples (R7)

Exports of canned pineapples from Malaysia-Singapore have doubled over the past 10 years and the bulk of this increase in output has come from West Johor. Malaysian exports in 1968 amounted to 66,000 tons. About 30,000 tons of Malaysian fruit were also exported to Singapore, mainly for canning at the one remaining factory there. Prices throughout this period for the canned product have been fairly stable, averaging around \$750 per ton. Exports to U.K., originally the largest market, have been expanding very slowly and the major growth in sales has been to North America and Western Europe, especially Germany. Since Hawaiian production is not expanding, prospects of producing for the continued growth of the market in N.

TABLE 2.2 Summary Evaluation of Group 1 Activities

	Oil Palms	Rubber
1. Internal rate of return	Percent	Percent
a) Commercial	9	8
b) Government financial	13	10
c) Social	28	18
2. Net present value	\$/acre	\$/acre
a) Commercial	-556	-790
b) Government financial	-176	-540
c) Social	+912	+239
3. Capital cost	\$/acre	\$/acre
a) Undiscounted negative cash flow	1858	1808
b) First positive cash flow	Year 5	Year 7
4. Employment		
a) Acres per worker at maturity	9	6.6
b) Capital cost per worker	\$16,722	\$11,930
5. Comparative advantage rating	+++	+++
6. Scale of enterprise evaluated	10,000	10,000
	acres gross	acres gross
7. Type of enterprise evaluated	Estate	Estate

America are reasonably favourable. A potentially large but untapped market exists in U.S.S.R. and E. Europe. Competition in canned fruits is keen and prices must be expected to fall slightly for example to about \$675 per ton fob by 1980.

Malaysian production could double again in the next decade, with expansion of acreages in Selangor and Trengganu and in West Johor round the new cannery near Pontian. New crop strains capable of raising yields per acre to an average of 40-45 tons over a five year cycle may become available before the end of the decade.

At present a 5-year cycle yield of 30-35 tons may reasonably be assumed. At this level pineapples grown under a labour intensive system on upland soils show a very low financial rate of return and have a very low comparative advantage rating. They will do better as a sole crop on the west coast peats where frequent replanting is not necessary. In the longer term however the advantage may shift to mineral soils as labour costs rise, because most machinery cannot be used on the Malaysian peats. Because the required techniques have not yet been tried in Malaysia, production of the crop by more mechanised methods has been considered among the Group 3 activities.

2.4.2 Coconuts (R2)

Coconuts and palm kernels produce similar cooking oils, and to some, but unknown, extent millers in Malaysia substitute palm kernel oil for the traditional coconut oil. It has been estimated that the demand for the two oils in W. Malaysia for cooking purposes and soap manufacture will grow some two and half times to about 190,000 tons by 1990, (R2). Copra output in W. Malaysia has been virtually static at around 150,000 tons for several years and it appears likely that there will be increased use of palm kernels.

Demand for coconut for confectionery purposes

will also grow at least in line with population growth in W. Malaysia and South and East Asia generally. Thus, while some fall in price from the present high level is expected as coconut supplies from the Philippines increase and palm kernel exports from Nigeria recover, the general downward trend is expected to be much slower than for palm oil.

TABLE 2.3 Projected Prices of Palm Kernels, Copra and Crude Coconut Oil (\$/ton fob Singapore)

	<u>Palm kernels</u>	<u>Copra</u>	<u>Coconut oil</u>
1975	370	450	750
1980	360	438	730
1985	351	429	715
1990	343	420	700

A planting programme of 20-30,000 acres in the project area using improved local tall strains could yield 20-30,000 tons of copra per annum at maturity. However current strains of coconuts on inland soils show a relatively low financial return and a low rate of labour use. Better returns and labour use are obtained when coconuts are mixed with beef, cocoa, goats, pineapples or perhaps short term crops. The complementary relationship and coefficients of this type of mixed activity have still to be tested in practice. Hybrid coconuts (selected semi-tall West African males crossed with Malaysian dwarf yellow females) may yield up to one and half tons copra per acre, 50 percent more than the existing local seedlings. Their commercial introduction however must be preceded by a period of development and testing and they are therefore considered among the Group 3 activities.

2.4.3 Pepper (R8)

Pepper is a traditional crop in Johor State, and is grown on about 2,000 acres. The crop has a major place in the research programme of the Sarawak Department of Agriculture, and it requires only a well ordered communications channel to ensure that the Johor agricultural extension service can keep farmers aware of improved technology.

World production of pepper amounts to about 80,000 tons per year. The principal producers are Indonesia, India, Malaysia, Ceylon and Brazil (in that order). Most of this production enters world trade. Overall yields in Sarawak average 30 cwt or more per acre while India's 250,000 acres of crop average only 2 cwt. There is obviously great scope for increased output in that country. Brazil has increased output considerably in the past 20 years. World demand is increasing at about two and half percent per year or 2-3,000 tons. This amounts to 1-1,500 acres at Malaysian yields and there is therefore no scope for a great increase in acreage here. A national figure of 400-500 acres might be reasonable with perhaps about 100-200 in Johor. Prices are subject to marked short-term fluctuations, but will probably average around \$120 per pikul for white and \$90 for black (unground, fob Singapore).

The peak yield is assumed to reach two tons per acre in the 9th year after planting and to remain at this level for five years. On these assumptions pepper gives acceptable financial returns on the level price basis, but is very sensitive to the valuation put on labour input. The risk associated with price fluctuations makes it relatively unattractive as a sole source of income.

2.4.4 Pigs and Poultry (R3; R4)

The output of pig and poultry products has

been expanding at a rapid rate in recent years. Both these commodities have relatively high income elasticities of demand, for example, consumers tend to increase their purchases of them as their incomes rise. Thus consumption within West Malaysia is expected to grow steadily over the study period. Estimated levels of consumption for 1970 and expected levels in 1980 and 1990 are as follows:-

Item	Unit	Estimated	Total	Consumption
		1970	1980	1990
Poultry meat	Mil. lbs.	135	231	398
eggs	Million	1,146	1,883	3,130
Pork	Mil. lbs.	124	210	355

Requirements of pig and poultry products are mainly locally produced, with occasional imports. Provided feed supplies are adequate there is no reason why output should not expand in line with demand. Expected price levels ex-farm are:-

Poultry meat	90 cents/kati liveweight, falling to 75 cents in 1990
eggs	7.5 cents each falling to 6.2 cents in 1990
Pork	\$1.00/kati liveweight falling to 90 cents in 1990.

Egg production at a yield of 200-220 eggs per hen housed at point of lay can show a reasonable profit. Poultry and pig meat production can also show quite good commercial rates of return. All three activities are extremely sensitive to changes in feed cost and feed conversion rates.

These activities have been evaluated as independent operations, but all are capable of subdivision and combination with others. There will generally be no common costs with any other activities, and so all costs, labour use and income will be in addition to those required for the other activities.

None of the activities is expected to have a marked comparative advantage in the project area and can be equally profitable if undertaken elsewhere. On the other hand, there is a place for most of them to the extent that demand generated in the project area can be met from production within the area.

2.4.5 Fish (R5)

There is an unsatisfied demand for freshwater fish. It is projected that if supplies were available per caput consumption in rural areas would rise to 25 pounds per annum, that is about one-third of the total fish intake. Urban dwellers buy freshwater fish on special occasions. The total 1990 requirement for freshwater fish in places that could be served by the project area is estimated at 5,000,000 pounds.

There are no large rivers and freshwater lakes within the project area, and natural freshwaters are poor in nutrient salts and of low productivity. They have a low potential for fisheries exploitation. However there are numerous perennial streams which, on gently sloping sites, could be used to develop fish farming projects. There are also valleys liable to localised and intermittent flooding, which, with flood control measures, could be made suitable for fish pond development. The projected 1990 requirement could be met from 2000 acres of fish ponds.

The main constraint on the development of fish culture schemes is the high cost of pond construction. However, yields per acre of pond can be high, varying with good management between

2600 and 3500 pounds per annum according to the system adopted, and internal rates of return over 20 years could be of the order of 25-30 percent. Another constraint is the present poor supply of fish fry. In the Second Malaysia Plan a fry multiplication station for Johor is proposed. By the time the Project Area is fully developed there could be an annual demand for some five million fry, and to supply this quantity more than one station would be required.

Fish culture technology is developing very rapidly in many countries and it is gratifying that valuable knowledge and experience will continue to flow from the excellent fishery research stations in Malaysia.

2.4.6 Fruits and Vegetables (R6)

Many fruits and vegetables are grown throughout the country. Such vegetables as green beans, okra and leafy greens like spinach and Chinese cabbage are best suited to the environment of the Project Area. Among fruit crops, rambutans, durians and mangosteens are native to, and widely cultivated throughout Malaysia and have seldom been grown successfully elsewhere.

The production of these fruits and vegetables is usually on a small scale for local consumption, though there is some export of fresh produce to Singapore. It seems likely that this pattern of small scale production will continue to supply the local demand, and expansion of the market to attract large scale commercial producers will require preservation of fresh or tinned produce to permit their export. Since there are technical problems to be overcome in this field, crops for canning are considered among Group 3 activities.

2.4.7 Tea

World production of tea has risen at an average rate of about two percent per year over the past fifteen years. At the same time the average price of tea sold at London auctions has fallen from 126 to 104 pence per kilogramme. This has resulted from the extremely slow growth in demand from the major importing countries, especially the U.K. This trend appears likely to continue. Discussions have taken place under the auspices of FAO on the possibility of establishing an international tea agreement to regulate the tea trade. Since Malaysia is not a large exporter such an agreement would probably preclude her entry into the world market on any scale.

There are many types of tea. Malaysian production is of the dominantly Assam type and about half the output is exported. Imports, which exceed exports in most years in quantity though not in value, are principally of cheaper tea dust from Indonesia or Ceylon, and of Chinese tea. Overall local demand is likely to double in the next 20 years, and some scope therefore exists for a limited increase in production. Given an increase in yield the acreage required might increase from the present 7,500 to 12,000 acres.

Most of the country's tea is grown in the Cameron Highlands. Although field practices need to be modified for production at low altitudes, this should not present any serious difficulty to an experienced highland tea planter. On the other hand there are no experienced tea workers in Johor and it would seem better to concentrate further development nearer existing producing areas. (Table 2.4 Page 9)

2.5 Group 3 Activities (Table 2.5)

The activities in this group are ones which are (a) already well established in other parts of Malaysia, for example, cocoa; (b) now being tried commercially in south Johor for example sugar cane,

tapioca; (c) the subject of research and experiment, for example grassland and dairy cattle and goats at the Central Animal Husbandry Research Station near Kluang; annual grain and pulse crops, groundnuts, sweet potatoes at the Federal Experiment Station, Serdang; (d) grown in or near the Project Area, for example coffee.

For all these activities some sort of technical constraint exists which must be removed by further experiment or testing before large scale development can proceed with reasonable certainty of ultimate success. The nature and severity of the constraints vary between enterprises and are discussed below.

2.5.1 Cocoa

The climate of the Johor Tengah Region is well suited to cocoa, possibly more suitable than that of the more strictly monsoonal parts of West Malaysia. The main doubts centre round the suitability of the two main soil series, Rengam and Harimau, for sustained production of high yields (over 1000 lb. acres). Observed plantings in the vicinity of the Region are not entirely convincing.

In Tanjong Pengerang there are soils of proven suitability for cocoa. The rainfall (120-130 inches per annum) could, however, be excessive; conditions are ideal for Phytophthora attack. This fungus has been identified in Johor, causing black pad and stem canker and effective economic control measures will be difficult under such heavy and frequent rainfall.

Before embarking on commercial production, a period of field trials is necessary, and recommendations are made accordingly in section 2.9.

Cocoa prices have traditionally been subject to wide year to year fluctuations, which result from a combination of low price elasticity of demand, and year to year fluctuations in supplies. In the period 1953-1965 world production grew from 800 to 1500 thousand tons per year or a growth rate of about 4.3 percent per year. Since 1965 production has fluctuated between 1.2 and 1.4 million tons, levelling off because of disease and pest problems in the main West African growing areas and reduced planting in the late 1950's and early 1960's. Prices in 1970 were at an historically high level. World consumption (at constant prices) is expected to continue to rise to about 2,400,000 tons by 1985 or at about 3.5 percent per annum.

A number of countries have large planting or rehabilitation programmes planned or under way. Present high prices should stimulate them. As these plans come to fruition a downward trend in the price of cocoa is likely, at least until 1985. World price trends (Malaysian cents per pound, fob Singapore) are forecast to be in the following range:-

1975	75 - 85 cents/pound
1980	65 - 80
1985	60 - 75
1990	60 - 75

It would not seem unreasonable for Malaysia to aim to produce 150-200,000 tons of cocoa by 1990 or 5-7 percent of world production. This would require some 300-400,000 acres.

2.5.2 Cattle (SV6; part 3; R10)

The most suitable crop for a large scale diversification programme in the Project Area is grass. The rainfall and sunshine condition are excellent for it; the soils are suitable and the crop is appropriate for much of the terrain. It is one crop for which the conditions in south-

TABLE 2.4 Summary Evaluation of Group 2 Activities

	Pineapples hand	Pepper	Coconuts	Pork	Poultry		Fish
					Meat	Eggs	
1. Internal rate of return				per 50 sow unit	per unit		
a) Commercial	6%	17%	7%	16%	17%	17%	27%
b) Government financial	8%	18%	10%	18%	20%	19%	27%
c) Social	25%	35%	14%	24%	30%	30%	30%
2. Net present value 15%	\$/acre	\$/acre		\$/unit	\$/unit	\$/unit	\$/acre
a) Commercial	-470	+350	-600	+2450	+1200	+2600	2442
b) Government financial	-400	+444	-309	+5800	+3900	+5300	2542
c) Social	+470	5790	-55	+17600	+12600	+17100	3642
3. Capital cost	\$/acre	\$/acre	\$/acre	\$/unit	\$/unit	\$/unit	\$/acre
a) Undiscounted negative cash flow	1081	3869	1340	42500	15900	22757	4720
b) Year of first positive cash flow	Year 2	Year 3	Year 8	Year 2	Year 2	Year 2	Year 2
4. Employment							
a) Acres per worker at maturity	9.25	1	20	n.a.	n.a.	n.a.	7
b) Capital cost per worker	\$ 9,500	\$ 3,869	\$ 26,800	\$ 42,500	\$ 15,900	\$ 22,760	\$ 30,873
5. Comparative advantage rating	+++	+++	+++	+++	+++	+++	+++
a. Scale of activity evaluated	1000 acres	1 acre	20 acres	30 sow unit	500 ⁹ Bird Broiler Unit	3000 layer unit	7 acres
b. Type of activity	Estate	Small- holder	Small- holder	Smallholder Specialist	Small- holder Special- ist	Small- holder Special- ist	Small- holder Special- ist

east Johor are better than in other parts of Malaysia. Here the environment is right for the crop and the location is right for the marketing of products from grassland, particularly milk, but also beef.

Malaysia is free of many of the world's serious cattle diseases. For those that occur, notably tick borne fevers, the control measures are understood. The work at the Central Animal Husbandry Research Station (CAHRS) has shown that high yielding grass pastures can be established and maintained. It has also been shown that crossing Local Indian Dairy cows with Friesian bulls can produce a satisfactory commercial milking cow, with good tolerance of the environmental condition. Steers and cull females from this cross also produce acceptable beef. The results at CAHRS are corroborated by those from other parts of the wet tropics and there is every reason to believe that, given an appropriate standard of animal husbandry, crossbred Friesians will be the most suitable stock from which to develop a national cattle industry.

The available information is enough to assert with confidence that there are no insuperable difficulties to the establishment and development of a sound cattle industry. Much additional information needs to be obtained, for example, on types of pasture/legume mixtures; their establishment and maintenance under different grazing intervals and stocking rates; the best type of animal to breed; stock management techniques. However, enough is known for activities to be started on a limited

commercial scale, provided that they are carefully monitored and backed at the same time by a strong, commercially orientated, research and experiment programme.

The West Malaysian demand for both beef and milk is expected to grow rapidly as follows:-

Item	Unit	Estimated Total Consumption		
		1970	1980	1990
Beef	Mil. lbs.	40	63	102
Milk	Mil. galls.	20	37	69

At present about ten percent of beef supplies are imported, mainly as live animals from Thailand. Imports will rise if domestic production is not increased. Prices at the farm gate are assumed to remain at 80 cents per kati liveweight throughout the period, with variations depending on quality.

The milk consumption figures quoted refer to fresh and powdered milk only. Total present dairy product consumption in Malaysia is estimated to be equivalent to some 50 million gallons of fresh milk. More than half this is consumed as condensed milk. Given the problems of expanding milk production in Malaysia it is not considered likely that any of the condensed milk market will be filled by domestic milk production in the study period. Fresh milk will in the near future be a partial substitute only for imported canned and powdered forms. The future price level will depend very much on

the growth of local production, but the most likely trend is for a steady fall in price from \$2.75 per gallon at the farm to \$1.80 in 1990. In addition to the Malaysian market, Johor is ideally suited to supply fresh milk to Singapore. The future size of this market is estimated to be about half that of West Malaysia, that is, thirty-five million gallons in 1990.

The main constraints on the rate and scale of development of both the dairy and beef industries are the virtual absence of management expertise at all levels, and a shortage of suitable female breeding stock. The expertise must be imported for at least the first stage of development.

The national herd of LID females of breeding age is estimated at 35,000 head. The Veterinary Department has plans for establishing crossbreeding multiplication units in Perak, Negri Sembilan and Trengganu using LID stock, and has already purchased over 1000 head for a similar programme at CAHRS. However if the special opportunities available to the Project Area through its proximity to the Singapore market are not to be lost, additional development work will be specifically required. It is considered realistic to assume that 3500 LID breeding females can be purchased over four years (over and above those bought by the Veterinary Department) without unduly affecting the existing dairy industry (SV6, part 3).

A dairy cattle multiplication scheme, has been proposed and evaluated based on crossbreeding and subsequent grading up of a dairy herd from the above 3500 foundation cows. The use of the Friesian crossbred allows a considerable off-take of beef as steers, cull cows and cull beefers. Further some of the culled female dairy stock may also be sold for mating with beef bulls to establish a national beef herd.

The calculated profitability, of such a multiplication unit is high, admittedly assuming that many technical problems are overcome. Evaluation of both small and large commercial farms, which might later (say in 10 years) be established with crossbred stock from the unit, shows that their profitability too is very good. Finally the activity remain profitable even if yields fall 40 percent below the assumed level of 510 gallons of milk per cow per year.

The rate of growth of the dairy industry could be increased by the importation of pure bred female Friesian calves as future breeding stock. The standard of herd management required would be higher than for crossbred stock. Also as the future price level of milk at any time will depend on the level of production at that time, an increase in the rate of development does not result in a similar increase in the monetary return. It is not advisable to make large imports of exotic female stock in the early stages in the scheme though a small unit is thought to be desirable in order to compare the performance of exotic and crossbred cattle under conditions of controlled high management.

The establishment and maintenance of a breeding herd of tropical beef type cattle, and the rearing and fattening of the offspring on a ranching scale is much less attractive. The labour utilization per acre is very low and the rate of return, at the assumed off-take of 450-500 pounds liveweight per acre per year, is less than from dairying. A modest (up to 6000 acre) unit could be justified to provide some good quality meat and good crossbred breeding stock for use with culled dairy cows and local stock. In general, however, although the Project Area would be well suited physically for large scale beef raising, it would seem to make better sense to locate large scale projects in East Malaysia where population pressure on land is not so great. The

rearing of calves to weaning from crossbred dairy beef cattle is fairly simple and could provide useful additional income to smallholders particularly in combination with coconuts. The weaned calves should be sold to specialists for ultimate fattening in feed lots.

2.5.3 Goats (R9)

Another enterprise under trial at the CAHRS is goat production by intensive methods.

Enough information has been obtained and will continue to become available to justify a gradual development of this activity among small farmers - either as a specialised undertaking or on a mixed holding. It would be particularly useful in existing areas of currently low yielding coconuts, where fodder grass could be established.

Mutton is obtained from two sources in Malaysia, goats and sheep. At present locally produced goat supplies about 30 percent of the market, the rest being imported as meat or live sheep. Consumption in 1970 is estimated at nine million pounds and is expected to rise to twenty seven million pounds by 1990. Local mutton commands a premium price over the imported product, but prices must come down if its share of the market is to increase. A price trend from present wholesale levels of \$1.35 per kati live-weight down to \$1.00 per kati by 1990 has been assumed.

Goats may suffer a disadvantage in the Project Area because of their susceptibility to respiratory diseases caused by the high rainfall conditions. This factor effectively restricts production to those systems in which goats are housed and their feed cut and carried. The financial return is low but the social return is acceptable at an annual off-take of 1762 pounds liveweight per acre of fodder.

2.5.4 Sugar

Attempts are being made in the private sector to establish sugar production in several parts of the country including Johor. Schemes proposed to date could extend to about 80,000 acres and meet virtually all the country's present consumption of about 200,000 tons per annum.

It is not yet certain which part of the country is best suited to cane production. The north with its monsoonal climate and distinct dry season can produce crops with a higher sucrose content than under the uniform rainfall pattern of Johor. On the other hand irrigation could well be required for maximum yield in the north, but not in Johor.

Sugar, although subject to fairly wide fluctuations in price, should continue to be freely available on the world market at around \$250 per ton. It would therefore seem to be unwise to extend sugar cane cultivation in the Project Area, or elsewhere, until the present enterprises have been established for some years and the relative performance and profitability of cane growing in the north and south have been determined beyond doubt.

2.5.5 Short-term Crops (R1)

Development of livestock production on the scale suggested earlier would mean a rapid increase in demand for animal feeds. To estimate this demand potential feeds have been broken down for convenience into two groups, carbohydrate-rich feeds and protein-rich feeds. The quantities which would be required are:-

	1970 est.	1980	1990
	Thousand tons.		
Carbohydrate feeds	372	769	1,490
Protein feeds	107	234	461

Carbohydrate feed sources include rice bran, maize, sorghum, tapioca and sweet potato. Protein feeds include coconut oil meal, palm kernel meal, soyabean meal, groundnut meal, fish and meat and bone meal. The quantities in the above tables are very approximate and the actual quantities used would depend upon the mixture of feeds used.

It is estimated that domestic rice bran production will rise from 113,000 tons in 1970 to 275,000 tons in 1990.

Tapioca at present makes up about 20 percent of animal feed, or about 70,000 tons of dry feed (equivalent to about 250,000 tons of wet root). Assuming this proportion is maintained the potential demand would be 250-300,000 tons of dried roots (1,000,000 tons wet root) by 1990. Part of this could be contributed by sweet potato. At expected grain price levels, tapioca root prices must be around \$1.70 per pikul at factory to be competitive. Predictions of export markets vary widely, but it may be possible to export a similar quantity as chips, pellets or starch products.

On the basis of the above predictions there will still be a demand for nearly a million tons of carbohydrate feeds to be made up by grains. Maize and sorghum are both under trial in Malaysia and are promising. Long-run prices are expected to be about \$11.30 per pikul for maize and \$10.40 per pikul for sorghums ex-farm to compete with imported supplies.

Present supplies of protein feeds are mainly from coconut oil meal, palm kernel meal, plus some imported oil cakes and fish meal.

Domestic supplies of copra are expected to grow only slowly and become relatively less important as an animal feed source. Palm kernel production will expand rapidly and could, if all crushed for oil in Malaysia, yield up to 330,000 tons of oil cake by 1990. But the meal is relatively fibrous and cannot be used at all for poultry or as the sole source of protein for pigs. However these two sources could supply one-third of total requirements by 1990.

Alternative domestic oil seed production could come from soyabeans or groundnuts. It is expected that the import price for soyabeans will remain at about \$330 per ton. This implies an ex-farm price in Malaysia of \$19 per pikul.

Groundnuts can be used for both oil production and as a confectionery item. Malaysian production at present is almost entirely used for the latter purpose. Ex-farm prices vary widely but average round \$70 per pikul for shelled nuts. At this price oil and meal production is not economic. It has been estimated that for feed purposes the price of groundnuts would have to be about \$27.50 for shelled nuts.

The profitability of large scale mechanised production of short-term rotation crops could be high, but there are formidable obstacles to overcome before they can be widely grown in the Project Area. They must in any event be restricted to areas with an average slope of not more than six degrees, and preferably not more than four degrees. Even so problems of soil conservation will be substantial and suitable field layouts will have to be worked out to safeguard the soil and at the same time to permit economical mechanical cultivation. A high degree of mechanisation will be required for good profitability, but mechanised harvesting, particularly of grain crops, will

present many difficulties in the climate of the Project Area. Much information will have to be obtained about the performance of untried machinery and, even when the right machinery and techniques are established, the continuous vagaries of the weather will increase the risk of unsuccessful operations and harvests. All these problems should receive the active attention of MARDI.

Some information is available from experiments at Serdang about the performance on a small scale of different varieties of sorghum, sweet potatoes, soyabeans, cowpeas, groundnuts, and cassava. Cultural trials and fertiliser experiments have been carried out. Further experiments at a research station and commercial scale testing are certainly warranted, with the emphasis on root crops, for which the harvest risks are less.

Evaluations have indicated that cassava as a monocrop can show satisfactory returns if yields of fifteen tons per acre can be obtained beyond the third to fourth year. That this is feasible needs to be demonstrated. The commercial rate of return on cassava is highest for a scheme relying on casual labour and this type of enterprise could provide useful and profitable employment in the early years of rubber and oil palm schemes.

2.5.6 Hybrid Coconuts (R2)

This activity is included in group 3 because hybrids have not yet been produced in Malaysia.

In West Malaysia dwarf palms bear earlier and more than tall types, but are more demanding in their environmental requirements, and are less suitable for planting on inland soils. However seed nuts from selected tall mother palms and planted on inland soil could be expected at best and under good management, to start bearing in the 5th-6th year from planting and to yield a maximum 2,200 pounds copra per acre from 11th year on. On this basis production is not commercially attractive.

Recent work in the Ivory Coast has resulted in the production of high yielding hybrids from crosses between repeatedly in-bred lines of semi-tall West African male palms and Malaysian dwarf female palms. The latest yield of these crosses in the Ivory Coast is 3600 pound copra per acre from year 8; the trees come into bearing a year earlier than the tall types, and in year 5-6 are bearing 1600 pounds copra per acre. In Cambodia some of these hybrids have been recently introduced and are reported to be doing as well as in the Ivory Coast. If the hybrids combine the yielding capacity of the Malaysian dwarf palms with the environmental tolerance of the tall types they could be invaluable to Malaysia and would make copra production an attractive commercial proposition.

It is therefore recommended that high priority be given by MARDI to a comprehensive agronomic programme and to the establishment of limited multiplication facilities. Detailed recommendations are set out in section 2.9.

2.5.7 Coffee

Some liberica coffee is grown in Johor and is processed locally. Both liberica and robusta coffee are being tested at the crop testing station at Kong Kong. Robusta coffee was not growing as vigorously as liberica, and appeared to be much more susceptible to berry borers. The market for liberica coffee is very limited and it is doubtful whether the crop is worth expansion. Robusta coffee development would require a further period of research and field trial under MARDI auspices before large scale plantings could safely be undertaken.

2.5.8 Fruit and Vegetables for Processing (R6)

The Government Food Technology Institute at Serdang is investigating problems of preservation. However, even if these are solved the industry is likely to expand only slowly unless improved cultivation techniques are introduced to increase the output of vegetables per worker.

Among fruits widely grown in Malaysia, the rambutan offers possibilities for export in competition with the lychee, which is the most important of the exotic tropical fruits now imported into the U.K. The demand in this market, however, is for a stoneless fruit, and attempt to remove the stone before canning have so far been unsuccessful. A stoneless variety is reported to be cultivated in Penang.

Some work has been done to improve the available varieties of rambutan and this must be continued before development of the export market is seriously contemplated. Other fruits, which could be worth some research with a view to canning are considered among group 4 activities.

The general impression gained from a brief examination of the canning industry is that canners and growers suffer from a lack of up to date information. The Department of Agriculture, which is responsible for research into both cultivation and preservation problems, is in a position to take the initiative to improve communications. The pineapple research station has been examining other crops recently and might usefully expand its programme further in this respect. The technical publications on pineapples from this station are impressive both in quality and quantity; if similar publications on other canning crops could be produced by this station and or the Department of Agriculture and disseminated to growers and canners, the impact could be considerable.

2.5.9 Mechanised Pineapple Production (R7)

As noted previously (Section 2.4.1) the mechanisation of pineapple production appears to be more profitable than exclusively hand methods, and this could make production on mineral soils more attractive than on peat soils. The exploitation of this potential will depend upon the successful introduction of suitable spraying and harvesting machinery. Recommendations for a programme of trials by MARDI are given in section 2.9. Adequate soil conservation measures would be essential, and the crop should be restricted to areas with an average slope of less than six degrees.

2.6 Group 4 Activities

The crops in this group require considerable research effort before they can be recommended for development, and the main investigation deemed to be necessary are given in section 2.9.

2.6.1 Bananas

The banana is widely grown on small-holdings throughout West Malaysia. The total acreage of the crop is estimated by the Ministry of Agriculture to be about 40,000 acres, of which 6,000 are in Johor. The existing and foreseeable domestic and Singapore demands are, and can be expected to remain, fulfilled without any expansion of acreage in the Project Area. The varieties at present grown in Malaysia are not suitable for export, and new cultivars must either be found locally or imported. The chosen cultivar would have to be amenable to transport without undue wastage. Recent work on the preservation of bananas, in particular by the process of lyophilisation (or accelerated freeze drying) may to some extent overcome the long standing hazards associated with exporting fresh bananas. But the commercial production of bananas for export is a long way off.

2.6.2 Ramie

Ramie fibre can be used in the textile industry especially for high-quality suitings. Production of the crop has been tried in a number of countries, but has seldom reached any scale mainly because of problems associated with degumming the decorticated fibre. Malaysia imports about 5,000 tons of cotton (worth about 7 million dollars) and, 2,000 tons cotton yard worth some \$15 million per year. It is possible that part of this could be substituted by ramie.

2.6.3 Cinnamon

This crop can do well on poor, sandy soils and in a damp, humid climate without a pronounced dry season. It could, therefore, be a possible crop for the poor coastal soils of Tanjong Penggerang.

Most of the production that enters world trade comes from Ceylon, which in recent years has been exporting some 3000 tons. The Seychelles exports about half this amount. The major importers of cinnamon are Mexico, West Germany, U.S.A. and Great Britain.

Various types of cinammon are recognised in Ceylon and some are known to be inferior, but little or no work has been done on the improvement of the crop. Present yields are of the order of sixty pounds quills per acre for the first cutting at 4-5 years old, rising to 150-200 pound per acre in subsequent cuttings and declining after ten years.

The crop is usually planted from seed but can be vegetatively propagated. There would appear to be scope for selection among the existing plant population and for subsequent vegetative propagation of improved material. Some attention to this crop by MARDI could well be justified, particularly if the recent political disturbances in Ceylon have adversely affected production in that island.

2.6.4 Various Fruits

Many tropical fruits could be rewarding subjects for research. The native mangosteen grows throughout Malaysia and papaya is widespread. The guava would undoubtedly flourish. The sour sop, the avocado pear, the yellow passion fruit and the giant granadilla are known to grow well in ecological conditions similar to those in the Project Area. The commercial development of any or all of these crops must be preceded by a programme of field research (Section 2.9). Concurrently with this work investigations on preservation, either fresh or in cans, must proceed and market research be intensified.

2.6.5 Various Nuts

The areca palm, the fruit of which is one of the main constituents of the betel quid, grows throughout West Malaysia. Production seems to be entirely small scale and seems likely to remain so.

Two dessert nut trees that might be worthy of trial are the Brazil Nut (*Bertholletia excelsa*) and the Paradise Nut (*Lecythis zabucajo*). The former is native of the Amazon forests, the home of rubber, and the latter is a large forest tree of the Guianas and Brazil. Both should therefore flourish in the south-east Johor environment.

The present world trade in Brazil nuts amounts to around 50,000 tons per year, almost all exported to Europe and the U.S.A. These nuts are all obtained by collection from wild trees. In the natural state trees do not fruit until at least ten years and sometimes as long as twenty years old. These could be an interesting and fruitful

TABLE 2.5 Summary Evaluation of Group 3 Activities

	Dairy	Beef	Goats	Tapioca	Cocoa	Short Term Crops	Hybrid Coco-nuts	Mechanised Pineapples
1) Internal rate of return (percent)								
(a) Commercial	19	17	5	16	7	17	13	18
(b) Government financial	19	21	6	19	9	20	15	20
(c) Social	24	18	20	26	21	23	20	26
2) Net present value at 15% (\$/acre)								
(a) Commercial	646	27	-2000	60	-690	+117	-189	190
(b) Government financial	770	112	-1900	180	-580	+271	-60	270
(c) Social	1700	181	890	510	+435	+473	+329	760
3) Capital costs per acre								
(a) Undiscounted negative cash flow	2600	214	3560	870	1640	890	1282	980
(b) Year of first positive cash flow	4	9	2	3	5	3	6	2
4) Employment								
(a) Acres per worker	10	300	3	10	8	40	14	14
(b) Capital cost per worker	26000	64200	10700	8700	13100	35600	18000	13700
5) Comparative advantage rating	++++	++++	+++	+++	+++	+	+++	++++
6) Scale of enterprise evaluated	2335 acres	10000 acres	3 acres	1000 acres	1000 acres	1150 acres	1000 acres	1100 acres
7) Type of enterprise evaluated	Multi-plication	Estate Developed	Small-holder over 8 years	Estate	Estate	Estate	Estate	Estate

field of work for the plant breeder with this crop. Similarly with the Paradise nut, which are said to be superior in flavour to the Brazil nut. Some commercial planting of this crop has been done in Trinidad from where further information and perhaps trial planting material might be obtained.

2.6.6 Gambier

This crop was once widely grown in Johor, usually in association with pepper. The leaves contain catechin and catechu-tannic acid. There has been a recent revival of interest in the plant for its catechin, for use in infant medicines against gastro-enteric disorders. A small trial of the crop was seen at the Rubber Research Institute Experiment Station, where it appeared to be growing quite well. Further experiments in Johor could be justified.

2.6.7 Essential Oils

Patchaoli (*Pogostemon cablin*), once grown in Penang and recently the subject of some observation at Serdang and in Kedah, might be worth testing in the Johor environment, as also might citronella grass, (*Cymbopogon nardus*), lemon grass, (*Cymbopogon citratus*), and perhaps vetiver grass (*Vetiveris zizanioides*).

2.7 Other Crops Considered

Besides the activities discussed in sections 2.3-2.6, some other possible crops were also examined and rejected for various reasons. The more important of these are discussed below with the reasons for their rejection.

2.7.1 Rice

No large areas suitable for intensive padi production have been identified in the project area; but small local schemes are possible. However, as the country is expecting to achieve self-sufficiency in rice production by 1975, and as Malaysian rice is not suitable for an unpromising export market, it

has not been included in any development plan for the project area.

2.7.2 Manila Hemp

Manila hemp yields a "hard" fibre used for twines, nets etc. The main fibres in this class are sisal and henequen. The markets for these fibres are under considerable pressure from changes in techniques in agriculture, which reduce the demand for agricultural twines, and because of the introduction of synthetic substitutes, adhesive tapes and other packaging material. The world market outlook for these commodities is uncertain, but a continued decline in prices and sales is expected. There appears to be no advantage in attempting to enter this market.

2.7.3 Cashew nut

The cashew is grown mostly for its kernel, but the shell oil is also of economic importance as its derivatives, particularly cardol, are used in more and more industrial processes, including the manufacture of plastics, resins, insulating varnishes and paints, corrosion-resistant coatings, pigments, insecticides and as an anti-fade agent in brake linings.

Spurred by these increasing industrial outlets, international trade has grown enormously in recent years. The main exporter of kernels is India; in 1925 these exports amounted to less than 50 tons; by 1941 they had reached nearly 20,000 tons and by 1956 were over 31,000 tons, 70 percent of which was taken by the U.S.A.

Though native to tropical America the cashew has been widely distributed throughout the tropics and is now naturalized in many countries, particularly in coastal areas. Its ability to thrive under a wide range of climatic and soil conditions has led to several countries taking an interest in developing a share of the expanding market. But although it grows in areas with annual rainfall varying between 20 inches and 150 inches, and at

altitudes from sea level to 4000 feet, it has been found in Tanzania (a major producer, where considerable research has been done), that conditions for optimum performance and for production of high quality nuts are more stringent.

Northwood and Kayumbo (1970) state:

"In Tanzania cashew flourishes in areas having an annual rainfall varying from 640-1300 mm (26-52 inches). It grows best in the warm, moist, coastal areas but most of the quality nuts come from southern inland areas in the 760-900 mm (30-36 inches) rainfall belt. Here there is a pronounced dry season from May to November during which the trees flower and mature their nuts. Out-of-season storms, which will damage the flowers, reduce fruit setting or lower nut quality, are uncommon compared with the coastal areas."

These conditions are unlike those found in south-east Johor. It is considered that the crop might be suitable for well drained soils in the northern parts of Malaysia, but that it should not be introduced into the Project Area or into a research programme designed for testing crops for equatorial conditions.

2.7.4 Castor

World demand for castor seed and oil has increased greatly in recent years and many countries, have been encouraged to attempt production. Some trials have been carried out in Malaysia. It is clear from this work, reported by Templeton (1969) that the use of the local unimproved, perennial cultivar could never be profitable and the successful introduction, establishment, and testing of an improved cultivar from U.S.A., India, Brazil or Dahomey is an essential prerequisite to any commercial development of this crop. This work is more appropriate to a research programme in the north of West Malaysia as the crop, being a seed, requires dry conditions for harvesting.

2.8 Summary of Prospective Activities

The foregoing examination of potential agricultural activities for the Project Area emphasises that there are at present many physical, technical and market limitations on choice. The following conclusions and recommendations can be made:-

- (a) In the first 6-10 years of development large scale commercial enterprise will have to be limited to oil palms and rubber.
- (b) During the immature period of these crops supplementary crops of tapioca are a possibility, providing advantages of increased production and employment.
- (c) Small livestock and fresh-water fish production can also be developed without delay on a modest scale to supplement income.
- (d) Coconuts interplanted with pineapples or grass may be introduced at an early stage on a small scale.
- (e) Cattle - primarily for dairy purposes, but also for beef - offer excellent prospects for large scale diversification. An early start should be made and the present constraints of lack of breeding stock and management expertise should be surmounted as soon as possible.
- (f) The prospects of hybrid coconuts warrant high priority for the necessary preliminary breeding programme and associated research.

2.9 Research

It is abundantly clear from the examination of the potential activities that much research and field scale experimental work will be required before new activities can confidently be developed on a large scale into commercial enterprises. It therefore satisfactory that MARDI is planning to establish a central research station in Johor Tengah, and that detailed soil surveys are being undertaken to check the suitability of a site east of the main railway line between Rengam and Kluang. The importance of getting this station functional very quickly cannot be over emphasised if the diversification potential of the Project Area is to be fully developed at the earliest possible time. The main subjects which, it is considered, should receive early examination by MARDI in the context of the development of the Project Area, in particular, and more generally, of the equatorial part of West Malaysia are summarised below.

2.9.1 Cattle

Very close liaison must be maintained between the Research Station and the management of the cattle multiplication unit which it is proposed should be set up a few miles to the north. Numerous problems of practical importance can be expected to emerge from the operation of the unit in connection with the maintenance of pastures and fodders; with the breeding and management of the cattle; with interrelationships of stock and pasture; with dairy hygiene; and with animal health. As there will be a considerable offtake of beef from the unit as well as milk and breeding stock, nutritional and stock management investigations must cover beef as well as milk production problems.

The Research Station must be adequately staffed with scientists in the following disciplines. Pasture and fodder crop agronomy; plant breeding; animal genetics; animal nutrition; animal husbandry; agricultural engineering and dairy technology. The services of the existing veterinary research organisation can, it is assumed, be used for investigating animal health problems.

2.9.2 Cocoa

The most important immediate requirements are to ascertain (a) the suitability of the Tanjong Penggerang climate for the crop and (b) the ability of the deep Rengam and Harimau soil series to produce profitable yields. Kanapathy and Thamboo (1969) concluded that the Kuantan series, derived from basalt, the Segamat series derived from andesite, and the Langkawi series, derived from limestone, might make better cocoa soils than the Rengam and Jerangau series, which are derived from granite and granodiorite.

The seedling cocoa seen growing in and around the Project Area is of very mixed genetic make-up. Whatever the parentage of the original hybrid material, it is clear that subsequent plantings have been made with seed, resulting from uncontrolled open pollination of the original F₁ hybrids.

Another problem is a die-back, the cause of which has not yet been identified with certainty, but which is now thought to be a physiological condition resulting from an adverse combination of nutritional, water and shade factors.

It is recommended that MARDI establish three pilot plantations one on Rengam soil and one on Harimau soil in Johor Tengah and a third on suitable soil in the wetter region of Tanjong Penggerang. All should be large enough to allow for seed to be planted of the best available hybrids

from Sabah, say 200 acres for each plantation. These three estates should be run on enlightened commercial lines to enable valid comparison to be made with results from East and other parts of West Malaysia. Fertiliser application and weed, pest and disease control methods should be worked out. Early attention should be given to perfecting techniques of vegetative propagation to permit rapid multiplication of those trees found to be the most productive. Breeding work, can be deferred, provide that material from Sabah can always be made available.

2.9.3 Hybrid coconuts

Promising hybrid nuts should be obtained from the Ivory Coast and trial plantings made on the Rengam and Harimau soil series and on the inland alluvia. At the same time, in anticipation of a good performance, a modest expenditure on establishing small units of breeding material should be risked. Suitable female dwarf palms are available in West Malaysia, but existing Malaysian Tall are a heterozygous population, unsuitable for breeding until after many years of selection. A small quantity of nuts from highly in-bred lines of West African Tall palms should be planted in an isolated nursery as soon as possible. If isolated areas of Malaysian yellow dwarf palms can be located growing on the appropriate inland soil series, the hybridisation programme could be expedited by the immediate importation from the Ivory Coast of pollen of West African Tall palms.

After the establishment of the above trials and nurseries, consideration may be given to seeking a Malaysian source of semi-tall male palms and breeding a suitable local male parent. The most likely source of repeatedly in-bred material would be an off-shore island, for example Natuna, where the original seed probably came from a few palms.

2.9.4 Short-term Crops

Variety and time of planting trials should be established to find out which of the short-term crops are most suited to the environment and the crop calendar. Fertiliser experiment and pest control trials must be carried out. Trials with machinery for cultivation and harvesting are required and field layouts suitable for this machinery and for soil conservation must be determined. The specific needs of tapioca as a monocrop need special attention.

2.9.5 Fruit, Vegetables and nuts

Testing of improved varieties of rambutans and guavas should be begun early. Other fruits worth putting under observation include soursop, granadilla and yellow passion fruit, avocado pears and mangosteens. Two nuts worthy of inclusion in any observation trials are the Brazil nut and the Paradise nut. Introductions that succeed in observation trials should be subjected to a programme of variety and cultural trials before being recommended for commercial development.

The possibilities of mechanised pineapple production on mineral soils should receive early attention. A programme of trials with tractor drawn sprayers for the application of liquid fertilisers, growth regulators, herbicides, insecticides and fungicides should be laid down. Ways of partially (at least) mechanising the harvesting require investigation.

A search among existing local banana cultivars must be instituted to find types suitable for profitable export production. These cultivars will then have to be vigorously tested for some years

to establish their acceptability to both producer and consumer.

There are possibilities for establishing a small market for fresh vegetables and fruits to the tourist industry in Tanjong Penggerang and the Singapore market is certain to expand. Present output of vegetables per worker is low and research is necessary to introduce improved cultivation techniques. Crops most likely to be suitable are green beans, okra and leafy vegetables.

2.9.6 Miscellaneous Crops

Other crops worthy of trial observations are ramie, cinnamon, gambier and some essential oils. If they prove promising, comprehensive improvement work, varietal testing and agronomic experiments will be required before they are introduced commercially. For ramie the research programme should include tests of the crops compatibility with rubber, and investigations of the fibre extraction problems.

THE AGRICULTURAL PLAN3.1 The Cropping Pattern

The extent to which the physical environment lends itself to new agricultural activities is indicated in Table 1.1 and Atlas Map 23. More than 90 percent of the land is suitable for the production of grass, coconuts, fruit and tea, and nearly one-third for tapioca and other short-term crops. Analyses of the market and technical constraints surrounding the introduction of new activities, and evaluation of their likely profitability have been made. From these analyses it is clear that the most attractive new activities are (a) the development of the cattle industry, particularly for milk, but producing substantial quantities of meat as well; (b) tapioca production; (c) hybrid coconut production; (d) fruit and vegetables, based on an expanded canning industry; (e) fish culture; (f) production of short-term grain and starchy root crops. The market and technical constraints outlined in Chapter 2 will determine the rate of their introduction on a commercial scale and the ultimate extent of any one of them.

The virtual absence of an independent middle income group farmer, with both the means and the knowledge to initiate new activities, the limiting conditions applied to the use of land under the current alienation orders, and the absence of assumed marketing facilities all act as further constraints on developing new enterprises.

Thus the extent to which the full potential for diversification of agriculture will be achieved in the next two decades will depend upon

- (a) the early establishment of the necessary research and experimental programme and upon the outcome of these investigations.
- (b) market prospects evaluated at the time that knowledge is sufficient to permit efficient production.
- (c) the introduction of land allocation policies designed to encourage farmers to diversify their activities.
- (d) the provision of an advisory service to extend knowledge and of institutional credit to give the means to farmers willing to initiate new activities.
- (e) the identification and/or creation of markets.

Table 3.1 shows the overall cropping pattern and Table 3.2 the regional patterns. It is stressed that this cropping pattern is used for evaluation purposes and it is not considered necessary or even desirable to adhere to it vigorously. Changes in technical knowledge and relative prices of inputs and products will necessitate constant review of the situation through time. The present cropping pattern is developed in the light of assumption made in 1971.

Seventeen percent of the net cropped area has been assumed to be developed by 1987 to cattle, tapioca, and other new activities. However diversification is not constrained by a shortage of suitable land or by environmental factors, and if the results of the investigational programmes warrant a more rapid expansion of any of the new activities, they can be substituted for rubber and/or oil palms without difficulty. After 1980 over 30,000 acres, at present assumed to go into rubber and oil palms, remain uncleared and therefore available for alternative uses. Further, after the year 2000 the early planted oil palms and rubber will become due for replanting and the land use on these areas could be changed if desired.

Oil palms and rubber are assumed to occupy 81 percent of the net cropped area (Table 3.1). The evaluation of these two crops (R11 and 12) indicate that, using the input and output assumptions made, the likely ranges of profitability of the two crops overlap to a large extent. Oil palms are perhaps slightly more profitable; however the potential for increase in yield and productivity in the foreseeable future looks greater for rubber, and the present apparent advantage of oil palms in this respect could well become smaller over time or disappear altogether.

Under existing Malaysian practice in the immature periods of the two crops more workers are employed on a given area of oil palms than on rubber. This position is reversed after the crops reach maturity. The capital cost per job created is less for rubber than for oil palms. A more flexible use of labour is also possible in rubber, since different tapping systems can be adopted to change the unit labour requirements. The advent of the newest yield stimulant, ethrel, enhances these possibilities of markedly increasing returns to labour. Further, product quality need not be adversely affected by these changes in tapping systems, whereas in oil palms alterations to the harvesting labour input can easily result in appreciable deterioration of fruit quality.

Because the present financial advantage of oil palms over rubber may decrease over time, and because oil palms employ more workers in the early years and produce a return earlier than rubber, more emphasis should be placed on oil palms than rubber in the early years. The emphasis may shift later when rubber could become relatively more important because of its greater flexibility for changes in labour utilisation if, as seems possible, labour costs per acre rise over time. The best ratio of oil palms to rubber on a national scale may lie between 60:40 and 50:50, and this is believed to be broadly the mix at which FLDA is aiming in its national development programme.

Johor, with its equatorial climate, is better suited to oil palms than more northerly States, which may be subject to more prolonged dry periods during the south-west monsoon. Johor's proximity to port facilities may also give it a comparative advantage over other States for oil palms. In the Project Area, therefore, it is considered that, where environmental conditions are suitable for both crops, preference should be given to oil palms. Where, however, land is rated as suitable for rubber but only marginally suitable for oil palms, it is likely that it will usually be more profitable to grow rubber, and, except where such marginal land occurs as very small areas in otherwise suitable oil palms blocks, it has been assumed for evaluation purposes that rubber will be grown.

Using the above criteria the final cropping pattern used for evaluating the Master Plan contains 58 percent of oil palms and 23 percent of rubber. It is important to remember that the relative merits of oil palms and rubber, as outlined above, are based on present day assumptions of future price and yield trends. These assumptions need to be reviewed continually, and planting programmes changed appropriately. The Project area is fortunately placed to permit this flexibility as most of the area suited to oil palms is equally suited to rubber.

TABLE 3.1 Overall Cropping Pattern (Net Crop Acres)

Year	Oil Palm	Rubber	Beef	Dairy	Tapioca	Others	Research	Total
1971/2	6,900	-	-	-	-	-	-	6,900
1972	7,800	13,400	1,300	850	-	-	850	24,200
1973	14,600	5,000	1,300	450	350	350	450	22,500
1974	13,550	5,400	1,300	450	1,950	1,650	450	24,750
1975	16,950	3,850	900	450	1,800	-	450	24,400
1976	23,200	4,250	1,650	850	-	2,200	450	32,600
1977	12,200	5,650	1,650	450	1,000	-	450	21,400
1978	11,100	1,250	1,650	450	2,750	1,500	450	19,150
1979	6,600	3,100	1,650	450	2,450	1,000	450	15,700
1980	14,300	3,400	-	400	950	-	-	19,050
1981	-	2,000	-	700	350	700	-	3,750
1982	4,400	-	-	1,200	-	300	-	5,900
1983	4,400	-	-	700	-	-	-	5,100
1984	2,300	4,000	-	-	-	-	-	6,300
1985	2,800	1,600	-	-	-	-	-	4,400
1986	3,500	-	-	2,400	1,000	1,000	-	7,900
1987	-	5,800	-	-	-	-	-	5,800
TOTAL	144,600	58,700	11,400	9,800	12,600	8,700	4,000	249,800
Percent	58	23	5	4	5	3	2	100

TABLE 3.2 Regional Cropping Patterns - Net Crop Acres

Year	TANJONG PENGGERANG						JOHOR TENGAH						Grand Total		
	Oil Palm	Rubber	Beef	Tapioca	Others	Total	Oil Palm	Rubber	Beef	Dairy	Tapioca	Others		Research	Total
1971	6,900	-	-	-	-	6,900	-	-	-	-	-	-	-	-	6900
1972	2,200	10,000	-	-	-	12,200	5,600	3,400	1300	850	-	-	-	-	24200
1973	11,000	1,250	-	350	350	12,950	3,600	3,750	1300	450	-	-	850	12,000	22500
1974	8,000	4,350	-	-	1,500	13,850	5,550	1,050	1300	450	1,950	150	450	10,900	24750
1975	11,200	2,550	-	-	-	13,750	5,750	1,300	900	450	1,800	-	450	10,650	24400
1976	6,400	4,250	1650	-	2,250	14,500	16,800	-	-	850	-	-	450	18,100	32600
1977	1,800	3,550	1650	-	-	7,000	10,400	2,100	-	450	1,000	-	450	14,400	21400
1978	5,300	1,250	1650	-	1,500	9,700	5,800	-	-	450	2,750	-	450	9,450	19150
1979	5,300	1,800	1650	-	1,000	9,750	1,300	1,300	-	450	2,450	-	450	5,950	15700
1980	-	1,100	-	-	-	1,100	14,300	2,300	-	400	950	-	-	17,950	19050
1981	-	-	-	-	-	-	-	2,000	-	700	350	700	-	3,750	3750
1982	-	-	-	-	-	-	4,400	-	-	1,200	-	300	-	5,900	5900
1983	-	-	-	-	-	-	4,400	-	-	700	-	-	-	5,100	5100
1984	-	-	-	-	-	-	2,300	4,000	-	-	-	-	-	6,300	6300
1985	-	-	-	-	-	-	2,800	1,600	-	-	-	-	-	4,400	4400
1986	-	-	-	-	-	-	3,500	-	-	2,400	1,000	1,000	-	7,900	7900
1987	-	-	-	-	-	-	-	5,800	-	-	-	-	-	5,800	5800
TOTAL	58,100	30,100	6600	350	6,550	101700	86,500	28,600	4800	9,800	12,250	2,150	4,000	148100	249800

3.2 Implementation

Although technical constraints will inevitably limit the extent of diversification in the next two decades, something can be done immediately to create more diverse employment opportunities in the rural sector by implementing the plan through a variety of production agencies, which may be private individuals, private companies or public organisations. Further, if land were to be alienated to such agencies in holding sizes designed to accord with their available or obtainable labour and financial resources, their technical knowledge and their practical experience, a more congenial climate for diversification would be created, a climate which would foster the growth of a middle income farming group. In the following sections recommendations are made on production agencies and on reforms of the existing system of land taxation and of the regulations governing land use. These recommendations are designed to promote the initiation and development of new, apparently attractive activities in the Project Area.

3.2.1 Production Agencies

FLDA is to be the largest agency for land development in the Project Area and is likely to be allowed to carry out its programme along its own well established lines in order to guarantee as far as possible that its overall, ambitious Second Malaysian Plan land development target will be achieved. FLDA has a proven record of successful land development and its continuance in the Project Area should be the best assurance of large scale creation of new employment in agriculture. This employment, however, is limited in its scope and diversity, concentrating, as FLDA must, on oil palms and rubber and in holding sizes designed to give a target income which by the time it is achieved may not be greatly in excess of subsistence requirements. Although FLDA is a far from inflexible agency, and has expressed its willingness to diversify its activities when the opportunities are clearly shown, and to carry out if required, a pilot project as a variation of its normal type of settlement, it cannot be expected to jeopardise the achievement of its development target by making major experimental changes to an organisation that has been proved capable of fast and effective employment.

It is therefore important, the more so because of the large share of the land allocated to FLDA, that the remainder of the Project Area should be allocated in such a way as to provide the maximum opportunities for diversification of activity and employment, both directly in agriculture and in the ancillary services arising from it. The relative merits of public sector settlement agencies (such as FLDA), public estates, private companies, cooperatives and individual holdings in reducing economic disparities and in promoting employment and growth are summarised in Supporting Volume 1 and discussed in detail in Supporting Volume 4 and in project working paper (R13). There may well be a place for all of these types of organisation somewhere in the Project Area.

The desirability of having a number of different production agencies in the Project Area points the need for a Development Authority to be responsible for the overall implementation of the Master Plan. Its function would be to

- (a) formulate policy;
- (b) initiate and coordinate action;
- (c) monitor and evaluate progress and continue forward planning of implementation;

- (d) ensure execution through the various operating agencies and to execute by outside contract or directly where these agencies cannot meet requirements on time or where no agency exists to perform required functions.

Tables 3.4, 3.5 and 3.6 show the net crop acres allocated to FLDA and other production agencies in the Project Area, and in Tanjong Penggerang and Johor Tengah Regions respectively. Virtually all development in Tanjong Penggerang in the Second Malaysian Plan will be carried out by FLDA.

Other possible production agencies include the State Lands Office, which controls schemes under the Group Settlement Act; the Land Rehabilitation Consolidation and Authority (FELCRA); the State Economic Development Corporation (SEDC); Majlis Amanah Ra'ayat (MARA); and large and small private investors.

The factors that have been taken into account in recommending those parts of the Project Area should be allocated to FLDA and those to other agencies are described in section 3.4.

3.2.2 Reforms of Land Taxation System and Land Use Regulations

It is acknowledged that reforms of the above nature cannot be made at short notice or in isolated areas; nevertheless it should be recognised that considerable procedural delays occur at present and these inhibit agricultural change. Any new system should aim to:-

- (a) be simple to operate
- (b) yield a reasonable revenue
- (c) be easy to collect
- (d) be as equitable as possible
- (e) aid maintenance of the land resource
- (f) stimulate enterprise flexibility.

It is recommended that land be classified into four broad groups as in the land use potential maps, that is

- (1) Annual and Semi-perennial
- (2) Annual, semi-perennial and perennial
- (3) Semi-perennial and perennial
- (4) Perennial only.

It is suggested that the following procedure be adopted in the Project Area:-

- (a) that when original applications is made for land, the premium charged should varied with the broad classification above. Thus group (2) areas generally have the widest potential and are most valuable. The following rates might be used, to include survey fee:-

Group (2)	\$80	
Group (3)	\$60	
Group (4)	\$40	
Group (1)	\$20	- possibly subject to flood.

Once this basic classification been established the operator should be free to grow any crops within those categories without any need for application for change of use. However this freedom of cropping must in no way detract from the operators responsibility to maintain his land in accordance with the proper conservation criteria, which should be established by legislation. Agricultural advisory service should have the duty of reporting malpractice to the Lands Department, which would have power under the law to prosecute offenders.

- (b) Since premia have been varied according to use group, it is suggested that, for simplicity of operation, an uniform annual tax rate be applied thereafter on the basis of holding

TABLE 3.4 Agricultural Development - Production Agencies

JOHOR TENGAH AND TANJONG PENGGERANG

Year	Acres			Percent	
	FLDA	Other	Total	FLDA	Other
1971/2	6,900	-	6,900	100	-
1972	17,000	7,200	24,200	70	30
1973	15,500	7,000	22,500	69	31
1974	13,600	11,150	24,750	55	45
1975	15,200	9,200	24,400	62	38
1976	15,900	16,700	32,600	49	51
1977	10,400	11,000	21,400	49	51
1978	11,700	7,450	19,150	61	39
1979	6,300	9,400	15,700	40	60
1980	11,100	7,950	19,050	58	42
1981	-	3,750	3,750	-	100
1982	-	5,900	5,900	-	100
1983	-	5,100	5,100	-	100
1984	-	6,300	6,300	-	100
1985	-	4,400	4,400	-	100
1986	-	7,900	7,900	-	100
1987	-	5,800	5,800	-	100
TOTAL	123,600	126,200	249,800	49	51

Sub-Totals

1971/75	68,200	34,550	102,750	66	34
1976/80	55,400	52,500	107,900	51	49
1981/85	-	25,450	25,450	-	100
1986/90	-	13,700	13,700	-	100

TABLE 3.5 Agricultural Development - Production Agencies

TANJONG PENGGERANG

Year	Acres			Percent	
	FLDA	Others	Total	FLDA	Others
1971/2	6,900	-	6,900	100	-
1972	11,400	800	12,200	93	7
1973	11,900	1,050	12,950	91	9
1974	9,800	4,050	13,850	70	30
1975	11,200	2,550	13,750	81	19
1976	5,300	9,200	14,500	36	64
1977	-	7,000	7,000	-	100
1978	5,900	3,800	9,700	60	40
1979	6,300	3,450	9,750	64	46
1980	-	1,100	1,100	-	100
TOTAL	68,700	33,000	101,700	67	33
1971-75	51,200	8,450	59,650	85	15
1976-81	17,500	24,550	42,050	41	59

TABLE 3.6 Agricultural Development - Production Agencies

JOHOR TENGAH

Year	Acres			Percent	
	FLDA	Other	Total	FLDA	Other
1971/2	-	-	-	-	-
1972	5,600	6,400	12,000	46	54
1973	3,600	5,950	9,550	37	63
1974	3,800	7,100	10,900	34	66
1975	4,000	6,650	10,650	37	63
1976	10,600	7,500	18,100	58	42
1977	10,400	4,000	14,400	72	28
1978	5,800	3,650	9,450	61	39
1979	-	5,950	5,950	-	100
1980	11,100	6,850	17,950	61	39
1981	-	3,750	3,750	-	100
1982	-	5,900	5,900	-	100
1983	-	5,100	5,100	-	100
1984	-	6,300	6,300	-	100
1985	-	4,400	4,400	-	100
1986	-	7,900	7,900	-	100
1987	-	5,800	5,800	-	100
TOTAL	54,900	93,200	148,100	37	64

Sub-Totals

1971/75	17,000	26,100	43,100	40	60
1976/80	37,900	27,950	65,850	58	42
1981/85	-	25,450	25,450	-	100
1986/90	-	13,700	13,700	-	100

size, for example, as follows:-

Up to 5 acres	- \$ 6 per acre
6 to 100 acres	- \$ 8 per acre
100 to 500 acres	- \$10 per acre
Over 500 acres	- \$12 per acre

Such a system would be simpler and more flexible in operation than that in use at present and would yield a slightly higher level of tax overall.

Alienations of the type suggest, which would contain the least possible number of restrictions on land use, would appeal to the more enterprising members of all ethnic groups, as they would offer the prospect of high rewards and an attractive way of life in return for hard work and initiative. In combination with suitable training facilities the availability of land on these terms could help to reduce the growing unemployment among youths with some higher educational attainments, to whom the standard of living likely to be derived from an FLDA type of holding is unlikely to appeal.

3.3 Location and Rate of Development

Not all the land suitable for agricultural development is available immediately. In Johor Tengah there are some 70,000 acres of unlogged forest, from which the timber has to be removed before the land is cleared for agriculture. There are also some 15,000 acres of forest land at present being worked under licences, which expire over the next ten years. Other areas are recommended for mineral prospecting. Access constraints, particularly in Johor Tengah also restrict the

choice of location of development, especially in the initial years.

The combined effect of all these factors makes it obligatory to develop as much of Tanjong Penggerang as possible in the SMP period. Fortunately the decision has already been taken to give priority to a spinal highway through the peninsular, and this will open up a large proportion of the region.

Table 3.7 shows the annual and cumulative rates of land development targets proposed for the Project Area. Figures 3.1 and 3.2 show the area available for agriculture, the development units and their phasing through the Second, Third, Fourth and Fifth Malaysian Plan Periods.

TABLE 3.7 Rate of Land Development

Year	Net Crop Acres		Per- cent	Net Crop Acres Per 5 Years	Per- cent
	Net Crop Acres Per Annum	Net Crop Acres Cumulative			
1971/2	6,900	6,900	3		
1972	24,200	31,100	12		
1973	22,500	53,600	21		
1974	24,750	78,350	31		
1975	24,400	102,750	41	102,750	41
1976	32,600	135,350	54		
1977	21,400	156,750	63		
1978	19,150	175,900	70		
1979	15,700	191,600	77		
1980	19,050	210,650	84	107,900	43
1981	3,750	214,400	86		
1982	5,900	220,300	88		
1983	5,100	225,400	90		
1984	6,300	231,700	93		
1985	4,400	236,100	95	25,450	10
1986	7,900	244,000	98		
1987	5,800	249,800	100	13,700	6

3.4 Development Units - General Considerations

The Project Area has, for purposes of development, been divided into development units (Maps in folder). These units have been located, their boundaries defined and cropping pattern determined after detailed study of soils, terrain and land use potential and after consideration of the requirements for communications and settlements. Access constraints, caused in the early years mainly by a lack of roads, and later also by the logging programme and by mineral prospecting, have also been taken into account. The cropping pattern for every unit is given in Appendix A.

In order to facilitate the layout and development of equitable smallholder settlements, areas have been identified for SMA development which appear, on the basis of the available survey and mapping level of detail, suitable for sub-division into relatively uniform small lots. Broadly speaking these are the areas with large sub-units of uniform terrain, soils and crop group potential.

Units with favourable sub-division characteristics and which are large enough to produce a natural catchment area for a village (4000-7000

acres), are considered to be eminently suitable for settlement by a large organisation. In the Second Malaysian Plan Period the decision to make FLDA responsible for developing 75,000 acres means, in effect, that these units will be the most suitable for FLDA, and they have been so shown on the maps. Where possible two or more of such units have been grouped together to improve the economics and logistics of phasing and processing.

Several areas have been indicated (as suitable) for non-FLDA smallholder development. These are principally small areas, often dissected by existing small alienations or by steep land but with relatively good access from regions likely to generate demand for such land. These are considered best developed along the lines of unsubsidised G.S.A. schemes, or by small individual alienations.

In FLDA and other units suitable for uniform sub-division, the villages have generally been placed in the centre of the scheme. The remaining units, which are unsuitable for sub-division into uniform small lots, could be developed by one operator or could be divided among many in unequal lots of wide range of sizes. They may thus offer more diverse employment opportunities than an FLDA type settlement, and in such units villages are sited as far as practicable to allow residents access to as many of these opportunities as possible. Again, insofar as practicable, land suitable for other agencies has been sited in proximity to FLDA units in order to bring this diversity of opportunity to the families of FLDA settlers.

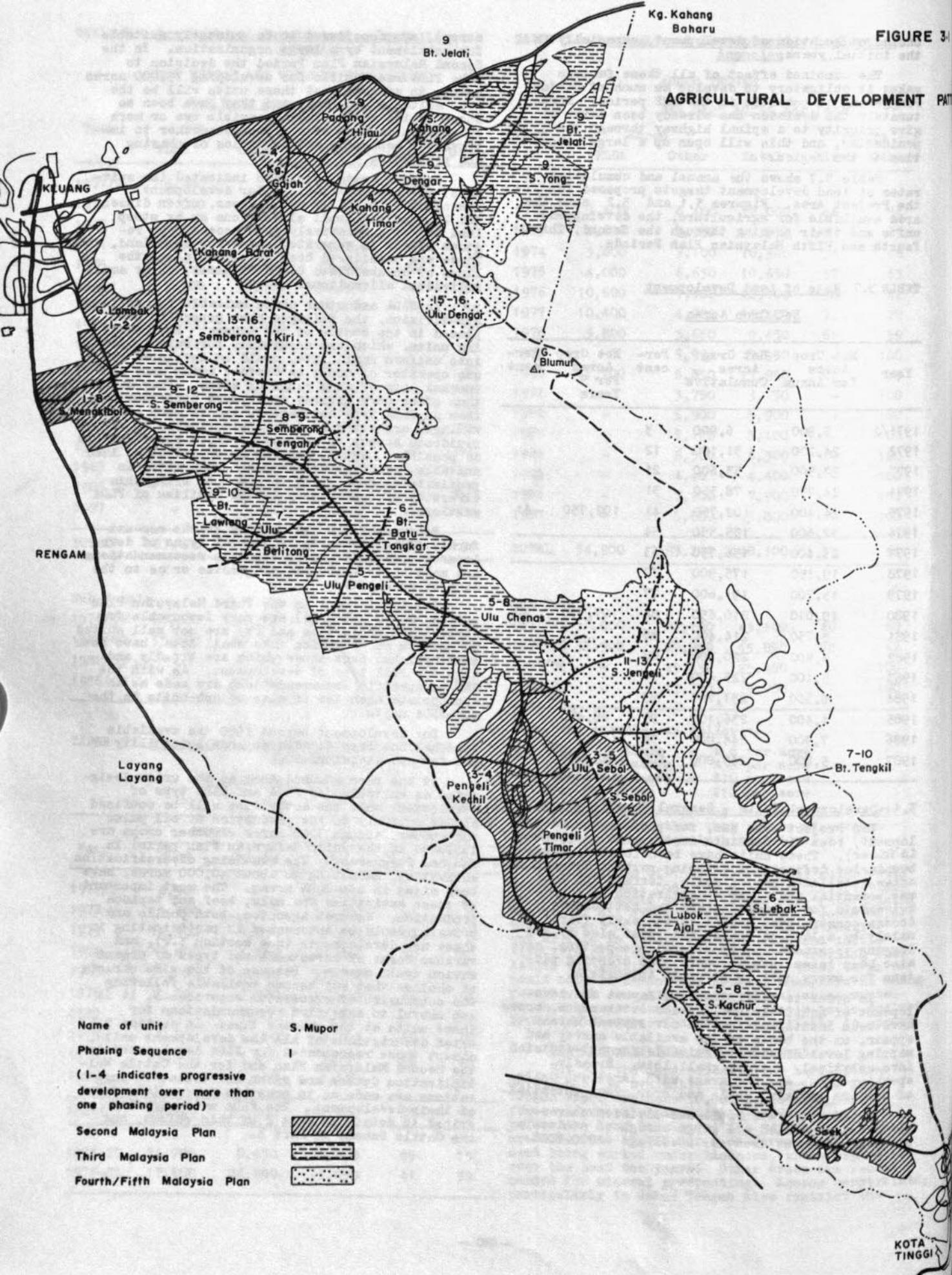
Because of the suitability of the non-uniformly divisible units to several types of development organisation, no specific recommendations are made as to appropriate agencies or as to the size of sub-units.

For development in the Third Malaysian Plan period, units which (a) are very favourable for diversified production and (b) are not well suited to uniform sub-division into small lots, have been distinguished from those which are broadly suitable for FLDA type of development. As with the SMP no specific recommendations are made as to appropriate agencies or size of sub-units in the non-FLDA units.

For development beyond 1980 the available land has not been divided to show suitability or not for sub-division.

It has been assumed that in the units designated as suitable for FLDA and FLDA type of development that the activities will be confined almost entirely to the production of oil palms and rubber, though 3200 acres of other crops are included in the Third Malaysian Plan period in Tanjong Penggerang. The remaining diversification activities, amounting to about 40,000 acres, have been sited in non-FLDA areas. The most important of these activities are milk, beef and tapioca production. Several agencies, both public and private, could be interested in participating in these new developments (see section 3.2), and various forms of investment and types of organisation could emerge. Because of the wide variety of choices that may become available following the conclusion of successful experiments, it is not useful to make firm recommendations for these units at the present time. In section 3.5 brief descriptions of all the development units, except those recommended for FLDA development in the Second Malaysian Plan and for the Cattle Multiplication Centre are given and tentative suggestions are made as to possible appropriate forms of their development. The FLDA units are described in detail in Part 2 of this volume, and the Cattle Scheme in Part 3.

AGRICULTURAL DEVELOPMENT PLAN



Name of unit

Phasing Sequence

(1-4 indicates progressive development over more than one phasing period)

Second Malaysia Plan

Third Malaysia Plan

Fourth/Fifth Malaysia Plan

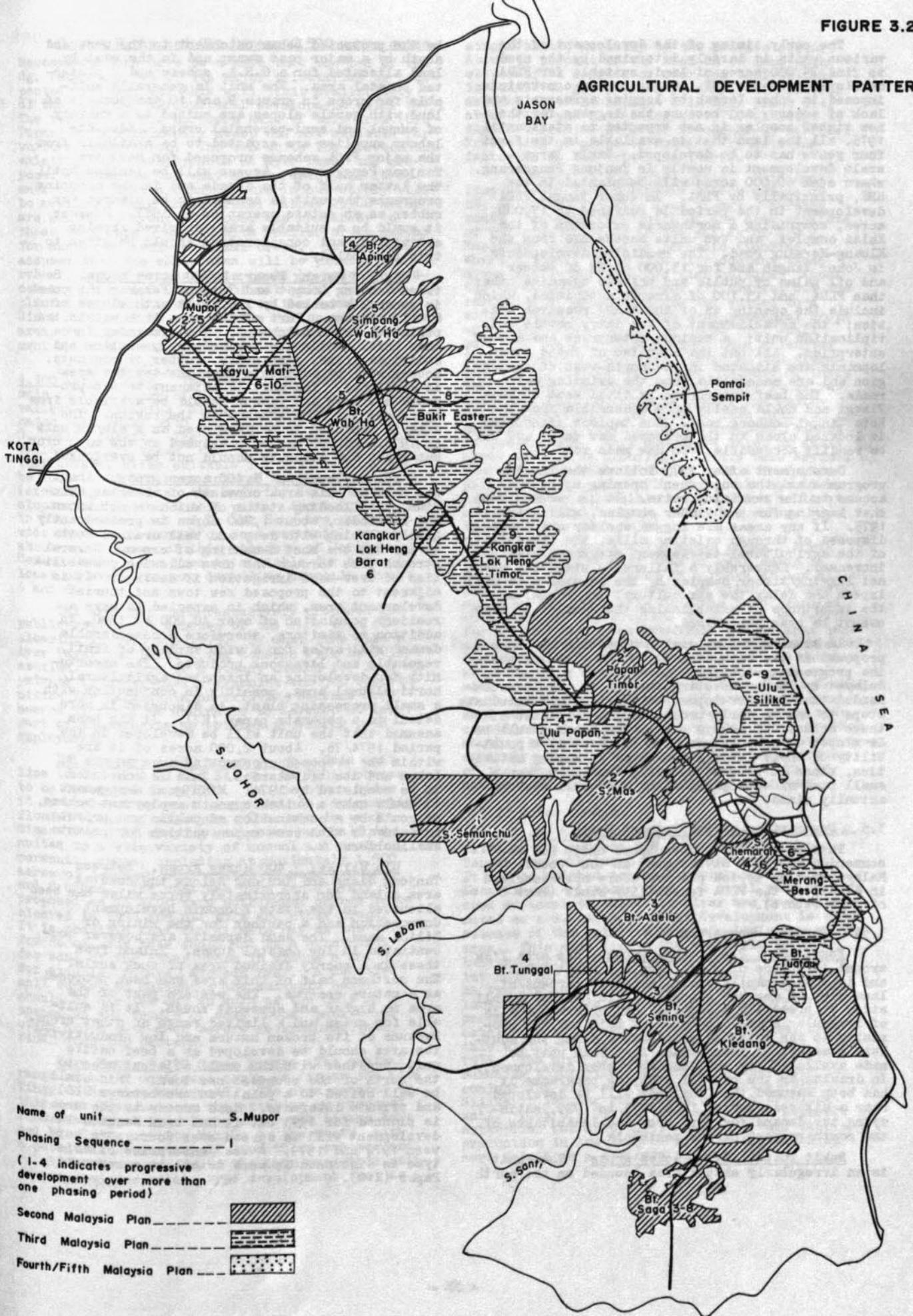
S. Mupor

1



FIGURE 3.2

AGRICULTURAL DEVELOPMENT PATTERN



The early timing of the development of the various units is largely determined by the need to find 75,000 acres of land, suitable for FLDA development in the SMP. Owing to the constraints imposed in Johor Tengah by logging agreements and lack of access, and because the logging for the new timber complex is not expected to start until 1975, all the land that is available in the first four years has to be developed. Early large scale development is mostly in Tanjong Penggerang, where some 60,000 acres will be planted in the SMP, principally by FLDA. In Johor Tengah FLDA development in the period is confined to 17,000 acres, comprising a northwards extension of the Kulai complex, and two units accessible from the Kluang-Mersing road. The remaining developments in Johor Tengah are for 13,000 acres of rubber and oil palms by public and private agencies other than FLDA, and 13,100 of diverse activities, which include the opening up of the MARDI research station; the establishment of the dairy cattle multiplication unit; a tapioca enterprise and a beef enterprise. All but the last two of these developments are situated in the north-west of the region and are accessible from the existing main roads. The beef enterprise is sited west of Kota Tinggi and could easily be made accessible from the Kota Tinggi-Lombong road. The tapioca enterprise is located close to the proposed new town, and will be readily accessible from new main road.

Development after 1975 follows the logging programme and the consequent opening up of the access to the remaining units. It is recommended that logging for the timber complex, will start in 1975. If any areas are logged earlier and the logs disposed of through existing mills, the flexibility of the agricultural development programme will be increased. Conversely a failure to start the planned logging/timber complex by the assumed date will impede and delay the agricultural programme, and the importance of establishing the complex on time cannot be over emphasised.

In areas where mineral prospecting has been proposed it has been assumed in the planning that the progress agricultural development will not be delayed by the prospecting interests. It is recommended that the Development Authority take immediate steps to ensure early prospecting and release of these areas. If delays occur, the areas should be developed to agriculture even if there is a possibility of their later disturbance by mining activities, since it is most unlikely that more than a small part of each prospecting area will ever be actually mined.

3.5 Description of Development Units

This section describes those units not recommended for FLDA development in the Second Malaysian Plan period and therefore not described in detail in the FLDA feasibility study (Part 2 of this report).

3.5.1 Tanjong Penggerang

Bukit Saga: 2,400 acres gross. The area lies around the bases of Bukit Saga and Bukit Pelati and is predominantly steep (about 50 percent of land over 12 degrees slope). It is bounded on all sides by presently alienated land or swamp and is of irregular shape. Because of this and its proximity to the existing settlements along the southern coast it is recommended that this unit be made available for smallholder rubber development. In drawing up the overall cropping programme it has been assumed that the unit will be developed over a six year period from 1973 to 1979, satisfying the demand for land from the inhabitants of the southern part of the peninsula.

Bukit Tuatau: 2,000 acres gross. This unit is an irregularly shaped area bounded on the north

by the protected Lebam catchment to the west and south by a major peat swamp and to the east by land alienated for a G.S.A. scheme and a protected coastal area. The unit is generally suitable for crops in groups 9 and 10 and pockets of land with gentle slopes are suited to a variety of annual and semi-perennial crops. Adequate labour supplies are expected to be available from the major FLDA schemes proposed for southern Tanjong Penggerang. Access will be limited until the latter half of the decade and in the cropping programme the unit is assumed to be cleared for rubber as an estate operation in 1977. However it would be a suitable area for mixed farming activities, and consideration should be given to this possibility.

Sungei Merang Besar: 2,700 acres gross. Between Tanjong Lompat and Tanjong Penawar the coast is generally backed by low hills with slopes of 6 - 12 degrees. Part of the area lies within the protected Lebam catchment. The remainder forms this unit. Soils are predominantly shallow and suited to grass, pineapples, rubber or coconuts. Access will be available when the tourist area is developed. The unit is adjacent to the proposed new town and labour should be available from there and the FLDA schemes in the region. The area is expected to be developed as a single unit in 1976. Rubber has been assumed as the main crop but grass and coconuts should not be overlooked.

Sungei Chemaran: 3,400 acres gross. About one half of this area consists of riverine alluvium, the flooding status of which is not known. The remainder, about 1,700 acres is predominantly gently sloping with deep and well drained soils to all but the most demanding of crops. Several streams pass through the area allowing possibilities of over-head irrigation if desired. It is adjacent to the proposed new town and tourist development area, which is expected to have a resident population of over 40,000 by 1990, in addition to visitors, therefore a considerable demand will arise for a wide variety of fruit, vegetable and livestock products. The opportunity for developing an intensive agricultural/horticultural area, possibly in conjunction with a small processing plant, is discussed in more detail in a separate paper (R7). It has been assumed that the unit will be developed in the period 1974/76. About 2,000 acres of it are within the proposed prospecting area in the S. Lebam and its tributaries. This is scheduled to be completed by 1974. With good management it could make a suitable youth employment scheme, or could be a combination of public and private investments with some opportunities for private smallholders.

Ulu Silika: 7,400 acres gross. Between Tanjong Siang and Tanjong Kelesa the coastal area inland for approximately three miles has been alienated to the State Economic Development Corporation and a partner for the mining of Silica sand. The sand deposits are however concentrated in low coastal dunes. Inland from these is a poorly drained area of muck soils. The northern half of this area has been proposed as a nature reserve. The western part of the area is higher and somewhat rough. It is suitable for grass and a limited range of other crops. Because of its broken nature and low productivity the area should be developed as a beef cattle unit, together with the small adjacent area to the north of the proposed new town. This could be well suited to a joint venture between SEDC and private interests. Road access to the area is planned for 1973 but it has been assumed that development will be spread over four years between 1976 and 1979. A beef enterprise of this type is discussed in more detail in a separate Paper (R10).

Sungei Papan and Ulu Papan: 6,500 acres gross.

Recommendations have been made that the bed of the Sg. Papan and two of its major tributaries be prospected for tin, and this will limit availability of the area for agricultural development until 1975. The terrain in the northern half of this area (Ulu Papan) is predominantly steep and not suitable for uniform subdivision. The two units lie between the existing FLDA developments at Ayer Tawar and proposed schemes to the east of S. Papan, and it is anticipated that a considerable labour supply will be available from these areas. About 2,500 acres are suited to group 10 crops, the remainder to those in groups 9 and 10 with smaller areas suited for annual or semi-perennial crops. It has been assumed that the whole area will be planted to rubber, but, if arrangements could be made for processing about 4,000 acres of oil-palms could be planted instead, with rubber on the remainder. Since SEDC will be responsible for prospecting the area, it appears suitable for agricultural development by them alone or as a joint venture.

Kr Lok Heng: Timor 7,000 acres gross; Barat 4,300 acres gross. The area to the east of the main central range of hills is dissected by wide valleys of riverine alluvium draining into a major peat swamp with its outlet to the sea via the S. Sedili Kechil. The degree of flooding in these valleys is not known, but it is considered likely that several sites suitable for fish farming could be found. Of the area covered by these two units (excluding alluvium) the majority is moderately sloping and suited to oil palm. About 2,000 acres in the eastern part of Kr Lok Heng are suited to a wide variety of annual or semi-perennial crops and about 1,000 acres of this consists of Jerangau Series soils. The area is suitable for some at least of even the more demanding crops in groups 6 and 8.

The area has been tentatively proposed for public-settlement schemes of the FLDA type for clearing in 1976 and 1979. By that time FLDA's Ayer Tawar and Bukit Aping schemes will be fully settled. If there is a steady demand for land by private or other public agencies and job opportunities for dependents on existing schemes are scarce it could be desirable to develop at least part of these units as estates providing paid employment.

Bt. Easter: 6,600 acres gross. This unit lies to the east of the Bt. Wah Ha FLDA schemes to be developed in 1975/6. On the other sides it is bordered by peat swamp or wide, frequently flooded areas of alluvium. The unit is predominantly gently sloping and about one half is suited to a wide variety of annual and semi-perennial crops, including approximately 1,500 acres of Jerangau soil suited to some groups 6 and 8 crops. The unit has been tentatively proposed as an FLDA type settlement scheme to be cleared in 1978 for oil palm and other crops. It is possible that the climate may be too wet for cocoa, but this would not be a constraint for some of the other crops in groups 6 and 8 for example, papaya, avocado pear. A detailed soil survey to delineate the suitable soils should be carried out as soon as the unit is opened up and trials of some cocoa, papaya and other crops laid down before determining the final cropping pattern.

Kayu Mati: 9,200 acres gross. The central range of hills continues north as far as the Kota Tinggi - Mersing main road. The area covered by this unit lies between the existing or proposed FLDA schemes of Ayer Tawar and Pasak to the West and Bt. Aping and Bt. Wah Ha to the east. With a potential labour supply from these schemes and relatively easy access to the main road this unit is proposed for estate type development (not as a

single unit), probably by the private sector. About 50 percent of the area is of land with slopes of 12 degrees or over and half of this is suited to group 10 crops only. It has been assumed that development will take place over about five years starting in 1976, although if demand warranted it could be opened up earlier. Processing of products would be by existing factories in the Kota Tinggi area.

S. Mupor: 3,300 acres gross. This area lies between FLDA's current rubber scheme of Bt. Aping and the main Kota Tinggi - Mersing road. Twenty-five percent of the area consists of riverine alluvium in the valley of the S. Mupor and is subject to periodic flooding. Where the soil has a high clay content these areas may be suitable for fish culture. About ten percent has slopes over six degrees but the remainder is gently sloping and suited to a wide variety of annual and semi-perennial crops as well as crops in groups 9 and 10. Small parts of the area have already been alienated in relatively small units, limiting its attraction as an estate operation. Because of these features and its ready accessibility it is recommended that the area be opened for small-holder development (in lots of less than 100 acres) with no restriction on cropping, except in steep areas. Care should be taken to avoid areas subject to flooding. It has been assumed that the area will developed over a four year period, starting in 1972. This unit should be considered as a possible one in which to locate a youth training scheme, if such a scheme were thought to be desirable.

Pantai Sempit: 4,700 acres gross. North of Tg. Kelesa the main area of peat swamp is separated from the coast by a range of low hills one to one and a half miles in width. A coastal strip up to half a mile wide has been proposed as a conservation area and should not be developed for agriculture. The remainder of the area consists of soils of rather low quality suitable only for perennial crops in group 10, such as rubber and coconuts. Access to the area is poor and will require a bridge and road from Sedili Kechil to the north or a coastal road from the Silika sand area to the south. The beaches along this coastline are of lower quality than those further south; pressure to open this area is, therefore, unlikely until at least after 1980 and, because of the general uncertainty surrounding it, it has been omitted from the cropping programme.

3.5.2 Johor Tengah

Sisek: 5,500 acres gross. This area is located in the extreme S.E. corner of the Johor Tengah region between S. Pelepah and S. Lebak. It can be reached across S. Pelepah from the Kota Tinggi - Lombong road. A small part of this area adjacent to the Johor River has been alienated as a G.S.A. scheme but development is slow because of the relative economic isolation of the area. This also limits the available local labour supply. From time to time some private interest has been expressed in beef production in the Project Area. Sisek would be a suitable location for this activity. It is therefore proposed that the area be developed for beef cattle production and it has been assumed that this will occur over the four years period 1972-1975. The area is small for commercial beef ranching enterprise, but could be developed in conjunction with a later development at Ulu Silika in Tanjong Penggerang or as a breeding unit. Like Ulu Silika this could be a suitable enterprise for SEDC participation. Beef cattle production in the Project area is discussed in more detail in a separate paper, (R10).

Lubok Ajal: 5,400 acres gross; S. Lebak: 6,100 acres gross. These units lie to the east of S. Johor and S. Linggiu and south of S. Tengkil. They consist almost entirely of Rengam soils on slopes of 6-12 degrees and are suitable for groups 9 and 10 crops. Development must await (1) completion of logging over 4000 acres of the Pantli Forest Reserve within the area, and (2) the provision of improved access facilities. At present there are only logging roads leading to Lombong and Kota Tinggi, and a crossing of S. Johor will be required to link the units with Bukit Besar and the main road network.

Since priority is being given to bridging the S. Sayong to provide access to the New Town, the crossing over the S. Johor will not be constructed until after 1975. It is tentatively proposed, therefore that these units should be cleared in 1976 and 1977 for FLDA type development.

Pengeli Kechil: 4,000 acres gross. The area to the south of the unlogged forest reserve area between S. Pengeli, S. Johor and S. Linggiu extends to about 21,000 acres and is predominantly of Hari-mau soils. About one half of the area has slopes of over six degrees but the remainder is flatter and is suited to a wide variety of annual and semi-perennial as well as perennial crops. About one-half of the area has been proposed as part of FLDA's SMP programme for oil palms and contains the site of the proposed timber complex, an oil palm mill and subsequent town area which will total 1,000-1,500 acres. The area between the town site and the S. Pengeli (4,000 acres), is almost entirely gently sloping and suitable for cropping with short term crops. Interest has been expressed by MARA and SEDC in growing and/or processing tapioca and it is considered that this area is well suited for such a purpose. Labour will be able to live in the town area or come from FLDA development in the Kulai complex or Pengeli area. The factory could be located in the town. Additional land suitable for tapioca exists in neighbouring units (see Ulu Sebol, Ulu Chenas) and to the west of S. Pengeli where development is currently underway, in addition to that in S. Kachur (see below). A factory in this location could serve an area of about 10,000 acres. Tapioca production is discussed in detail in a separate paper (R1). It has been assumed that the unit will be developed for tapioca in 1974 and 1975, with first harvest in 1976.

S. Kachur: 5,300 acres gross. This unit lies to the south-east of the Pengeli Kechil area. About one half of the area comprises land with slopes of over six degrees suited mainly to grass, pineapples, and tree crops in groups 9 and 10. The remainder is of less than six degrees slope, and suited to a wide variety of annual, semi-perennial and perennial crops. About 3,000 acres in the unit comprise unlogged sections of the Pantli Forest Reserve, which will be logged by 1975. When a crossing of the S. Johor to Lubok Ajal is constructed, access will be relatively easy, especially to the Kulai/Pontian area, from which it is expected there will be a considerable demand for land in the latter half of the 1970's. It has therefore been proposed that the area be made available for private sector development, with the exception of 300 acres adjacent to the small Orang Asli reserve which should be alienated to that group for expansion of their settlement. It has been assumed that the unit will be developed over four years beginning in 1976 and that cropping will comprise 2,600 acres of oil palms and 2,000 acres of tapioca, (if the Pengeli Kechil factory is built).

Ulu Sebol: 5,600 acres gross. This unit lies immediately to the east of Pengeli Kechil and the new town area and is equally divided into areas with slopes of above and below six degrees. It is proposed that the unit should not be developed as

a settlement scheme but by private or public sector agencies providing paid employment. (It could be divided into several sub-units). It has been assumed that it will be cleared for oil palms over three years 1974-76, but if a tapioca factory is built in the adjacent town area, up to half the area could be devoted to that crop. It could provide a suitable location for a youth employment scheme.

Ulu Chenas: 8,500 acres gross. This unit has three distinct parts. The most northerly 2,500 acres lies on the southern slopes of Bt. Jengeli and is relatively steep. This is assumed to be developed for rubber. The central belt of 2,500 acres has slopes of 6-12 degrees and is proposed for oil palm. The remainder is lower lying between S. Ohenas and S. Pengeli and parts of this area may need drainage. Most of the alluvia in this area have been recommended for prospecting before being released for agricultural development. Also 6,800 acres are unlogged and scheduled for logging in 1975. It has been assumed that the low lying section will be planted to tapioca to serve the factory in the new town. Because of the units lack of uniformity it is not considered to be suitable for uniform subdivision of the FLDA type and it has been recommended for development by other public or private agencies between 1976 and 1979. The lower part of the area served by the S. Pengeli and Ulu Chenas is likely to provide several suitable fish pond sites.

Ulu Pengeli: 6,700 acres gross; Bt. Batu Tongkat: 5,800 acres gross; Ulu Belitong: 6,600 acres gross. These three units are scheduled for logging in 1976, 1977 and 1978 respectively. They are predominantly of Rengam soils with 60 percent of land on slopes of 6-12 degrees and only about ten percent with steeper slopes. Apart from small areas of marginal suitability they are all well suited to oil palms and to possible uniform subdivision. They form a compact unit of 18,000 acres and are well suited to FLDA type settlement and it has been tentatively proposed that they be developed for this purpose, with processing facilities located at Ulu Belitong.

Sembrong Tengah: 5,400 acres gross; Bt. Lawiang: 4,300 acres gross; Sembrong Tengah is scheduled for logging in 1979. It is rather diversified, 20 percent of it being on slopes of over 12 degrees and 25 percent of less than 6 degrees. As such it is marginally suited to uniform subdivision. Bt. Lawiang borders Sembrong Tengah to the south and is very similar in nature. It is under a logging agreement expiring in 1980. On the south and west it is bordered by existing estates and access could easily be created to Rengam and the main state road network.

Because of their rather broken nature these two units are best suited to development of a variety of crops in a wide range of holding sizes, probably by smallholders and by private and public sector estates. It has been assumed that clearing will take place in 1979 to 1981 and that cropping will be 3,500 acres of oil palm and 5,000 acres rubber. It is considered likely also that several sites for fish farming will be found in the area. The unit contains the recommended site for a master village. This is the logical site for rubber and oil palm factories to serve the upper Sembrong area and it has been assumed that such factories will be built.

S. Mengkibol: 4,500 acres gross. MARDI have applied for this land as a site for a southern region research station. The area will be developed as soon as possible for this purpose

and at a rate dictated by research requirements. Development over eight years is assumed in the land development programme.

S. Sembrong: 6,500 acres gross. This unit is scheduled for logging in 1980. Eighty percent of it has slopes of less than six degrees and although areas may need drainage it is suited to most crop groups. By 1980 the research programme instituted by MARDI at the Mengkibol station should have begun to yield results in terms of methods of growing annual crops, and identification of suitable varieties. In addition the cattle multiplication centres will have built up herds of cross-bred animals and be in a position to supply stock to other areas. Pasture management problems should also have been solved. The S. Sembrong is likely to provide a reliable water source for fish farming and it is probable that several suitable sites will be found. Thus, unless research suggests the inadvisability of attempting to grow short-term crops, this unit would be ideally suited to the development of mixed farming on holdings of varied size. As such it is not suited to FLDA type settlement. It has been assumed that clearance will be carried out in 1980-83 and that cropping will be 1,000 acres oil palm, 1,300 acres tapioca, 2,600 grass for dairying and 1,000 acres other crops.

Sembrong Kiri: 16,300 acres gross. The proposed logging programme starts in 1975 moving north west along the main Johor Tengah spine road until 1980. Thereafter it continues in the Jengeli area returning to the remainder of the Sembrong catchment in 1983-85. The western half of this area is broadly similar to the S. Sembrong area described above and is well suited to the development of mixed farming, including fish culture. The eastern half is more broken and about 1,500 acres are suited to group 10 crops only. It has been assumed that development will take place between 1984 and 1987 after the S. Sembrong unit and that the cropping pattern will be oil palm 5,100 acres, rubber 4,900 acres, grass for dairy 2,400 acres, tapioca 1,000 acres and other crops 1,000 acres. It is clearly not possible now to ascertain the likely demands for land by, and mode of operations of, FLDA type schemes or private settlement in 15 years time and no attempt has been made to suggest development agencies for this area.

G. Lambak: 6,700 acres gross. Application has already been made by the Police Benevolent Fund for approximately 5,500 acres of this area for operation as a rubber estate. Output from this scheme could be processed on site or in Kluang. In estimating water needs it has been assumed that a factory will be built on the scheme. The remainder of the unit is adjacent to the rapidly expanding town of Kluang and is suited to smallholder development of fruit and vegetables, or, on steeper slopes, to rubber. A small area may also be required for urban expansion.

Kg. Gajah: 2,900 acres gross. This area is predominantly hilly and 40 percent of it is over 12 degrees in slope and suitable only for group 10 crops. The remainder is partly covered by the coarse phase Rengam soil which is unsuitable or only marginally suitable for other than group 10 crops. The unit borders the Kluang-Mersing road and is readily accessible. It is recommended that the unit be opened for smallholder development for rubber, avoiding the steepest slopes. It has been assumed that development will extend over four years starting in 1972, assuming that the 500 acre logging concession in the centre of the unit is worked out.

S. Kahang: 1,400 acres gross. This small

area lies east of the Kahang river and to the west of a logging agreement area running to 1980. It is an area of gently sloping and Harimau soils suitable for a wide range of annual, semi-perennial and perennial crops. It is considered marginal for the most demanding crops such as cocoa and bananas. Having gentle slopes and being close to the S. Kahang it is likely also that several sites suitable for fish farming will be available. Access is by logging road through the proposed cattle multiplication unit or directly across the Kahang River to the Kluang-Mersing road. The latter route is however likely to be subject to periodic flooding. Because of its accessibility and crop suitability it is recommended that the area be opened over the period 1972-9175 for G.S.A. type smallholder development particularly for those in the nearby kampongs and new villages where there is a considerable demand for land.

S. Dengar: 1,400 acres gross; S. Yong 4,600 acres gross; Bt. Jelati: 6,700 acres gross. These three units, totalling almost 13,000 acres will not be available for development until approximately 1980. S. Dengar and most of Bt. Jelati are covered by logging agreements running to that date and S. Yong is covered by an unlogged portion of Kluang forest reserve which is outside the phased logging programme but scheduled to be logged to existing mills by 1980.

S. Dengar is comprised of gently sloping Harimau soils suitable for a wide range of crops. It adjoins the proposed FLDA Kahang Timor oil palm scheme and would form a logical extension to it.

S. Yong and Bt. Jelati are separated by the S. Kahang. To the west are soils of the Serdang Series, to the east predominately Yong Peng. The latter can contain a compacted layer at 2-4 feet and for this reason may be marginal for oil palm. Moreover, because of their proximity to the Kahang Timor scheme, which will contain an oil palm mill it is tentatively proposed, that these areas be developed as FLDA type schemes and cropped with oil palms.

Ulu Dengar: 6,800 acres gross. This unit is not scheduled to be logged until 1986. It is a diverse area. About 20 percent lies on slopes of over 12 degrees and consists mainly of coarse Rengam soils suitable for group 10 crops only. The remainder consists of normal Rengam and Yong Peng soils, suitable for oil palm and rubber, but with smaller low-lying and possibly swampy areas in the valley of the S. Dengar. It would not appear to be suitable for uniform subdivision. No recommendations are made on development agencies but it is considered suitable for development in a variety of holding sizes. It has been assumed that development will take place in 1986 and 1987 and be divided between 3,500 acres of oil palms and 2,500 acres of rubber.

S. Jengeli: 14,600 acres gross. This area is scheduled to be logged between 1981 and 1983. It consists principally of Rengam soils with smaller areas of Harimau in the south and Holyrood and Durian series in the north east. The north west part comprising about 2,000 acres on the slopes of Bt. Jengeli, lies on slopes of over 12 degrees but is physically suited to group 9 and group 10 crops. The area of Durian soils is suited to rubber only. Of the remainder, 60 percent is moderately sloping and suited to semi-perennial and perennials and the final 15 percent is of less than six degree slope and is suited to most crop groups. Because the demand for land in the nineteen-eighties, the opportunities for diversification and the mode of operation of the various agencies by that time are unknown, no attempt has been made to recommend appropriate

agencies for development. In the cropping programme it has been assumed that development will take place between 1982 and 1984 and consist of 8,800 acres of oil palm and 4,000 acres of rubber, and that factories will be constructed to handle this output.

Bt. Tengkil: 1,900 acres gross. This somewhat isolated area lies to the north of the old tin-mining area along S. Tengkil and east of the S. Linggiu. It is of rather mixed quality, about 800 acres consisting of shallow soils with slopes of six degrees or less unsuitable for rubber or oil palms but which could be used for some short-term crops on grass. The remaining 1,000 acres is divided almost equally into areas with slopes above and below 12 degrees and is suited to group 9 and 10 crops. Access will not be good until the road across the Linggiu is improved. In general it is recommended that the area be made available to relatively small developers. It has been assumed that the flatter areas of 800 acres will be planted to tapioca and the rest to rubber, with development taking place between 1979 and 1982.

SUPPORTING SERVICES4.1 Introduction

As development proceeds it will be necessary to establish and/or expand some institutional services to producers. The most important of these services are marketing and, where necessary processing, agricultural advice and credit. The most suitable forms of organisation for providing these services must take into account the nature of the activities being developed, and the type and location of production agencies that are to operate in the Area.

In the assumed cropping pattern the activities, in descending order of acreage are as follows:-

Oil palms	144,600 net	crop	acres
Rubber	58,700 net		acres
Tapioca	12,600 net		acres
Beef	11,400 net		acres
Dairying	9,800 net		acres
Other	8,700 net		acres
Research	4,000 net		acres
	<hr/>		
	249,800 net		acres

The most important production agency will be FLDA and/or an FLDA type of organisation. Beyond 1980 no suggestions have been made as to whom the land should be allocated, but for the 210,650 acres to be planted by 1980, land suitable for settlement by FLDA or similar agencies has been delineated. It amounts to 123,600 acres, leaving a balance of 87,050 acres to be shared between other production agencies, public and private, large and small. In order to obtain, with the required high proportion of settlement schemes, the greatest possible diversification of employment opportunities, the FLDA and non-FLDA types of agency have been located in close proximity to each other throughout the Project Area insofar as this was possible.

4.2 Oil Palms4.2.1 FLDA/FLDA-type units

It has been assumed that 127,200 acres of oil palms will be planted by 1980, of which 108,500 acres will be in FLDA or FLDA-type units. Thus oil palm production will be dominated by FLDA or a similar type of organisation. FLDA at present organises collection and transport of fresh fruit bunches through contractors, performs processing and marketing functions on behalf of its settlers and provides them with credit. Until settlers have paid their debt they do not operate a specific holding, but are organised and managed on the basis of an estate labour force. The need for the provision of advisory services, to settlers does not, therefore, arise during this debt repayment period. Insofar as the new oil palm development in the Project Area are concerned, it is unlikely that such a service will be required before 1990. By that time the early settlers near the Project Area (in the Kulai complex) will have been the sole or cooperative owners of their land for some years, and arrangements for continuous services will have been made, which if working satisfactorily, will undoubtedly act as a precedent for the Project Area. It is known that possible suitable arrangements are at present under consideration by FLDA, and that no final decisions have been made. However whether settler production is organised on a cooperative or individual basis, an advisory service will be required to ensure the maintenance of good standards of management and it seems sensible to assume that some of the existing,

trained FLDA field staff should remain to provide this service. Likewise, whatever ownership arrangements are made with regard to the FLDA palm oil factories, it is essential that their management should remain in the hands of an efficient, experienced organisation, capable of producing processed products to known and acceptable standards. Again it could appear logical to leave FLDA trained personnel in charge of these operations, whether or not the functions are retained by FLDA or handed over to a new organisation.

4.2.2 Other agency units

Oil palm production by other agencies (private and public) up to 1980 is assumed to cover 18,700 acres only. After that year a further 17,400 acres remain to be planted by unspecified agencies (among which FLDA could be included) to complete the development programme. Thus the maximum acreage of oil palms outside FLDA is assumed to be 36,100 acres, less than 25 percent of the total.

Processing facilities for these units may (but cannot necessarily) be provided by extension of existing FLDA factories. Additional factories of appropriate capacities will sometimes need to be located to serve them; such factories could be suitable investments for public or private interests and for joint ventures.

It is recommended that the agencies undertaking the processing should also provide the necessary field advisory staff to ensure that growers adopt good management practices and produce fruit bunches in satisfactory condition for processing. Such processing centres may also provide credit to growers, or be used to channel credit provided by the Bank Pertanian or other lending agency.

A satisfactory form of service organisation could be worked out on the nucleus estate system. In this the central processing, advisory and credit organisation would initially at least grow sufficient oil palms to guarantee a minimum economic throughput to the factory, and would obtain further supplies from surrounding producers, who would be given contracts for delivery of fruit from an agreed acreage at specified prices. Prices would be on a sliding scale depending on the market value of palm oil and kernels, and on the quality of the fruit.

Transport of fruit to the factories should be left to private contractors as is now done by FLDA. This is an activity which could be sponsored by MARA through the provision of loans to would-be transport contractors to purchase their initial fleet of vehicles. Transport contractors in the sense used could include co-operative wishing to transport the produce of producer members.

4.3 Rubber4.3.1 FLDA/FLDA-type units

Only 11,900 acres out of 45,300 acres assumed to be planted to rubber by 1980 are allotted to FLDA. Insofar as this area is concerned the services are provided by FLDA to the settlers as they are for oil palms during the period of debt repayment and again it will be necessary to ensure their continuance when this period is over. As was suggested in the case of oil palms it would obviously be sensible to retain at least some of the trained personnel and expertise in the Project

Area. The main differences between the oil palm and rubber situation are in the relative importance of FLDA-type to other agencies, and in the fact that, for rubber, there are already well established. Advisory Services available to farmers through the Rubber Research Institute. The smallholder service includes among its activities assistance to smallholders' to establish group processing centres. It would seem, therefore, logical that the FLDA-units and service for rubber should ultimately be taken under the wing of the RRI Advisory Services.

4.3.2 Other Agency Units

It is assumed that 33,400 acres of rubber will be planted in these areas by 1980. Up to a further 13,400 acres could be added after 1980. It is recommended that the RRI Advisory Services should be expanded as necessary to service these areas.

The provision of credit facilities to potential rubber producers is more difficult than with oil palm because of the difficulty of enforcing any sales contract and of ensuring repayment of loans. This is a problem even for FLDA which is much better placed to cope with it than any less formal organisation or system. One possible means might be through Farmers Associations which could assist in applications for land by members who might then be more easily dealt with as a group. Loans, for funds provided by MARA, Bank Pertanian or other agency might be made available and the Association stand surety for a portions of these loans. Where applicable these could be supplemented with funds derived from the Rubber Replanting Board Fund "B".

4.4 Tapioca

Large scale production of tapioca is a new enterprise to Johor. While it is an annual crop it is similar to oil palms in that the crop must be processed near to the site of production. Thus provision of processing facilities and initiation of production go hand in hand. It is therefore recommended that the crop be developed in the form of a nucleus estate. The most suitable site for initial development is adjacent to the proposed new town in Johor Tengah, east of the S. Pengeli. It is recommended that a factory be located in the new town. Applications should be invited for supply of roots to this factory from land to be developed adjacent to it. This could be done and loans made available in the same way as suggested for oil palm. It is recommended that the tapioca and oil palm developments in the area be combined so that individuals may apply for production contracts for both crops. This would promote the development of mixed holdings (R14) containing both tapioca and oil palm. Initial contracts might be for minimal holdings of 20 acres with a minimum of ten acres for each crop. Care should be taken to ensure that land alienated for such holdings is not too steep for satisfactory cultivation of tapioca. Tapioca contracts could be subject to renewal at specified intervals and this will enable farmers to diversify further, for example, to livestock or other short-term crop enterprises as these become possible. The extent to which the factory will need to specify planting and harvesting dates to contract holders and to provide extension advice or issue instructions to growers, will become apparent as the schemes progress.

4.5 Other Products

Other crops products requiring processing could be introduced in a similar way for example fruits, vegetables and fresh water fish and

prawns for processing (see paper R 5). Dairy production needs also be closely tried to the market as discussed in Part 3 of this Report. Efforts might also be made to assist in the development of meat production by the establishment of small processing plants to produce frozen chicken pieces, tinned curries etc. These could supply institutional as well as retail markets.

APPENDIX A

PROPOSED CROPPING PATTERN BY UNITS--JOHOR TENGAH

Unit	Oil Palm	Rubber	Beef	Dairy	Tapioca	Other Crops	Total
Pengeli Timor	5,600						5,600
S. Sebol	3,600						3,600
Kahang Barat	3,800						3,800
Kahang Timor	4,000						4,000
Lubok Ajal	4,700						4,700
Ulu Pangeli	5,900						5,900
Bt. Batu Tongkat	5,100						5,100
S. Lebak	5,300						5,300
Ulu Belitong	5,800						5,800
S. Dengar	1,200						1,200
S. Yong	4,000						4,000
Bt. Jelati	5,900						5,900
Sisek			4,800				4,800
S. Mengkibol						4,000 ⁺	4,000
G. Lambak		5,900					5,900
Kg. Gajah		2,600					2,600
Padang Hijau				4,800			4,800
S. Kahang		1,000			150	150	1,300
Pengeli Kechil					3,600		3,600
Ulu Sebol	5,000						5,000
S. Kachur	2,600				2,000		4,600
Ulu Chenas	2,100	2,100			3,300		7,500
Bt. Tengkil		600			1,100		1,700
Sembrong Tengah	1,300	3,400					4,700
S. Sembrong	1,000			2,600	1,100	1,000	5,700
Bt. Lawiang	2,200	1,600					3,800
Sembrong Kiri	5,100	4,900		2,400	1,000	1,00	14,400
S. Jengeli	8,800	4,000					12,800
Ulu Dengar	3,500	2,500					6,000
T O T A L	86,500	28,600	4,800	9,800	12,250	6,150	148,100

+ Research Station.

PROPOSED CROPPING PATTERN BY UNITS - TANJONG PENGGERANG

Unit	Oil Palm	Rubber	Beef	Tapioca	Other Crops	Total
S. Semenchu	6,900					6,900
Papan Timor	700	5,100			700	6,500
S. Mas	2,200	4,100				6,300
Bukit Adela	4,900					4,900
Bukit Sening	6,100	900				7,000
Bukit Kledang	5,000	800				5,800
Bukit Tunggai	3,000					3,000
Bukit Aping		1,000				1,000
Bukit Wah Ha	5,700					5,700
Simpang Wah Ha	5,500					5,500
Kr. Lok Heng Barat	3,900					3,900
Kr. Lok Heng Timor	5,300				1,000	6,300
Bukit Easter	4,400				1,500	5,900
S. Mupor		2,200		350	350	2,900
Bukit Saga		2,100				2,100
S. Papan/Ulu Papan		5,900				5,900
S. Chemaran					3,000	3,000
Kayu Mati	4,500	3,800				8,300
Ulu Silika			6,600			6,600
S. Merang Besar		2,400				2,400
Bukit Tuatau		1,800				1,800
T O T A L	58,100	30,100	6,600	350	6,550	101,700

APPENDIX B

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