

The Republic of Indonesia
The Study on the Improvement in Quality of the Tropical Fruits

(Volume 1)
MAIN REPORT

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Layout View of Fruit Production Development Area

Location Map

Location Map in North Sumatra

Location Map in West Java

Location Map in East Java

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ABBREVIATIONS AND GLOSSARY

AAET	Badan dan Pandidihan Latihan Pertanian	Agency for Agricultural Extension and Training
AARD	Badan Penelitian dan Pengembangan Pertanian	Agency for Agricultural Research and Development
ADB	Bank Pembangunan Asia	Asian Development Bank
AFTA		ASEAN Free Trade Area
AMDAL	Analisa Mengenai Dampak Lingkungan	Environmental Impact Assessment
APBD	Anggaran Pendapatan dan Belanja Daerah	Local Budget of Receipts and Expenditure
APBN	Anggaran Pendapatan dan Belanja Negara	National Budget of Receipts and Expenditure
ASEAN		Association of Southeast Asian Nations
BAPPEDA	Badan Perencanaan Pembangunan Daerah	Provincial Development Planning Board
BAPPENAS	Badan Perencanaan Pembangunan Nasional	National Development Planning Agency
BBI	Balai Benih Induk	Seed Production Center
BBP	Balai Benih Pembantu	Local Seed Production Farm
BBU	Balai Benih Umum	Main Seed Production Farm
BIPP	Balai Informasi dan Penyuluhan Pertanian	Rural Agricultural Information and Extension Center
BPP	Balai Penyuluhan Pertanian	Rural Agricultural Extension Center
BPSB	Balai Pengawasan dan Sertifikasi Benih	Seed Certification and Control Services
BPTP	Balai Pengkajian Teknokogi Pertanian	Assessment Institute for Agricultural Technology
BRI	Bank Rakyat Indonesia	Pepple's Bank of Indonesia
BUMN	Badan Usaha Milik Negara	State Owned Enterprise
Bupati	Kupala Daerah Tingkat II	District Chief
CAE		Center for Agricultural Extension (MOA)
CAQ		Center for Agricultural Quarantine (MOA)
Camat	Kepala Kecamatan	Sub-district Chief
CBS (BPS)	Biro Pusat Statistik	Central Bureau of Statistics
CIF		Cost, insurance and freight
CRIH		Central Research Institute for Horticulture
DAS	Dinas Pertanian Tingkat II	District Agricultural Service
DATI I	Daerah Tingkat I	Provincial Level Government
DATI II	Daerah Tingkat II	District Level Government
DEKOPIN	Dewan Koperasi Indonesia	Indonesia National Union of Cooperatives
Desa		Village

DGFCH	Direktorat Jenderal Tanaman Pangan dan Hortikultura	Directorate General of Food Crops and Horticulture (MOA)
DINAS		Provincial Government Sector Development Offices
DIPERTA	Dinas Pertanian	Provincial Agricultural Service
DI	Daerah Istimewa	Special Territory
DIP	Daftar Isian Proyek	Approved Project Budget
DKI	Daerah Khusus Ibukota	Special Capital District
Dusun		Cluster of Villages
FOB		Free on board
F/S	Studi Kelayakan	Feasibility Study
GATT		General Agreement on Tariffs and Trade
GBHN	Garis-garis Besar Haluan Negara	Guidelines of State Policy
GDP	Pendapatan Nasional Bruto	Gross Domestic Product
GNP	Pendapatan Nasional Netto	Gross National Product
GOI	Pemerintah Indonesia	Government of Indonesia
GOJ	Pemerintah Jepang	Government of Japan
GRDP	Produk Domestik Regional Bruto	Gross Regional Domestic Product
HGU	Hak Guna Usaha	Land Use Right
HRD	Pengembangan Sumber Daya Manusia	Human Resource Development
HYV	Jenis Unggul	High Yielding Variety
IBRD	Bank Rekonstruksi dan Pembangunan Internasional	International Bank for Reconstruction and Development (World Bank)
IDT	Inpres Desa Tertinggal	Presidential Instruction for Program Aid to Less Developed Villages
IHDUA		Integrated Horticulture Development in Upland Areas
Ijon		Buying system of crops from a farmer by paying long time before the harvest
INMAS	Intensifikasi Massal	Mass Intensification (farm input program)
INPRES	Instruksi Presiden	Presidential Instruction (rural public works program)
INSUS	Intensifikasi Khusus	Special Intensification Program (farm input credit program for groups of farmers)
IPEDA	Iuran Pembangunan Daerah	Land Tax
JICA		Japan International Cooperation Agency
Kabupaten		District (Level II Local Government)
Kecamatan		Sub-district(administrative division of Province)
KANWIL	Kantor Wilayah	Provincial Office of Central Line Agency
KCl		Potassium Chloride
Kelompok Tani		Farmers Group

Kepala		Head of Organization
KIK	Kredit Industri Kecil	Small Industry Credit
KMKP	Kredit Modal Kerja Permanen	Credit for Permanent Working Capital
Kotamadya		Municipality (Level II Local Government)
KUD	Koperasi Unit Desa	Village Unit Cooperative
KUT	Kredit Usaha Tani	Credit for Farmer
LKMD	Lembaga Ketahanan Masyarakat Desa	Village Resilience Body
LPTP	Loka Pengkajian Teknokogi Pertanian	Assessment Station for Agricultural Technology
MOA	Departmen Pertanian	Ministry of Agriculture
MOCSED		Ministry of Cooperatives and Small Enterprises Development
MPW	Departemen Perkerjan Umum	Ministry of Public Works
M/P	Rencana Induk	Master Plan
NGO		Non-Governmental Organization
ODP(s)		Orchard Development Project(s)
OECE		Overseas Economic Cooperation Fund
O&M		Operation and Maintenance
Palawija		Secondary crop (planted after rice)
Pancasila		The five principles of the Republic of Indonesia (Belief in God, Humanism, Consciousness, Sovereignty of the People, Social Justice)
PJP-II	Pembangunan Jangka Panjang	Second Long-Term (25 Year) Development Plan
PMO	Kantor Manajemen Proyek	Project Manager Office
PMU	Unit Manajemen Proyek	Project Management Unit
PPL	Penyuluh Pertanian Lapangan	Agricultural Field Extension Worker
PPM	Penyuluh Pertanian Madya	Mid-level Agricultural Extension Officer
PPS	Penyuluh Pertanian Spesialis	Agricultural Extension Specialist
PRAS	Dinas Pertanian Tingkat I	Provincial Agricultural Service
RAD	Pembangunan Pertanian Daerah	Regional Agricultural Development
RFI		Regional Financial Institute
Repelita	Rencana Pembangunan Lima Tahun	Five-Year Development Plan
SGP	Kelompok Pengolahan Usaha Kecil	Smallholder Group Processing
SPC	Pusat Pengolahan Kelompok Usaha Kecil	Smallholder Group Processing Center
SPL		Second Program Loan (OECE)
SUSENAS	Survei Sosial Ekonomi Nasional	National Socio-Economic Survey
Tebasan		Buying system of crops just before their harvest
TSP		Triple Super Phosphate
VAT	Pajak Pertambahan Nilai	Value Added Tax
WTO		World Trade Organization

MEASUREMENT

Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer

Area

m ²	=	square meter
ha	=	hectare
km ²	=	square kilometer
bata	=	14m x 14m (local unit used in West Java)

Volume

cm ³	=	cubic centimeter
l	=	liter
kl	=	kiloliter
m ³	=	cubic meter

Derived Measures

m ³ /s	=	cubic meter per second
kWh	=	kilowatt hour
MWh	=	megawatt hour

Weight

g	=	gram
kg	=	kilogram
ton	=	metric ton
quintal	=	100 kilograms

Currency

US\$	=	US Dollar
Rp.	=	Rupiah
¥	=	Yen

Time

s	=	second
min	=	minute
h	=	hour
d	=	day
y	=	year
%	=	percent

Other Measure

°	=	degree
° C	=	degree(s) Celsius
10 ³	=	thousand
10 ⁶	=	million
10 ⁹	=	billion

Fiscal Year

April 1 - March 31

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

In the Sixth Five-Year Development Plan (Repelita VI: 1994/95 to 1998/99), the objectives of food crop and horticultural development are to improve farmers' welfare, maintain food self-sufficiency, enhance food and raw material production to meet market demand, improve human nutrition through food diversification, increase job opportunities in rural areas, promote market development, domestic and abroad, and create linkage with private sectors.

To attain these objectives, the Government of Indonesia (GOI) is promoting the improvement in quality and increase in production of horticultural crops to meet increasing demand in urban areas after accomplishment of self-sufficiency in rice in 1984. However, the horticultural sub-sector has still several constraints to be tackled, especially in fruit market-oriented production, because of farmers' high dependence on traditional methods of growing a few fruit trees in their home yards with low level of technique and management.

Aiming at immediate take-off of the horticultural sub-sector, the Government of Indonesia (GOI) requested the Government of Japan (GOJ) in January 1996 to conduct a feasibility study on the improvement in quality of tropical fruits in eight Provinces throughout Indonesia. Before dispatching a preparatory study team in response to the request, GOJ considered it is necessary to carry out field survey and investigation of physical, socio-economic and agricultural conditions, marketing (demand and supply) analysis of tropical fruits in domestic and international markets, and assessment of possibility of increasing their production. Consequently, GOJ decided to concentrate the proposed study in four Provinces: North Sumatra, East Java, West Java, and South Sulawesi, considering the fact that these four Provinces are endowed with high potentials for growing tropical fruits, and to formulate a master plan.

In line with such decision, GOJ executed a preparatory study in March 1997, and the Scope of Works (S/W) was concluded to execute the Study (Master Plan) on the Improvement in Quality of the Tropical Fruits covering the four Provinces as a result of discussion between both governments. In accordance with the S/W, GOJ through its executing agency, the Japan International Cooperation Agency (JICA), commenced the Study from July 1997.

1.2 Study Objectives

The objectives of the Study are:

- a. to prepare a Master Plan for each of the four Provinces aiming at increasing small-scale farmers' income through the improvement in quality of the target tropical fruits corresponding to the need for supply to domestic and international markets; and
- b. to carry out technology transfer to the Indonesian counterpart personnel concerned in the course of the Study.

1.3 Study Area and Target Tropical Fruits

The Study covers 237,789 km² in total comprising four Provinces; North Sumatra, West Java, East Java, and South Sulawesi. This area is equivalent to about 12.4% of the national geographical area, but has a population equivalent to 47.1% of the country's total population. The four Study Provinces represent a variety of socio-economic situations and are likewise considered as the most advanced fruit production regions in Indonesia. Nine target tropical fruits were taken up in this Study and their presence in the respective Provinces is as shown in Table 1.1.

Table 1.1 Target Fruits in Respective Provinces

No.	Fruit	North Sumatra	West Java	East Java	South Sulawesi
1.	Avocado		○	○	○
2.	Banana			○	
3.	Duku		○	○	
4.	Durian	○	○	○	
5.	Mango		○	○	○
6.	Mangosteen	○	○		○
7.	Marquisa	○			○
8.	Rambutan	○			○
9.	Salak	○	○	○	

1.4 Study Performance

The Study was conducted from July 1997 to May 1998 (during eleven months) and with the following three phases: (i) Phase-I study during the period from the end of July 1997 to the middle of November 1997, (ii) Phase-II study during the period from the middle of November 1997 to the beginning of March 1998, and (iii) Phase-III study from the beginning of March 1998 to the middle of May 1998.

For the execution of the Study, JICA formed a Study Team consisting of nine experts. A total of 17 Indonesian counterparts appointed by MOA and four Provincial Agricultural Services Offices were involved in the Study since the beginning of Phase-I Field Work. The list of members of the JICA Study Team and Indonesian counterparts is shown in Table A-1-1.

In the Phase-I Field Work carried out in Indonesia during a period of 3.5 months from the end of July 1997 to the beginning of November 1997, the Study Team explained and discussed the contents of the Inception Report describing the plan of operation of the Study on July 23, 1997 with representatives of the GOI authorities concerned. After the meeting, the JICA Study Team commenced the collection of relevant data and information from various agencies, and visited the respective potential areas, seedling propagation facilities, market places with the authorities concerned to grasp the present situation of orchard development in Indonesia as well as each of the four Provinces, and assess the present constraints and problems. All the results of assessment and preliminary basic development plan were compiled into the Progress Report (I). With reference to the comments and suggestions of GOI in the meeting on the Progress Report (I) on October 28, 1997, and the results of further study in Japan, the Interim Report was compiled in the middle of November 1997 in Japan.

In the Phase-II Field Work carried out in Indonesia during a period of 2.5 months from the middle of November 1997 to the end of January 1998, the Study Team explained and discussed the Interim Report on November 25, 1997 with representatives of the GOI authorities concerned with a view of confirming all the study results obtained so far, especially focusing on the "basic development plans" formulated for each of the four Provinces. After the meeting, the JICA Study Team collected additional data and information from various agencies and exchanged views on development prospects of the respective potential areas with the authorities concerned as well as interested small landholding farmers to formulate programs for orchard development in each of the four Provinces. Main outputs from the Phase-II Field Work were discussed in the meeting held on January 23, 1998. In consideration of the comments and suggestions of GOI, the Progress Report (II) was compiled and submitted to GOI.

Successively, the Study Team conducted the Phase-II Home Work in Japan by the middle of March to prepare the Draft Final Report. From the end of March to the mid-April 1998 (Phase-III Field Work), the Study Team visited Indonesia for the purpose of making presentation and discussion about the contents of the Draft Final Report and held successively the seminars in each of the four Provinces: West Java, North Sumatra, East Java and South Sulawesi. During a series of discussions with the officials concerned and relevant authorities, the comments and suggestions on the Draft Final Report were presented from GOI side and they were summarized in the Minutes of Discussion (dated on April 9, 1998) and seminar reports.

In the Phase-III Home Work in May 1998, the Study Team prepared the Final Report referring to the above comments and suggestions and through revising the Draft Final Report.

1.5 Transfer of Technology

In accordance with the Technology Transfer Plan prepared on the basis of the results of discussion with the Indonesian counterparts, the transfer of technology started in close cooperation and joint work with the counterpart personnel, both the officers of DGFCH (MOA) and four Provincial Agricultural Services Offices (PRAS). Technology transfer has been done mainly by the "Learn-by-Doing" method during the field works.

Technical guidance to the respective counterparts was carried out by transferring knowledge and know-how of each member of the Study Team. The contents of technology transfer undertaken by the respective Study Team members within their specific field of expertise are classified as follows:

- | | |
|-------------------------------|--|
| a. Agricultural production | Seedling production, cultivation/extension, and infrastructure/facilities; |
| b. Post-harvest and marketing | Post-harvest/marketing, and market analysis; and |
| c. Village and farm economy | Farm economy, rural society/gender, and institutional development/farmers' organization. |

Technology transfer was facilitated by the weekly meetings held in Jakarta regarding the progress in the week through the field investigations conducted by the Study Team members in the four Provinces. In addition to the above, the Provincial counterparts have participated in the baseline survey and could have the opportunity to learn survey methods for future monitoring and evaluation of orchard development planning.

Under the training program of JICA, two counterparts of DGFCH (MOA) were dispatched to Japan for about one month from February 9 to March 10, 1998. During this period, various training programs were conducted by JICA focusing on the advanced techniques on seedling propagation and orchard management, post-harvest technology, marketing development, quarantine system, institutional development, and so on.

CHAPTER 2 BACKGROUND OF HORTICULTURAL DEVELOPMENT IN INDONESIA

2.1 General Condition

Indonesia is a tropical country spreading over along the equator, and its upland area over 1,000 m of altitude occupies 11.5% of the total territory. To make the most use of its land, it is possible to promote the fruit production development for the both tropical and temperate fruits. The income increase of the people due to the latest economic growth (up to the middle of 1997) generated a good deal of fruit demand, especially high quality ones and in urban areas, and their imports show a steady increase in volume and amount, respectively. In addition to the import of temperate fruit like apple, citrus, pear and others, that of tropical fruit from the neighboring countries continues to increase, though its volume is still negligible.

In Indonesia, the basic infrastructure and facilities for production and marketing of fruit crops have not been duly improved so far and then this sub-sector is lagged far behind in all aspects for not only fruit quality improvement but its production itself.

2.2 National Development Policy

The Second "Long-Term (25-year) Development Plan (1994/95 - 2018/19) called "PJP-II" was formulated to provide the country with direction in its socio-economic development efforts. This long-term plan is served as a guiding frameworks for preparation of the short and medium-term policies, strategies and plans.

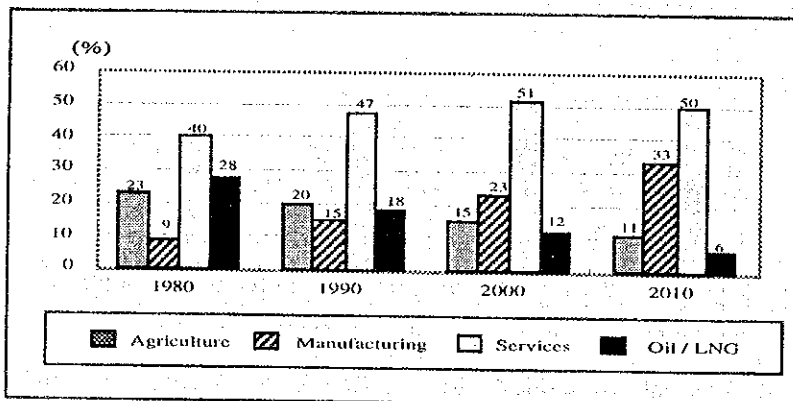
While past achievement have opened up new opportunities for development, they have also given rise to the following new challenges or tasks :

- maintaining a robust pace of economic "growth" to improve living standards and provide gainful employment to the rapidly expanding labor force;
- promoting "equity" by reducing poverty, abolishing regional earning differentials, and broadening participation in development; and
- protecting the "environment" by conserving resources and limiting pollution.

Regarding the prospect of the agricultural sector, the share of agriculture in Gross Domestic Product (GDP) is expected to continue to decline from about 20% in 1990 to 15% by 2000 and further to 11% by 2010 as shown in Figure 2.1. Nevertheless, the agricultural sector will continue to play a vital role in the economy, as the main source of employment. Also, given supportive policies, the agricultural growth, while slowing, could still average 3% per annum

during the period of 1990 to 2010 and thereby continue to contribute to raising living standards and reducing poverty.

Figure 2.1 Outlook of Economic Structure



Source: Indonesia - Sustaining Development, 1994, The World Bank.

The self-sufficiency in staple food (rice) was attained during the period of the PJP-II. However, such achievement or success did not necessarily lead to the increase of farmers' income. In 1996, Indonesia still has about 22.5 million poor people, equivalent to 11.3 % of the total population, and majority of them (15.3 million or 68 %) live in rural area.

In Repelita VI (1994/95 - 1998/99), GOI targets a further reduction in absolute poverty to 6 % of the population by 1999 and is implementing special poverty alleviation programs in the "less-developed villages". The main targets to be reached in Repelita VI are the following:

- Average annual economic growth rate : 7.1% (revised in August 1995 from the initial target set at 6.2%)
- Annual population growth rate : 1.5% at the final plan year (1999)
- Per capita Gross National Product (GNP) : Over US\$1,280 at the final plan year (1999)
- Population living in absolute poverty : Less than 1.2 million people or 6% of the total population at the final plan year (1999)

Among others, the major policy objectives in the agricultural sector are as indicated below:

- Agricultural human resources development;
- Natural resources management;
- Agricultural research development and adoption of appropriate science and technology;
- Strengthening of agricultural institutions including public agencies, farmers' organizations and economic institutions;

- Food self-sufficiency and promotion of food and nutrition diversification;
- Betterment of integrated farming system, especially small scale farming;
- Alleviation of poverty;
- Improvement of agro-industry, marketing and trading, focusing upon agricultural products processing, quality and standard, information and promotion, marketing system, export and market expansion, and pricing policy;
- Intensification of agricultural investment;
- Establishment of administration and control system; and
- Strengthening of sectoral and international cooperation.

Since the middle of 1997, the country and its people are placed in serious socio-economic situation due to the financial crisis caused by currency turmoil. Presently, GOI is striving for re-structuring/restoring its financial structure.

2.3 Fruit Production Development Policy and Target

(1) Policy Background

Up to the early 1980s, GOI had concentrated its available resources of research, extension, seed multiplication and farm inputs into intensive activities to realize rice self-sufficiency. Direct subsidies on fertilizer and chemical inputs together with concessive credit arrangements and price support schemes for rice stimulated production. Since rice self-sufficiency was achieved in 1984, such heavy subsidies have been progressively removed and GOI has been directing efforts toward diversification into higher value crops such as horticulture, especially fruit and vegetables.

In line with such crop diversification policy, several studies on horticultural development focusing on fruit and vegetables were carried out in the 1980s by MOA and the Ministry of Industry with GOI's budget or foreign technical assistance such as FAO/UNDP, the World Bank, the Asian Development Bank (ADB), the German Government, and the United States Agency for International Development (USAID). However, the development target levels set up in these studies were too high compared with the actual condition of the horticultural sub-sector. As a result, none of various projects proposed by these studies has been implemented so far with the only exceptional case of USAID's technical assistance program focusing on technical information services.

Horticultural development has been assisted recently by GOI's development incentives in line with the policy of moving toward a more competitive agricultural sector. More attention is paid to fruit production development in Repelita VI, because fruit crops have a big opportunity as

one of the sources for major growth in food crops and the horticultural sub-sector. Development of fruit production is directed toward:

- increasing income of community;
- increasing farmers' welfare;
- creating job opportunities; and
- increasing foreign currency earning.

Therefore a strong policy, considering the targets to be reached, problems faced and the potential and prospect of fruit production development, is needed.

(2) Development Target

During the period of 1985 to 1990, GDP of food crops and the horticultural sub-sector increased from Rp. 11,894 billion to Rp. 13,558 billion based on 1993 constant price with an annual average growth rate of 2.65%. Based on the past achievements, GOI set the GDP targets for food crops and the horticultural sub-sector in Repelita VI as shown in Table 2.1. The production targets of food and horticultural crops in Repelita VI are summarized in Table AT-2-1.

Table 2.1 GDP Targets and Position of Food Crops and Horticultural Production in Repelita VI

	1993	1994	1995	1996	1997	1998	Growth Rate 1993-1998
GDP of Food Crops and Horticultural Sub-sector (Rp. billion)							
· Constant Price 1983	14,598	14,963	15,337	15,736	16,129	16,533	2.52
· Constant Price 1989	26,573	27,237	27,918	28,644	29,360	30,094	2.52
- Share of Crops (%)							
1) Rice	54.67	54.35	54.02	53.68	53.33	52.95	-
2) Palawija (Secondary crops)	25.78	25.75	25.73	25.71	25.71	25.74	-
· Corn	8.28	8.37	8.47	8.56	8.65	8.74	-
· Soybean	4.65	4.68	4.70	4.73	4.75	4.77	-
· Cassava	7.27	7.69	6.92	6.76	6.59	6.43	-
· Sweet potato	1.31	1.31	1.30	1.29	1.28	1.27	-
· Peanut	3.38	3.38	3.39	3.42	3.46	3.54	-
· Mungbean	0.90	0.92	0.94	0.96	0.98	1.00	-
3) Horticulture	19.55	19.90	20.25	20.61	20.96	21.31	-
· Vegetables	6.69	6.68	7.02	7.19	7.36	7.53	-
· Fruit	12.86	13.04	13.23	13.42	13.60	13.78	-
Total	100.00	100.00	100.00	100.00	100.00	100.00	-

Source: Policy and Development Pattern of Food Crops and Horticultural Production, DGFCH.

Table AT-2-2 presents the actual contributions to the national GDP of the agricultural sector as well as food crops and the horticultural sub-sector during the period of 1994 to 1996. Food crops and the horticultural sub-sector had still the highest contribution, nearly 53%, to GDP of the agricultural sector compared to other sub-sectors of estate, livestock and fishery, with a higher growth rate (3.5%) than the target (2.52%) set in Repelita VI.

The current development tendency indicates the transformation of the economic structure, where the agricultural sector with food and horticultural crops initially played the major role as the backbone and then has stepwise shifted to the support of industrial and other sectors for pushing the national economic growth. Therefore, the important thing to think about is how to create the condition that the agricultural sector in general and particularly food crops and the horticultural sub-sector are not left behind the other sectors and able to sustain the development for creating a balanced economic structure.

2.4 Organization for Fruit Development and Financial System

(1) Central Level

At the national level, DGFCH is primarily responsible for horticultural development under MOA, of which structural organization is as shown in Figure AT-2-1. Based on the Decision Letter of MOA No.96/Kpts/OT.210/2/1/1994, the main task of DGFCH is to assist the Minister for Agriculture in formulating and implementing policies for the development of food crops and the horticultural sub-sector.

In principle, DGFCH implements a series of technical services covering planning and programming of food crops and horticultural development, guidance on and monitoring of the use of seeds, optimization of rice and Palawija production, and utilization of agricultural tools and machinery. Moreover, DGFCH takes charge of development and optimization of production of fruit, vegetables, ornamental and medicinal crops, guiding and improving agribusiness, and farmers' entrepreneurship. Farmland development and rehabilitation, water management and integrated pest management are also executed by DGFCH.

To assume the above tasks and duties, DGFCH is composed of the Secretariat of Director General and seven Technical Directorates as illustrated in Figure AT-2-2. The total number of permanent staff attached to DGFCH is 1,098 as of 1997 as shown in Table 2.2. Among the seven Directorates, the Directorate of Horticultural Production Development is mainly responsible for technical and administrative assistance in horticultural development by using the national development budget. The total number of staff of this Directorate is 101.

Table 2.2 Number of Staff by Directorate in DGFCH

(Unit: person)

Directorate	Echelon						Total
	Functional		Non-functional				
	III	IV	IV	III	II	I	
Secretariat of Director General	5	16	10	55	124	36	246
Programming Development	4	13	0	55	46	8	126
Seed Development	4	16	2	51	36	8	117
Food Crops Production Development	4	14	1	51	51	10	131
Horticultural Production Development	4	14	4	39	31	9	101
Land Rehabilitation and Development	4	14	3	43	55	9	128
Farm Business and Processing Development	5	20	4	60	35	5	129
Plant Protection Development	4	16	5	47	41	7	120
Total	34	123	29	401	419	92	1,098

Note: Not including functional structural employees.

Source: JUMLAH PEGAWAI REPUBLIK INDONESIA, DGFCH, 1996

The Sub-directorate of Fruit Production under the Directorate of Horticulture Production Development is responsible for provision of guidance on optimization of fruit production through efficient use of land, production input facilities, and technology application. The total number of staff of this Sub-directorate is 11 comprising one Head, four staff for the Land Utilization Section, three for the Production Input & Facilities Section, and three for the Technology Application Section.

As the tasks and functions of DGFCH related to horticultural development cover a wide scope of activities in several specific fields, another three Directorates under DGFCH are involved in administrative activities related to horticultural development. These are the Sub-directorate of Horticulture Seed Development under the Directorate of Seed Development, the Sub-directorate of Horticulture Post-harvest under the Directorate of Farm Business and Processing Development, and the Sub-directorate of Integrated Pest Management for Horticulture under the Directorate of Plant Protection Development. Table AT-2-3 shows the allocation of staff for the respective Sub-directorates related to horticultural services in DGFCH.

(2) Local Level

Administratively, the Provincial Agricultural Services Office is in charge of planning and monitoring of horticultural development programs and projects under the direction of the Governor of each Province. Each Provincial Agricultural Services Office has divisions (Sub-dinas) which correspond to the Directorates of DGFCH. Between DGFCH and the respective Provincial Agricultural Services Offices, there are two channels for keeping technical and administrative coordination: One is a direct linkage, while the other is through the Regional Office (KANWIL) of MOA, as illustrated in Figure AT-2-3.

At the District (Kabupaten) level, the chief called Bupati has the administrative authority on overall development issues. Under the direction of Bupati, the District Agricultural Services Office is responsible for the implementation and management of horticultural development programs and projects. Each District Agricultural Services Office also has sections equivalent to the Provincial Agricultural Services Office.

At the Sub-district (Kecamatan) level, the chief called Camat is responsible for coordination activities between Bupati and each village head called Kepala Desa under the direction of Bupati. At the village level, Kepala Desa is used to play a role as an intermediate for smooth implementation of the programs and projects, and to disseminate information to farmers.

(3) Finance for Fruit Production Development

In Indonesia, there are two kinds of fund sources in the development budget. One is the "National Budget of Receipts and Expenditure (APBN)" which is disbursed to development projects based on the national development plan.

The other is the fund source (APBD-I and APBD-II) which is raised by the respective Provincial and District governments themselves. This fund is mainly allocated to the local development projects planned and designed by the local governments. For implementation of these local projects, the national budget is often appropriated as an additional finance. The costs for operations and management of the projects implemented with the APBN, are usually covered by the local government funds.

In the fiscal year 1995/96, the revenue of the central government amounted to Rp. 72.4 trillion, while its expenditure for development projects was Rp. 29.8 trillion, accounting for 41.1% of the total revenue. On the other hand, the total revenue of the local governments as a whole amounted to Rp. 24.1 trillion in the same year, while its development expenditure was Rp. 9.5 trillion, accounting for 39.4% of its total revenue. The percentages of development budgets in each revenue of the Provincial and District governments, range from 20% (minimum) to 75% (maximum) according to the respective socio-economic conditions.

2.5 Previous and On-going Horticultural Development Programs

In the 1988 GBHN, the development policy for the Fifth-Five Year Development Plan (Replita V: 1989/90 to 1993/94) was focused on to economic development with emphasis on the agricultural sector to maintain rice self-sufficiency and to diversify food and horticultural crop production. Since then, GOI placed stress on the effective utilization of land resources through crop diversification in non-paddy areas. In line with this policy and strategy, DGFCH started to implement the following horticultural development programs by allocating the APBN:

- Fruit Crops Production Center (Sentra Produksi Buah-Buahan);
- Farm Operation in Special Area (Usahatani di Wilayah Khusus);
- Integrated Farm Operation in Marginal Land (Usahatani Terpadu di Lahan Marginal); and
- Integrated Rural Agricultural Project (Proyek Pertanian Rakyat Terpadu).

As to the "Fruit Crops Production Center", a part of the program was realized with financial support of Sector Program Loans (SPL) provided by the Overseas Economic Cooperation Fund of Japan (OECF). The above programs were implemented by the Sub-directorate of Fruit Production under the Directorate of Horticulture Production, DGFCH. Main purposes of the programs are:

- To promote production of horticultural crops in farmlands;
- To improve the quality of fruit; and
- To assure stable supply of fresh fruit or raw materials to markets and processing industries.

For most of these programs, the development scale was limited to less than 50 ha at the initial stage because of too many selected sites for development. However, considering the salability or marketability of their products, its scale was increased to 500 ha by limiting the number of development sites. Under the above horticultural development programs, 19 kinds of fruit trees were planted throughout the country covering area of 174,719 ha. The major fruits are citrus, durian, mango, and rambutan. All the programs were supported with a single year financial scheme by providing fruit seedlings and agro-chemicals to farmers. Furthermore, no budgetary arrangement was taken up for the second year to assist farmers in technical and financial aspects for planted fruit trees. Accordingly, the idea to establish fruit production estate could not be realized.

In due consideration of a wide range of experiences learned through the implementation of the above single-year financed programs, MOA formulated a new multi-year financed program in 1995/96 from the viewpoint of integrated approach to horticultural development by undertaking a feasibility study under the Agricultural Development Project by OECF. Based on the project implementation program as the final output of this study, GOI requested GOJ to provide financial assistance for the implementation of a newly formulated project called "Integrated Horticulture Development in Upland Areas (IHDUA)" in February 1996. After the project appraisal by OECF in April 1996 and loan preparation by both governments, the Loan Agreement for five-year financing was signed in December 1996 and DGFCH, as the project executing agency in MOA, commenced the IHDUA Project in April 1997. The loan eligible project components comprise not only procurement and distribution of planting materials but

also land development, inter-cropping of food crops, farm management, development of infrastructure and post-harvest facilities, installation of post-harvest and processing equipment, promotion of fruit marketing, set-up of fruit growers' groups, and training of project management and extension staff as well as participatory farmers, all of which are prerequisite for the creation of agribusiness-oriented orchards. The total development target area is 21,600 ha in 31 Districts of 15 Provinces with eight target fruits, namely banana, citrus, durian, mango, marquisa, melinjo, rambutan, and salak.

As shown in Table 2.3 presenting the horticultural development programs which were realized and are under way as of 1997 under DGFCH, the total land developed in the last seven years amounted to 222,670 ha. In 1996/97, the project components were broadly revised so that budget for rehabilitation of completed fruit production development programs and improvement of fruit seedling propagation and distribution system will be covered by APBN. As to the fund for implementation of the fruit production development program, GOI intends to rely on the OECF loan.

In addition to the programs listed above, several studies on horticultural development are being carried out by DGFCH with foreign technical assistance. A study, named "Indonesia Horticulture and Agribusiness Development" carried out by ADB in parallel with this master plan study was re-considered for future implementation, because the proposed development scale was rather small or judged as not so viable.

Table 2.3 Realized and On-going Horticultural Development Programs

(Unit: ha)

No.	Programs/Projects	'91/92	'92/93	'93/94	'94/95	'95/96	'96/97	'97/98	Total
1.	Fruit Production Center (APBN)	8,000	19,685	31,036	-	-	-	-	58,721
	- PRT DATII	-	-	-	30,538	8,856	5,100	-	44,494
	- Klonalisasi	-	-	-	-	-	21,650	1,050	22,700
	- NON SPAKU	-	-	-	-	-	4,275	4,750	9,025
	- Lembaga Mandiri	-	-	-	-	-	-	155	155
	- SPAKU	-	-	-	-	-	3,580	1,976	5,556
	- Pemeliharaan	-	-	-	-	-	-	1,000	1,000
	- Rehabilitasi Jeruk	-	-	-	-	-	1,225	1,000	2,225
2.	Fruit Production Center (SPL/OECF)	5,500	1,000	7,700	-	-	-	-	14,200
3.	Special Area Development (APBN)	-	1,030	2,325	-	-	-	-	3,355
4.	Marginal Area Development (APBN)	17,926	24,337	16,786	-	-	-	-	59,049
5.	Integrated Rural Agricultural Development (APBN)	-	-	-	4,500	-	-	-	4,500
6.	Integrated Horticulture Development in Upland Areas (IHDUA/OECF)	-	-	-	-	-	-	2,190	2,190
	Total	31,426	46,052	57,847	35,038	8,856	35,830	12,121	222,670

Source: Directorate of Horticulture Production, DGFCH

CHAPTER 3 PRESENT CONDITION OF FRUIT PRODUCTION SUB-SECTOR IN INDONESIA

3.1 Socio-economic and Agro-ecological Conditions

(1) Socio-economic Aspects of the Fruit Production Sub-sector

Indonesia with a total area of 1,919,317 km² is the largest archipelago nation consisting of five major islands (Sumatra, Kalimantan, Java, Sulawesi, and Irian Jaya) and about 30 smaller island groups. The population of Indonesia in 1996 is estimated at some 198.3 million, which is translated to 101 persons/km² in terms of average population density.

The Gross Domestic Product (GDP) for farm food crops subsector including the horticulture amounted to Rp.33,650 billion in 1996 and accounted for about 8.1% of its GDP total. Its annual average growth rate was about 3.1% during the period from 1994 to 1996.

Horticulture consists of four main crops; vegetables, fruit, ornamental plants, and medicinal crops, each consisting of many kinds of crops. In the past, horticultural development had been constrained by GOI's concentration on the policy of rice self sufficiency. However, the horticultural sub-sector is nowadays considered the most effective tool to generate employment opportunities and strongly supported by GOI. Several positive initiatives are taken by GOI to stimulate horticultural production and agribusiness development including budgetary support.

(2) Agro-ecological Conditions

Due to its geographic shape which is long in the west-east direction along the Equator and its undulating terrains, Indonesia covers a wide variety of agro-ecological and agro-climatic zones. Geographically, the country extends from latitude 6° N to 11° S, and from longitude 95° E to 141° E, or about 2,000 km north to south by 5,000 km east to west, approximately centered on the Equator.

The climate is highly diverse, reflecting the country's wide variety of agro-ecological zones ranging from coastal lowlands to high altitude mountains and ranges, and featured by two distinctive seasons which generally change every six months. The driest season is used to be in June to September and the wettest season from December to March. Spreading over a tropical zone, year-round average humidity is relatively high ranging from 70% to 90%. Temperature remains constant throughout the year, while sunshine, wind and particularly rainfall vary between the seasons according to the apparent migration of the sun between the tropics. As a result, most of the country enjoys a moist tropical climate with abundant rain and high temperature. With the exception of rainfall, climatic conditions at a particular place vary little

throughout the year.

3.2 Fruit Seedling Propagation and Control System

(1) Research and Development (R&D) of Fruit Seedlings

In MOA, the Agency for Agricultural Research and Development (AARD) takes charge of overall technical and administrative management of agricultural R&D works through its one secretariat and 10 centers. Of these, the Research Institute Center for Horticulture covers technology development for vegetables, fruit, and ornamental plants. Its R&D activities are split into three Research Institutes, located in Lembang in West Java for vegetables, Solok in West Sumatra for fruit, and in Jakarta for ornament plants. Among these, the Research Institute for fruit located at Solok is in charge of research and development with the following activities:

- Exploration, evaluation and conservation of plant genetic resources;
- Undertaking of research on breeding, plant physiology, crop management, plant protection, agro-ecology, agro-economy, post-harvest, and mechanization aspects;
- The priority fruits are banana, citrus, mango, mangosteen, and rambutan. Research on other fruits such as papaya, watermelon and melon is carried out on a cooperative basis;
- Undertaking of research on the technological components of orchard management system; and
- Services for research collaboration and dissemination.

With a view to evaluating new technologies developed by institutes, field trials are undertaken by 17 Institutes/Stations of Agriculture Technology Assessment (BPTP/LPTP) of AARD. In April 1998, it was decided to establish BPTPs in each Province throughout the country. However, at present, only one BPTP located at Sukarami in West Sumatra is responsible for assessment of the new technologies and varieties of fruit developed by the Research Institute for Fruits.

(2) Predominant and Recommended Varieties

Due to the wide agro-ecological variability within the country and as a result of the different needs for fruit in rural communities, a very large number of fruit species are grown in Indonesia. Most of these are well known indigenous species.

Proper selection of fruit varieties is of paramount importance, if the fruit crops are to be planted for a specific use or processing and the fruit market is to be expanded remarkably. In this regard, DGFCH has registered specific varieties of the respective fruit trees as recommended under the name of Minister for Agriculture through evaluation of the National Seed Board. Table AT-3-1 shows the latest list of recommended fruit varieties with data on their origin and location.

(3) Propagation of Fruit Seedlings

In MOA, technical directions on fruit seedling propagation at the central level are provided by the Sub-directorate of Horticulture Seed Development under the Directorate of Seed Development of DGFCH, and followed by the Central Seed Production Farm (BBI) in every Province. BBIs are established individually for paddy, Palawija crops, and vegetables, and fruit.

The tasks and functions of BBI for vegetables and fruit are as follows:

- Provision of up-trunks (scions) of mother plants and low-trunks of main trees;
- Management of foundation blocks and scion multiplication blocks;
- Observation of propagation technology;
- Seedling information center; and
- Provision of training and meeting forum for extension workers, key farmers, private nurseries, public officers and experts.

Main Seed Production Farms (BBU) established under BBIs for vegetables and fruit function as multiplication units for scions which come from the scion multiplication blocks of BBIs. The standard facilities of BBUs are to be equipped in line with their duties and commodity. The average size of a BBU is 5 ha.

The private sector is involved in import of new varieties of fruit plantlets and propagation of fruit seedlings in nurseries. The private nurseries also play an important role in not only propagation of certified seedlings from scions but also in production of rootstocks. Multiplication and distribution system for fruit seedlings is as shown in Figure AT-3-1.

(4) Fruit Seedling Certification and Control System

As a technical implementation unit of DGFCH, the Seed Control and Certification Services Offices for Food Crops and Horticulture (BPSB/TPH) have been established at 15 locations in Indonesia. The tasks and functions of BPSB are recognition of cultivars, certification of seed, examination of seed through laboratory analysis, and control of seed markets. The first three items are mainly applied to food crop seeds, while imported vegetable seeds and fruit plantlets

are examined by laboratory analysis. The certification granted for seeds and seedlings gives guarantee of place, package, and hierarchy of seed class. The certification system of seedlings for citrus is established and practiced by the agencies concerned. The certified fruit seedlings are labeled as follows:

- Breeder seedling is indicated by a white label;
- Foundation seedling is indicated by a white label;
- Stock seedling is indicated by a purple label; and
- Extension seedling is indicated by a blue label.

The certification system for other fruit seedlings has not yet been established so far. At present, all the certified seedlings, propagated by any means are labeled with pink labels by BPSB.

3.3 Fruit Growing and Production

(1) Fruit Growing

Fruit is mainly produced by small landholders. As these small landholders often grow a wide range of crops, the area of an individual crop is very small. Those who cultivate fruit among their crops have only a few and often only one tree of particular fruit.

Of all the countries in the tropics, Indonesia stands out as one with a rich variety of fruit growing activities and has practiced many forms of fruit growing. Fruit growers in Indonesia could be broadly classified into the following four types:

- Growers for home consumption characterized by a wide array of fruits, fruit trees planted in the home yard, harvest used mainly for home consumption and gift to neighbors and/or relatives, non-business motivation, low level farming technology, and small number of trees with no regular spacing and special cares;
- Small scale growers with a bit of business-mind featured by small scale farming with five to 20 trees of the same variety of fruit planted in the home yard, fruit selling benefit occupying an important share as income source, and fruit seedlings recommended by extension workers or procured from private nurseries;
- Intensive fruit growers whose fruit growing is the principal occupation based on monoculture-oriented orchard farm management with a relatively high technology, and main income from sale of fruit; and
- Large scale or corporate-typed growers whose farms are managed by large landholders or corporate bodies based on monoculture-typed plantation controlled

with advanced technologies and methods, and agribusiness with multi-activities covering production to processing and/or marketing of the products.

Among the above, the majority is the first type, while the second and fourth types predominate to a very limited extent. The present target of horticultural development is to create the third type on small landholding fields.

(2) Fruit Production

The actual production, harvested area and yield per hectare of all kinds of fruit from 1993 to 1996 are summarized in Table 3.1, and those of target fruits except mangosteen and marquisa from 1984 to 1996 are shown in Table AT-3-2. According to these tables, the fruit production grew at the annual average rate of 19.47% during the period of 1993-1996.

Table 3.1 Fruit Production, Harvested Area and Yield

Item	1993	1994	1995	1996*	Average Annual Growth Rate (%)
Production (1,000 tons)	5,629	6,403	10,922	11,468	19.47
Harvested Area (1,000 ha)	460	505	673	667	9.73
Yield (ton/ha)	12.23	12.68	16.22	17.21	8.92

Note: *; Preliminary figures

Source: Directorate of Horticulture Production Development, DGFCH

According to Figure AT-3-2 which illustrates the average annual productions of fruits, each of the four Study Provinces ranks at higher positions (within the top-five); sharing 27.5% of West Java, 19.3% of East Java, 5.6% of South Sulawesi and 5.6% of North Sumatra, respectively. These larger shares and rankings indicate the potentials of the Study Provinces in fruit production. The average actual production of the targeted fruits by Province from 1993 to 1996 is also presented in Figures AT-3-3 to A-3-11.

3.4 Pest and Disease

In the tropical region where the temperature and humidity are always high, there exist many kinds of pests and diseases throughout the year. However, in an area where the ecosystem is well balanced or functions soundly, a serious outbreak of pests and diseases is rarely taken place, because the rule of natural balance is used to work in such ecosystem. If its ecosystem is unbalanced or changed due to implementation of a large-scale and monoculture-typed orchard development project, it is possible that disease and pest break out and cause big damage and loss to the orchard management and fruit production as well. The major pests and diseases by target fruit tree are shown in Table 3.2.

Presently, the countermeasures to control the pests and diseases indicated in the above table are taken up only in relatively large-scale orchards and their experimental farms by using the corresponding insecticides and fungicides.

In the remote mountainous areas of outer island, fruit crops are often damaged by the predators such as wild boars, monkeys, squirrels and others.

Table 3.2 Major Pests and Diseases by Target Fruit Tree

Commodity	Pest	Disease
1. Avocado	Stem borer	Anthracnosa Scab Botryosphaeria fruit rot Phytophthora stem canker Phytophthora root rot
2. Banana	Banana weevil Banana scabmoth	Bacterial wilt Fusarium wilt Bunchy top virus Cercospora leaf spot
3. Duku	Fruit fly Fruit borer	Dieback gloeosporium
4. Durian	Stem borer Fruit borer Squirrel	Phytophthora root rot Phythium root rot Patch canker
5. Mango	Mango hoppers Mango weevil Fruit fly Stem borer	Anthracnose Powdery mildew Bark disease Pink disease
6. Mangosteen	Mite	Stem canker Physiological gamboge disorder
7. Marquisa	Fruit fly Mite California red scale Mealy bug	Fusarium wilt Brown spot Fruit scab
8. Rambutan	Leaf caterpillars	Powdery mildew
9. Salak	Weevils	Pink disease

Source : DGFCH

3.5 Post-harvest Handling and Processing

(1) Harvesting and Post-harvest Handling of Fruit

Harvesting of avocado, duku, mango, mangosteen, and rambutan is commonly done by climbing the tree or using a ladder or bamboo pole with a small cutter knife and pouch at the pole end. Banana bunches are usually harvested by joint work of a cutter and a helper, who are assisted by a group of carriers. Harvesting of durian depends on natural drop of fruits, and cut-grasses are used for covering the land around the tree to minimize damage by drop. Marquisa is harvested by picking by hand or collecting naturally dropped fruits. Harvesting of salak is done by cutting bunches of fruits.

Post-harvest treatment including cleaning, sorting, grading, etc. has not been practiced in a systematic way. Harvest is not always based on maturity indices. Packaging are limited to traditional methods using bamboo baskets and wooden cases, and in most cases, no special measure especially for high temperature is taken during transportation and storage of fruits, causing decrease in shelf life. Similarly, no packing house and storage facilities have been developed neither at production sites or regional markets. According to the proceedings of Australian Center of International Agricultural Research (ACIAR), post-harvest losses of fruit and vegetables are estimated at approximately 20% to 25%. The losses in other countries are reported to be 15% to 20% in Malaysia, 25% to 30% in Thailand, and 40% in the Philippines.

MOA is now preparing the specifications on quality standard for tropical fruits produced in Indonesia. Recently, specifications for several fruits have been published and some are ready for printing.

(2) Fruit Processing

Fruit processing can be classified into two types: one is small-scale production by traditional home industry, while the other is relatively large-scale food processing industry. Raw materials used for the home industry are avocado, banana, durian, mango, rambutan, and salak, and those for the processing factory are marquisa. The quantity and value of processed fruits in 1995 are shown in Table AT-3-2. Canned pineapple and fruit juice made of marquisa and orange occupy a major portion of the product and some quantity of banana is processed as chip and dried product. The total value of processed fruit amounted to Rp.140 billion in 1995.

Although processed pineapple products share 95 % of export volume and value, the remaining exported products comprising mainly fruit juice are well balanced with imported vegetables juice and processed products in terms of volume and value which are around 4,500 tons and US\$5 million every year, respectively. This fact reveals that fruit processing can be regarded as an important industry to utilize excess fruit, to absorb labor in rural area, and to acquire foreign exchange.

3.6 Fruit Marketing

(1) Distribution

In most cases, village collectors buy fruit from farmers in cash. Village collectors visit farmers carrying packaging materials with them and harvest fruit by themselves. After harvesting, they do sorting and grading prior to selling fresh fruits to traders of rural markets or wholesaler buyers from other Provinces or urban markets as illustrated in Figure AT-3-12.

The following systems are commonly observed in rural areas in trading and marketing fruits:

- The "Pajak" system is common only in North Sumatra. Traders buy fruit from farmers, while fruit is still on the trees and green or near to ripen stage. In this system, the growers have no attention to harvest results or harvesting activities;
- The "Ijon" system is common in Java and Sulawesi. Traders buy fruit from farmers by paying a cash long time before the harvest. This system is based on the good relationship or trust between the both parties;
- The "Tebasan" system is common in Java and Sulawesi. This is a buying system of fruit similar to the above "Ijon" system. In this system, traders buy the crops just before the harvest; and
- "Kontrak Pilih" is universal in Indonesia. This is a contract system for purchasing the specific products with the selected growers. The grower makes a promise to sell his harvests, and the trader pays in advance a part of the contracted amount.

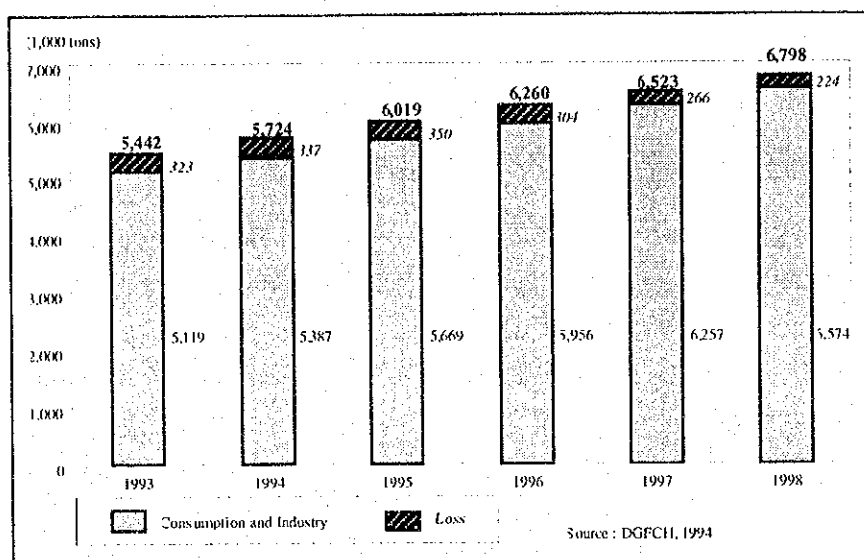
Transportation is a burden for traders. There are still few businesses specializing in transportation of fruit. Pick-up trucks are usually used for transportation by collectors. Large trucks are used in the case of inter-island transport, such as from North Sumatra to Jakarta and from South Sulawesi to East Kalimantan.

(2) Fruit Consumption

The production figure in 1996 corresponded to 37.8 kg per capita allotment for the nation. This is far beyond the nationwide figure of per capita fruit consumption that is 24.49 kg, according to the National Economic Survey at 1996 as shown in Table AT-3-3. A per capita fruit consumption of 60 kg is recommended by the Food and Agriculture Organization (FAO) to maintain sound human health.

The average monthly per capita expenditure for fruit is shown in Table AT-3-4. It increased from Rp.1,191 in 1993 to Rp.2,021 in 1996. The ratio of fruit expenditure in food also increased 0.4% for three years and reached 5.2 % in 1996. This trend can be more clearly proved in the urban area. The per capita fruit consumption in the urban area increased more than 10% between 1993 and 1996. The consumption trend in the urban area has shifted from banana to apple, mango and orange, while that in the rural area has still more directed to banana and less to apple and orange. Due to the gradual decrease of post-harvest losses, the demand for vegetables and fruit for direct consumption and processing during the period of 1993 to 1998 is projected to increase 5.1% per year as shown in Figure 3.1.

Figure 3.1 Fruit Demand Projection between 1993 and 1998



(3) Export/Import

Table 3.3 indicates the export and import volumes of fresh fruit during five years from 1992 to 1996.

Table 3.3 Indonesia's Export and Import of Fresh Fruit, 1992-1996
(Unit : ton)

Year \ Item	1992	1993	1994	1995	1996	Av. Growth Rate (%)
- Import	6,368	29,595	40,895	68,923	93,842	(95.93)
- Export	43,881	73,137	83,760	122,907	97,503	(22.09)
- Balance	-37,514	-43,542	-42,865	-53,984	-3,660	-

Source : Vademekum Pemasaran 1986-1996

Although the export volume of fresh fruit is still negligible in the country, it shows a remarkable increase (about 15 times) from 6,368 tons in 1992 to 93,842 tons in 1996. On the other hand, its import volume increased nearly three times from 43,881 tons in 1992 to 122,907 tons in 1995, but it decreased to 97,503 tons in 1996. The average annual growth rate of imported fruit was 22.1% during this period. As to the export/ import balance, it shows a continued "minus", as shown in the above table.

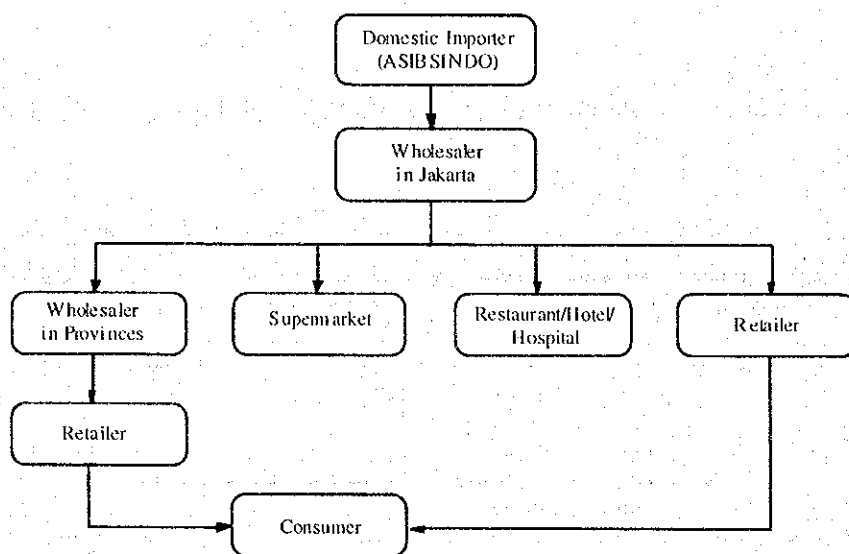
Table AT-3-5 shows the export quantity and value of Indonesian tropical fruits (fresh or chilled). The quantity is extremely small nevertheless prospected markets exist in the neighboring Asian countries. Fresh banana including plantain was exported in the largest quantity, amounting to 101,495 tons in 1996. The second largest export quantity is that of

mangosteen, fresh or chilled, with 1,981 tons followed by mango, fresh or chilled, with 566 tons, and durian with 307 tons.

Mangosteen, mango, and durian are exported by air cargo because their quantity is still small for ship cargo and no cold storage transportation system is available.

Table AT-3-6 shows the import quantity and value of tropical and sub-tropical fruits in 1996. It is apparent that about 5,000 tons of tropical fruits were imported. Another attention should be paid to the rapid increase of the import quantity of temperate fruits such as apple, mandarin, pear and orange, reaching more than 100,000 tons in quantity and US\$70 million in value. However, the quantity of imported fruit depends to a large extent on the economic situation, and for the time being, it tends to decrease. The marketing system of imported fruit is as shown in Figure 3.2.

Figure 3.2 Marketing System of Imported Fruit



Source: DGFCH

3.7 Supporting Services and Farmers' Organization/Cooperative

(1) Extension Services and Training

Institutionally, the Ministry of Home Affairs has jurisdiction over provision of agricultural extension services to farmers and each District authority is responsible for management of extension activities at the field level. On the other hand, MOA functions as a supporting agency for provision of technical assistant services to extension workers at the field level.

Under MOA, the Center for Agricultural Extension (CAE) under the Secretariat General takes

charge mainly of designing of extension policies, planning of extension activities, and improvement of the extension methodology and working system as well as upgrading of human resource and institutional development of DGFCH and the other three Directorate Generals, namely Estate, Fishery, and Livestock Services. On the other hand, the Agency for Agricultural Education and Training (AAET) is responsible for management of agricultural training and education activities through its three Centers for Agricultural Education Development, Personnel Training and Education, and Extension Training and Education. Regular training services are provided through the Regional Training and Education Centers established at 33 locations throughout the country.

Every Provincial Agricultural Services Office is responsible for supporting daily agricultural extension activities done by the respective District Government Offices. At District level, Rural Agricultural Extension Centers are established for covering independently food crops, estate crops, livestock, and fisheries. To strengthen and enhance extension services of these Centers in response to practical needs at the field level, the Rural Agricultural Information and Extension Center is under set-up by each District Government Office.

A total of 32,771 Agricultural Field Extension Workers (PPL) attached to 1,718 Rural Agricultural Extension Centers and 247 District Government Offices are engaged in general extension activities under Bupati's direction throughout the country. Agricultural Extension Specialists (PPS) who are positioned in CAE are spread to the Regional Offices and BPTP of MOA, Agricultural, Estate, Livestock and Fisheries Services Offices of Provincial and District Governments as well as the Rural Agricultural Information and Extension Centers at District level. Basically, one to 16 PPS are assigned to each District Government for dissemination of agricultural information to both PPL and farmers' groups. Another duties of PPS cover the conduct of staff training as well as upgrading courses and seminars for PPL at the Rural Agricultural Information and Extension Centers. The courses provided at these Centers usually range from one to three days at maximum.

In general, one PPL takes care of 16 farmers' groups covering an area of two to five villages (Desa), depending on the farming intensity of the area. This is equivalent to about 1,600 farmers per PPL. Each PPL is responsible for calling on each group once every two weeks. Extension services are mostly provided on the basis of the "Training and Visit model" advocated by the World Bank known as LAKU system in Indonesia. This system takes three steps in providing the farming techniques to the majority of farmers:

- Step 1: Each PPL gives technical instructions to the contact farmer (Kontak Tani) who is usually the representative of Desa or farmers' group;
- Step 2: Each Kontak Tani instructs the key members of the farmers' group (Kelompok Tani) in their acquired techniques; and

- Step 3: These group representatives disseminate the acquired techniques to the remainder of the group.

Extension services for fruit growing are the responsibility of the Food Crops PPL who are principally in charge of extension services for food crops. In general, however, very few of PPS and PPL are specialized in horticulture, inclusive of fruit growing and post-harvest handling activities.

(2) Credit Facilities

In Indonesia, two types of farm credit facilities handled by KUD are available: One is the Small Traders Credit Program (Kredit Candak Kulak, KCK) applied to low income groups and petty traders with a loan repayment period of one year. This credit service started in 1976 and restarted in 1995 after a 10-year suspension due to accumulation of bad debts. The other is Farm Credit (Kredit Usaha Tani, KUT) extended to farmers with loan repayment period of seven months and an interest rate of 14% per annum. The finance source of this credit facility is the Bank Rakyat Indonesia (BRI) which is one of state banks. The credit is disbursed to farmers through KUD designated by the BRI as short-term working capital to purchase seeds, fertilizers and agro-chemicals as well as living expenses for the period from planting to harvesting.

Another credit menu financed by the Central Bank of the Republic of Indonesia (Bank Indonesia, BI) is provided to KUD called Cooperatives Credit (KKUD) and to members of KUD called Unit Village Cooperative Members Credit (KKPA). The former offers short-term working capital with the same loan condition as KUT, while the latter provides one-year short term working capital, and 10-year long term investment fund up to Rp.50 million. Of similar type to the latter credit facility is the State-owned Company Profit Fund which started its services in 1990.

(3) Farmers' Organization

Farmers' group specializing in fruit growing and trading are not yet organized in Indonesia. However, most farmers are members of Farmers' Groups (Kelompok Tani) at Desa level which is a commune-based non-administrative unit aiming mainly at paddy and Palawija crop cultivation. Each Kelompok Tani organized at Desa level consists of approximately five to 35 farmers who have participated in voluntarily. In the country, one or more Kelompok Tani exist at 53.3% of Desas in total. One of the most important functions of Kelompok Tani is to keep contact with PPL.

Besides farmers' organization, some social groups are active to promote rural development at

Desa level. The Rural Community Institution (LKMD) is one of the Desa administrative bodies to unite voluntary social groups and to control a wide range of public activities. With its realistic and sound activities up to date, LKMD has been exerting big influences on life and living of the farmers in rural areas. From this respect, the social groups like LKMD are expected to play an important role in bottom-up or grass-root type rural development.

(4) Village Cooperative Units

Village Cooperative Units (Koperasi Unit Desa, KUD) have been established as GOI-sponsored institutions rather than voluntary grass-roots associations. The Ministry of Cooperatives and Small Enterprises Development is the agency responsible for the control of KUD activities. According to the 1993 Agricultural Census, the total number of KUD in Indonesia was 7,707 units. This is still below the Ministry's target of 18,206 units. Based on status of activities, KUD is classified into three types; KUD Mandiri, Potential KUD Mandiri, and Not Yet KUD Mandiri. Of these, KUD Mandiri stands for self-reliant KUD. As of 1993, the total number of active KUD Mandiri in Indonesia was 4,092, accounting for 61.0% of the total active KUD of 6,699.

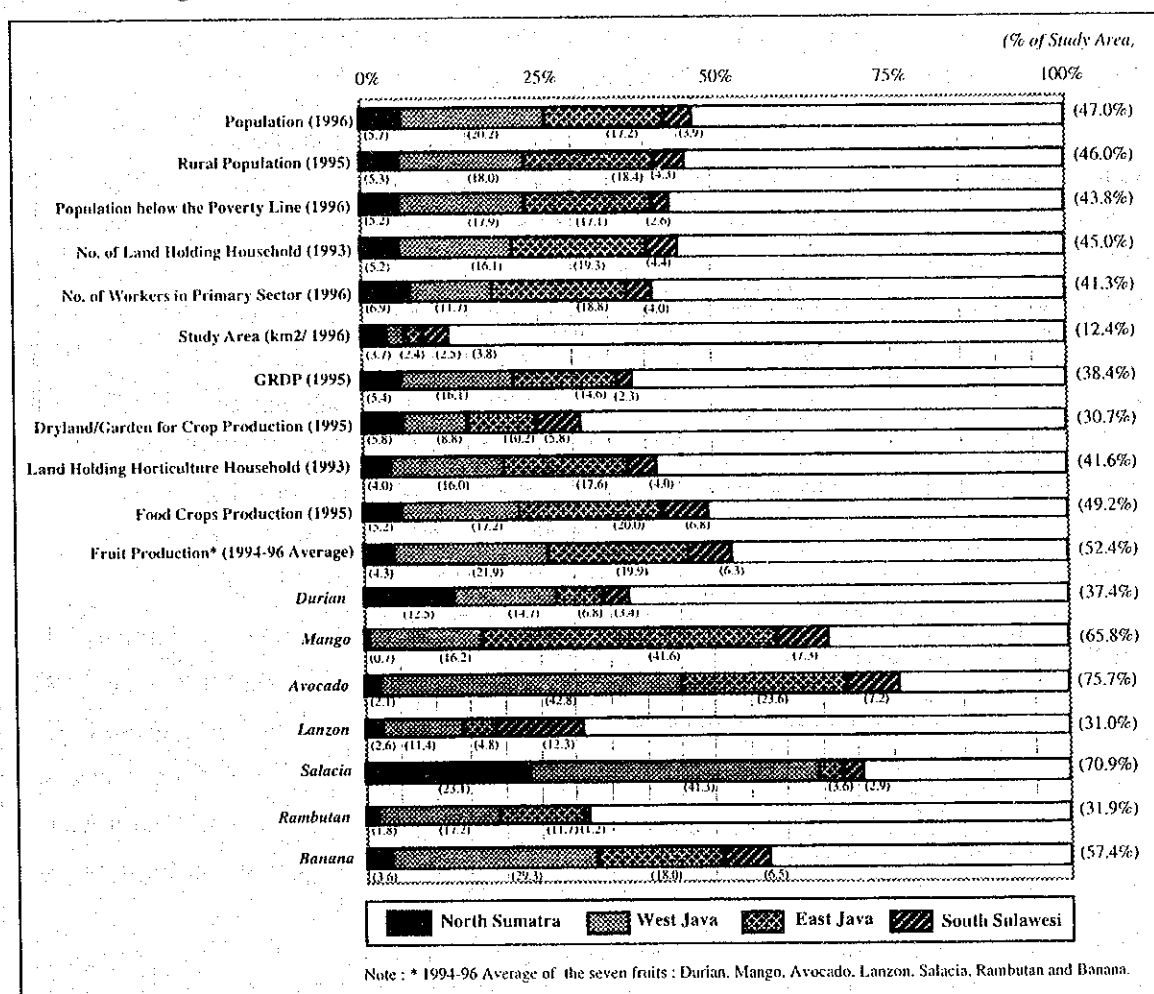
The cooperative law revised in 1992 requests KUD to make their cooperative operations more independent and more market-oriented in accordance with the national policy. In line with this policy, Repelita VI directs the main items for strengthening KUD's activities including marketing and human resources development.

CHAPTER 4 FRUIT DEVELOPMENT IN THE STUDY AREA

4.1 Position of the Study Area

Indonesia's economy, reflecting its physical geography, climate and political history, is significantly different in each region, ecological zone and even in each respective area. The relative position of the Study Area in the national socio-economic and spatial development could be perceived or realized with the key indicators graphed in Figure 4.1.

Figure 4.1 Proportions of the Study Area to the Country's Totals



Sources: Statistical Year Books of Indonesia 1993-1996; Agricultural Census 1993, BPS

Although the total land area of the Study Area occupies only 12.4% of the country's total, most of the Area's socio-economic indicators like population and GRDP share from 40% to 50% of the country's totals. The Study Area consisting of four Provinces includes almost all types of socio-economic and agro-ecological features and is endowed with a relatively wide range of natural resources.

4.2 Socio-economic Conditions

(1) Administrative Division

Administratively, Indonesia is divided into central and local level units. The latter comprise 27 Provinces including one Special Capital District (D.K.I. Jakarta) and two Special Districts (D.I. Aceh and D.I. Yogyakarta). Under each Province, there are administrative units consisting of District/Municipality (Kabupaten/Kotamadya), Sub-district (Kecamatan), and Village (Desa) in hierarchy order. The area and number of administrative units in the Study Area as of 1996 are as shown in Table 4.1.

Table 4.1 Area and Number of Administrative Units in Four Provinces

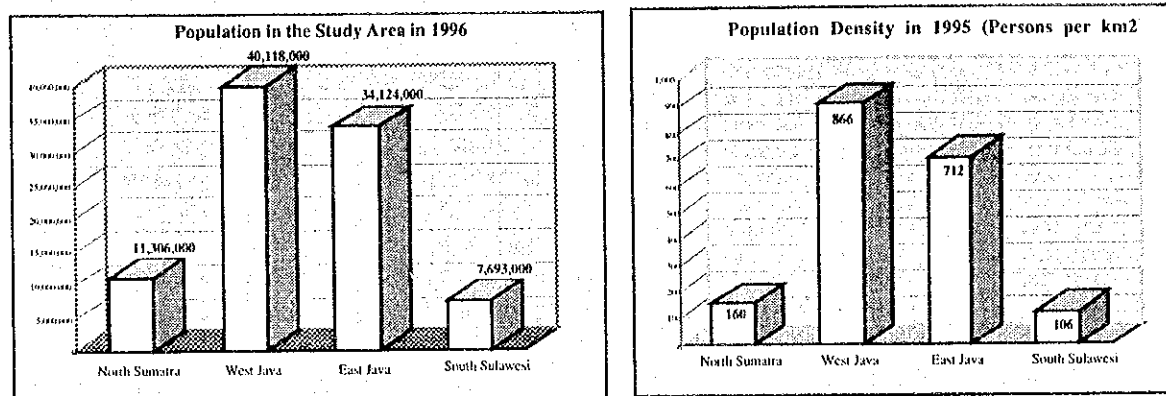
Province	Area (km ²)	% to Whole Area	No. of Districts	No. of Municipalities	No. of Sub-districts	No. of Villages
North Sumatra	70,787	3.69	11	6	252	5,242
West Java	46,300	2.41	20	5	529	7,166
East Java	47,921	2.50	29	8	615	8,426
South Sulawesi	72,781	3.79	21	2	185	2,878
Study Area	237,789	12.39	81	21	1,581	23,712
(% to Total)	(12.4)		(32.8)	(33.3)	(39.3)	(35.8)
Indonesia	1,919,317	100.00	247	63	4,022	66,158

Source: Statistical Year Book of Indonesia, 1996 and Environmental Statistics of Indonesia 1996. BPS.

(2) Population

The population in the Study Area is estimated at some 93.2 million in 1996 as summarized in Table AT-4-1 and Figure 4.2. This accounts for about 47% of Indonesia's population. The population in the Study Area grew at rates varying from 2.12% per year in West Java to 0.82% in East Java between 1990 and 1996. The annual growth rates of 1.64% in North Sumatra and 1.63% in South Sulawesi were nearly equal to the national rate of 1.7% per year in the same period. The highest population density is 847 person/km² in West Java, while the lowest is 106 person/km² in South Sulawesi.

Figure 4.2 Population and Population Density in the Study Area



Source: Statistical Year Book of Indonesia, 1996

As to the urban and rural population distribution in each of the four Provinces, South Sulawesi, which is deemed an agro-based region, shows the largest share of rural population (71.7%). On the contrary, North Sumatra has a relatively large urban population share of 41.1%, next to that of West Java (42.7%) as shown in Table 4.2.

Table 4.2 Urban/Rural Population Distribution in 1990 and 1995

(Unit 1,000 persons)

Province	Population Distribution 1990		Population Distribution in 1995 (Urban+Rural=100%)				Growth Rate (% in 1990-95)	
	Urban	Rural	Urban (%)	Rural (%)	% to Total	% to Total	Urban	Rural
North Sumatra	3,639	6,613	4,568 (41.1)	6,547 (58.9)	(6.5)	(5.2)	4.65	-0.20
West Java	12,208	23,170	16,738 (42.7)	22,469 (57.3)	(23.9)	(18.0)	6.51	-0.61
East Java	8,916	23,572	10,850 (32.1)	22,994 (67.9)	(15.5)	(18.4)	4.06	-0.50
South Sulawesi	1,685	5,295	2,137 (28.3)	5,422 (71.7)	(3.1)	(4.3)	4.86	0.47
Study Area (% to Total)	26,448 (47.75)	58,650 (47.37)	34,293 (49.03)	57,432 (46.01)	(49.0)	(46.0)	5.33	-0.42
Indonesia (Total)	55,391	123,808	69,937 (35.9)	124,818 (64.1)	(100.0)	(100.0)	4.77	0.16

Source: Statistical Year Book of Indonesia, 1995 & 1996 and SUPAS 1995

On the other hand, the average annual urban population in West Java was 6.51 % during the period of 1990-95, while that in East Java was 4.06 % which is less than 4.77 % of the national average. The higher growth rate in West Java implies the inflow of population from the metropolitan area.

Based on the population growth rates estimated up to the year 2000 by the Central Bureau of Statistics, the population in the Study Area up to the year 2015 was projected as shown in Table 4.3. In Indonesia, it is also estimated that the population growth declines gradually. Such tendency will slow labor force growth and cause in the future labor market tightening because of the several factors like longer school attendance of young generation, increase of aged population and so on.

Table 4.3 Population Projection and Annual Growth Rate

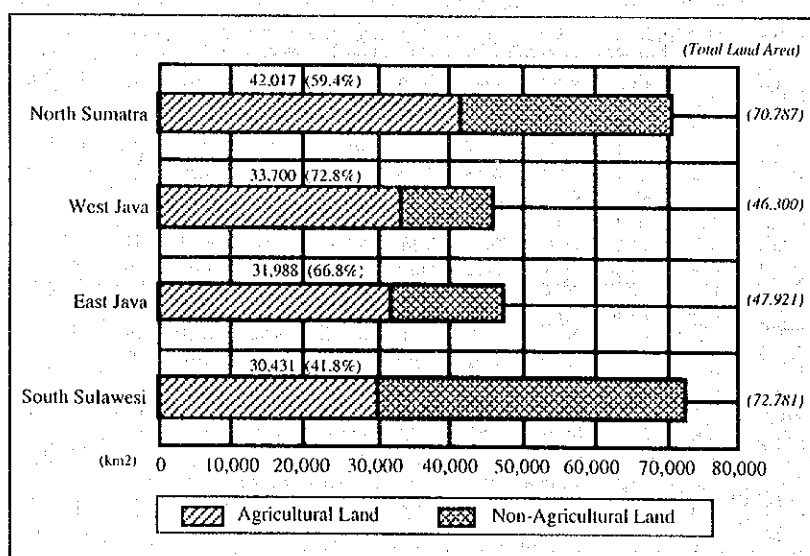
Year	North Sumatra		West Java		East Java		South Sulawesi	
	Growth Rate (%)	Population (thousand)	Growth Rate (%)	Population (thousand)	Growth Rate (%)	Population (thousand)	Growth Rate (%)	Population (thousand)
1990-1995	1.62	11,145.3	2.06	39,336.5	0.82	33,885.9	1.61	7,577.8
1995-2000	1.35	11,915.1	1.93	43,285.3	0.63	34,972.2	1.46	8,149.3
2000-2005	1.12	12,597.5	1.81	47,347.0	0.49	35,837.5	1.33	8,705.8
2005-2010	0.93	13,194.2	1.70	51,510.7	0.39	36,541.8	1.21	9,245.4
2010-2015	0.78	13,716.9	1.59	55,738.1	0.30	37,093.2	1.11	9,770.1

Notes: 1) Proyeksi - Penduduk Indonesia Per Kabupaten/ Kotamadya, 1990-2000, BPS.
 2) Figures in 1995 and 2000 are the estimates of the Central Bureau of Statistics.
 3) Populations in 2005 to 2015 are estimated by the JICA Team.

(3) Land Use and Landholding System

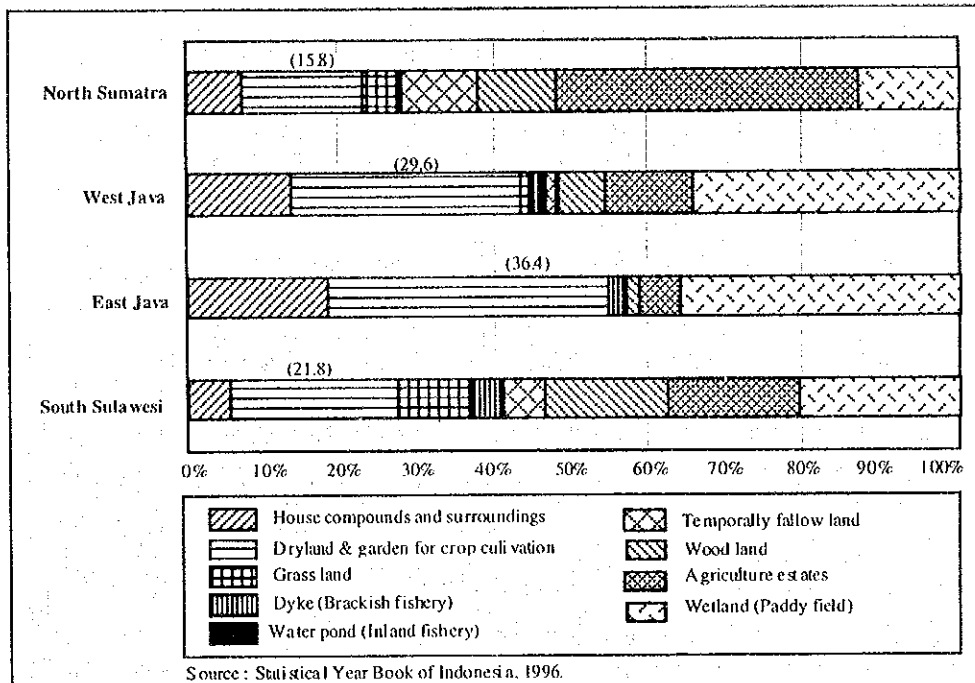
Figure 4.3 indicates agricultural land of four Provinces. As shown in Table AT-4-2 and Figure 4.4, the agricultural land is classified into nine categories : house compound and surroundings, dryland and garden for crop cultivation, glass land, dyke (brackish fishery), water pond (inland fishery), temporarily fallow land, wood land, agricultural estates and wetland (paddy field).

Figure 4.3 Land Area of Four Provinces



Source: Statistical Year Book of Indonesia, 1996

Figure 4.4 Agricultural Land Use in Four Provinces



There are several forms of land ownership as described below:

- Absolute ownership with a certificate of title is the most secure type of ownership, and is granted only to Indonesian citizens;
- Land owned by GOI may be leased to a person or company under the land use right (HGU=Hak Guna Usaha) system. The period of HGU lease is usually 35 years but longer periods may be negotiated depending on the development. Investments in perennial tree crops with a life expectancy exceeding this lease period or those requiring a large initial capital for infrastructure development could apply for an extension of the HGU term;
- Traditional ownership exists in some Provinces where village or "clan" ownership replaces individual ownership. Collectively all the members of a village or family clan are the recognized owners of an area of land although they may not have certificate of title to that land; and
- GOI's vacant land and private land are often occupied and farmed by people who have no right or title to use that land. Such situation may continue for many years or even generations, and can lead to disputes, if development is proposed by the rightful owner of the land.

(4) Landholding Farm Households

In the Study Area, the total number of farm households engaging in horticulture amounted to about 2 million in 1993, accounting for 22.6% of the total number of landholding farm households as shown in Table 4.4. The District level data on the number of farm households engaging in horticulture are given in Tables AT-4-3 to AT-4-6.

Table 4.4 Number of Landholding Farm Households in 1993

Province	Landholding Farm Household			Paddy, Palawija crops	Horticultural Households			Estates Crops	Livestock Farming
	No. Households	(%)	(%)		No.	(%)	(%)		
North Sumatra	1,017,915	(11.5)	(5.2)	869,770	191,452	(9.6)	(4.0)	379,420	191,895
West Java	3,172,219	(35.8)	(16.1)	2,910,659	768,712	(38.4)	(16.0)	503,994	381,240
East Java	3,813,763	(43.0)	(19.3)	3,306,474	849,068	(42.4)	(17.6)	1,012,523	1,486,334
South Sulawesi	860,758	(9.7)	(4.4)	743,798	191,273	(9.6)	(4.0)	380,143	285,616
Study Area (% to Total Indonesia)	8,864,655	(100.0)	(45.0)	7,830,701 (45.5)	2,000,505	(100.0)	(41.5)	2,276,080 (36.5)	2,345,085 (45.6)
Indonesia	19,713,80	-	(100.0)	17,213,742	4,817,636	-	(100.0)	6,244,343	5,146,447

Source: Biro Pusat Statistik, Sensus Pertanian, 1993

The average land size ranges from 0.48 ha to 1.10 ha per household as shown below.

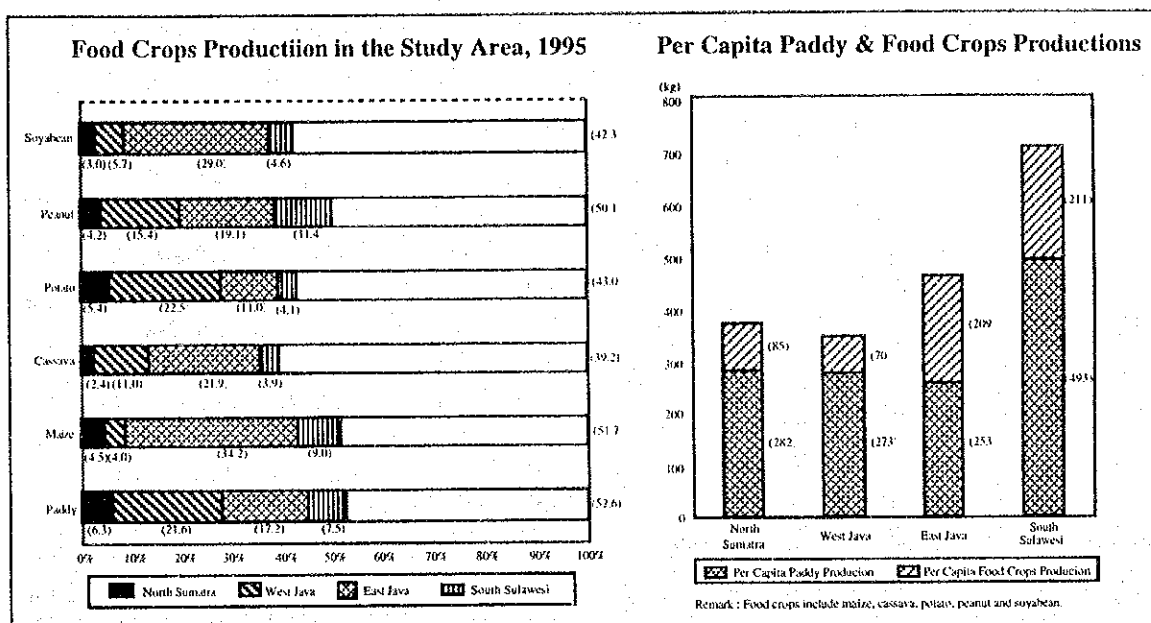
- North Sumatra	:	0.96 ha
- West Java	:	0.48 ha
- East Java	:	0.48 ha
- South Sulawesi	:	1.10 ha

Source: Biro Pusat Statistik, Sensus Pertanian, 1993

(5) Food Crops Production

For most of the small-scale landholding farmers in the Study Area, the production of food crops including rice and upland field crops is the mainstay of their livelihood. As shown in Figure 4.5 and Table AT-4-7, East Java is the largest producer of food crops among the four Provinces. The surplus production of paddy and other food crops in South Sulawesi covers staple food requirements of other Provinces located in the eastern part of Indonesia.

Figure 4.5 Food Crops Production and Its Per Capita Production in Four Provinces



Source: Environmental Statistics of Indonesia 1996, BPS.

(6) Farm Economy

As shown in Table 4.5, the contribution of the agricultural sector to rural household income was still dominant at an average of 45.1%, ranging between 35.7% in West Java and over 51.6% in South Sulawesi.

Table 4.5 Agricultural Share in Rural Household Income and Real Income Per Capita at 1983 Constant Price

Province	Agriculture Share		Income Per Capita (Rp.1,000)		
	1987	1990	1987	1990	Growth (%/year)
North Sumatra	50.8	43.5	190.2	183.2	-1.2
West Java	28.1	35.7	171.3	188.2	3.2
East Java	40.7	45.3	170.5	175.2	0.9
South Sulawesi	58.3	51.6	154.2	176.5	4.6
Indonesia	46.8	45.1	183.5	189.0	1.0

Source: National Economic Census (Susenas) 1987 and 1990, CBS; and The Sixth Five-Year Agriculture Development Plan (Replita VI Pertanian)

Based on the National Economic Census data, the real per capita income of rural households in major provinces and regions ranged from Rp.175,000 to Rp.210,000 per year. During the period of 1987 to 1990, the real per capita income of rural households increased 1% per annum. The highest increase was recorded in South Sulawesi (4.6%) followed by West Java Province (3.2%).

During the same period, the real per capita income of rural households in North Sumatra, where the role of the estate sub-sector is quite important, showed a tendency of decline. This was mainly due to the lower growth rate of estate commodity prices than the inflation rate, coupled with the relatively slow increase of smallholders' productivity.

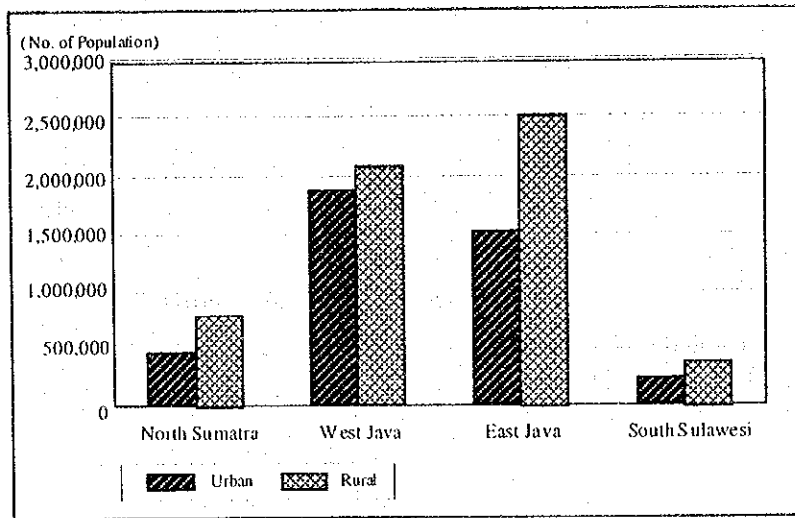
This divergence is closely related to the level of development and regional economic diversification. It is noteworthy that West Java, which is adjacent to Jakarta, showed a relatively small agricultural income share, while in the eastern regions the share of agricultural income is still dominant.

(7) Poverty in Rural Areas

It is generally acknowledged in Indonesia that poverty cannot be measured solely in terms of consumption or income, and that a more comprehensive definition must take account of basic needs and of what is considered to be a minimum standard of living. These basic needs include health, life expectancy, primary education, access to clean drinking water, and public services. In 1996, the official national poverty lines were about Rp.27,413 (\$13.7) per capita per month in rural areas and Rp.38,246 (\$19.1) in urban areas. The poverty line is defined as the minimum income needed to purchase food of 2,100 calories per capita per day plus other essential items including housing, fuel, clothing, education, health, and transport. However, the poverty lines vary in each Province depending on average prices. Poverty in Indonesia is now increasingly localized by geographical location, occupation, household size, age, gender, education and other characteristics. The poverty incidence both in urban and rural areas of the four Provinces is shown in Figure 4.6.

The poverty incidence is higher in rural areas than in urban areas. It is also noted that East Java has the biggest number of rural poor amounting to over 2.5 million or 16.5% of the country's total rural poor, followed by 13.6% in West Java, 5.1% in North Sumatra, and 2.5% in South Sulawesi as shown in Table AT-4-8.

Figure 4.6 Population below the Poverty Line in the Study Area



4.3 Agro-ecological Conditions

(1) Physiography

The physiography of the Study Area is as outlined below:

North Sumatra is composed of four physiologic zones: Eastern Coastal Swamplands, Eastern Plains and Hills, Barisan Mountains, and Western Foothills and Plains. The Eastern Coastal Swamplands zone facing the Strait of Malacca is made up of a complex of advancing riverine flood plains, estuaries, marine foreshores and alluvial basins. The Eastern Plains and Hills zone is featured by monotonous rolling sedimentary plains and hills at an altitude varying from 50 to 200 m. The Barisan Mountains zone forms a prominent high backbone of the island and commonly reaches 2,000 m in elevation. The Western Foothills and Plains zone comprises a discontinuous strip of alluvial outwash plains and dissected hills. This zone faces the Mentawai Strait of the Indian Ocean;

West Java and East Java consist of four physiologic zones: Northern Alluvial Plains, Northern Foothills and Plains, Central Volcano Mountains, and Southern Dissected Plateaus and Plains. The Northern Alluvial Plains zone is dominated by alluvial plains, mainly derived from sediments laid down by many rivers draining the interior volcanic mountains. The Northern Foothills and Plains zone has landforms ranging from undulating to rolling hills and hillocky plains. Dissection of the landscape by dense stream networks has resulted in low ridge systems with short but usually steep side slopes; and

- South Sulawesi is formed by three physiographic zones: Southwestern Plains and Mountains, Eastern Mountains and Karst, and Central Mountains. The Southwestern Plains and Mountains zone is the most extensively developed in the Province. It is characterized by cultivated alluvial and undulating sedimentary plains, and wooded low hills separated by sparsely forested mountain ranges and young volcanoes. The Eastern Mountains and Karst zone extends in the northeastern part of South Sulawesi. This zone is separated from the Central Mountains zone by a major tectonic and stratigraphic break. The southern boundary of the Central Mountains zone marks an equally sharp change from the mountains in the Southwestern Plains and Mountains zone.

(2) Climate

In Java, most areas receive rainfall of 2,000 mm to 4,000 mm annually. The driest areas with rainfall of less than 1,500 mm exist along the north coast, reaching Asembagus in the northeast, the driest area in Java, with a minimum rainfall of less than 1,000 mm. There are dry inter-montane basins with rainfall of less than 2,000 mm around Bandung and Garut in West Java, and around Kediri and the Malang basin in East Java.

In Sumatra, rainfall distribution is strongly influenced by the Barisan Mountains. These lie very close to the west coast and separate a narrow and wet coastal strip to the west from broad and relatively dry plains to the east. Mean annual rainfall in Sumatra is mostly less than 3,000 mm, falling below 1,500 mm in the northeast coast and below 2,000 mm in several inter-montane basins from Aceh to Bengkulu.

In Sulawesi, rainfall distribution reflects the complex topography. Most areas receive 1,500 mm to 3,000 mm of rain per year, with less than 1,500 mm in narrow strips of land in the southern coastal area.

Seasonal variation of mean temperature is small. Elevation accounts for all the regional variation and creates a latitudinal stratification of natural vegetation and cultivated crop types. Below elevation of 500 m, temperature variations relate to differences of latitude, topography and aspect, and are usually 3°C to 4°C. Above elevation of 500 m, mean maximum temperature continues to decrease by about 6.01°C/1,000 m increase in elevation.

Mean monthly relative humidity is uniformly high, and exceeds 80% in most months. High humidity greatly favors fungal and bacterial growth in the soil and on plants, and can be a major limitation to successful and economical cultivation of crops such as cocoa, mangosteen, and others.

Surface winds are generally weak. Typical wind speeds vary from 2 to 3 m/s in the coastal areas to 1 m/s in inland areas. Very strong gusts of gale force can occur at or after the equinoxes (March to April and September to October), particularly in upland areas. Wind often causes severe damage to tree crops, particularly the newly planted young ones.

Sunshine generally decreases with increasing rainfall and altitude, but the numerous small high inter-montane basins in both Sumatra and Java are dry and consequently sunny. Sunshine increases towards the southeast of Indonesia, showing a strong negative correlation with cloudiness and rainfall. Cloud cover is always low in the southeast, offering ideal climatic conditions for crops requiring high levels of incident radiation, and always high in Sumatra, where in general only those crops tolerant to low levels of insolation are likely to thrive.

The agroclimatic zones recognized in the report "The Land Resources of Indonesia: A National Overview" consist of permanently dry, seasonally dry, seasonally wet, permanently wet, and permanently cool or highland zones. Within the cool/highland zone, sub-montane and montane and alpine sub-zones are recognizable. The agroclimatic zones of the Study Area are as shown in Table 4.6.

Table 4.6 Agroclimatic Zones of the Study Area

Island Groups	HOT								COOL				Total			
	Wet (12wm)		Moist (0-4dm)		Dry (5-8dm)		Arid (9-12dm)		Wet (12wm)		Moist (0-4dm)				Dry (5-8dm)	
	km2	(%)	km2	(%)	km2	(%)	km2	(%)	km2	(%)	km2	(%)	km2	(%)	km2	(%)
- Java / Bali	1,010	(0.7)	61,025	(44.2)	52,724	(38.1)	0	(0.0)	897	(0.6)	20,192	(14.6)	2,356	(1.7)	138,204	(100.0)
- Sumatra	8,187	(1.7)	416,989	(87.7)	1,570	(0.3)	0	(0.0)	2,131	(0.4)	46,432	(9.8)	0	(0.0)	475,309	(100.0)
- Sulawesi	0	(0.0)	138,936	(74.6)	8,971	(4.8)	224	(0.1)	0	(0.0)	37,790	(20.3)	224	(0.1)	186,145	(100.0)
- Kalimantan	105,149	(19.6)	410,059	(76.5)	224	(0.0)	0	(0.0)	12,555	(2.3)	7,847	(1.5)	0	(0.0)	535,834	(100.0)
- Nusa Tenggara	0	(0.0)	20,409	(25.3)	52,706	(65.3)	2,803	(3.5)	0	(0.0)	3,813	(4.7)	1,009	(1.2)	80,740	(100.0)
- Maluku	0	(0.0)	68,940	(88.4)	5,941	(7.6)	336	(0.4)	0	(0.0)	2,578	(3.3)	224	(0.3)	78,019	(100.0)
- Irian Jaya	91,193		222,543		20,415		0		59,898		20,751		0		414,800	(0.0)
Total	205,539		1,338,901		142,551		3,363		75,481		139,403		3,813		1,909,051	(0.0)

Note: The island groups covering the Study Area are in "Bold".

Source: The Land Resources of Indonesia: A National Overview (Main Report), May 1990, Regional Physical Planning Programme for Transmigration

(3) Soils

Indonesian soils range from highly fertile to virtually sterile with a wide range of intermediate conditions. Each plant has its own ideal range of soil requirements, both physical and chemical. Soil texture, depth, drainage and ten aspects of chemical fertility are used in the suitability assessment. It is said that soil is not so important limiting factor as agro-climate, because low fertility can be improved by appropriate fertilizer application. However, the practicality of doing this is a matter of availability, cost, and ease of supply. Although the most important

fertilizers are commercially available in the major distribution centers, their cost to the average smallholder in the greater part of the country is prohibitive in spite of public subsidies.

4.4 Characteristics of Target Fruits

Salient features of nine target fruits are outlined below:

Avocado is considered one of the most nutritious and wholesome fruits. In Indonesia, avocado trees grow widely from lowlands up to highlands with an elevation of 1,500 m or more above sea level and grow well if the groundwater table is about 2 m deep. Flowering time of avocado generally starts at the end of the dry season every year. After six months, the fruit could be harvested.

Banana has high calorie (refer to Table C5.1 of Appendix C), and is the most widely and commonly grown fruit in the country. Agro-ecological conditions for optimum growth of banana are monthly rainfall equivalent to 200 mm, temperature between 15.6 and 35 °C, and deep and friable loamy soils with good drainage and aeration. Banana is a fast growing plant that yields a heavy crop within a short period. The fruit is available in the market throughout the year.

Duku is also a popular tropical fruit in the country, grown in home yards. Duku is a humid tropical plant and grows well in the lowland area at an elevation of lower than 650 m above sea level. It thrives in different kinds of soil which have effective depth, enough moisture and rich organic matter, and also prefers to grow in the shade area.

Durian is the most highly valued fruit. Durian requires high humidity and high temperature. It thrives well in the areas with annual precipitation of more than 2,000 mm and optimum temperature ranging from 27 to 32 °C. Durian grows in areas with an elevation of up to 700 m above sea level, where rainfall is distributed throughout the year, and the groundwater table is below 2 m depth. Durian is a highly cross-pollinated plant, therefore at least two varieties or more need to be planted in the field so as to assure a high percentage of fruit set. After five years from planting, grafted or budded durian trees will start flowering and the fruit will be harvested after three to five months flowering.

Mango fruit has a valuable nutritional supplement. Mango belongs to the dry lowland crops. It grows well in areas with an elevation up to 500 m above sea level with a definite alternation of wet and dry seasons. Mango can grow at a wide range of temperature, but the ideal growth takes place at 23.9 to 26.7°C. It also grows well under a wide range of annual rainfall from 750 to 2,500 mm provided that there is a timely dry season for flowering. Although mango may be grown on a wide range of soil types from light to heavy texture, alluvial loamy soils

fertile and deep with good drainage have always given the best yields. Grafted or budded trees start bearing about five years after planting. Mango trees are irregular bearers and production varies from year to year. A heavy bearing year is often followed by one or more years of light harvests.

Mangosteen is considered the most delicious fruit of the tropics originated in Indonesia. Mangosteen belongs to the plants of Asian rain forest zone, and needs a humid and equatorial climate with no dry season or only a short one. It will thrive in different kinds of soils which are moist and rich in organic matter. Mangosteen grows in shade areas with an elevation of up to 800 m above sea level, where rain falls all the year, but its growth is very slow.

Marquisa is well known as "passion fruit" and has good marketing prospects in Indonesia or abroad. As marquisa is a climbing plant, it needs a supporting structure for its growing. Marquisa grows well in highland areas with an elevation between 1,000 m and 2,000 m above sea level. It requires a warm climate with a well distributed rainfall for its optimum growth and fruit bearing. Rainfall of 1,200 mm distributed throughout the year is considered essential for commercial marquisa growing. The plant is also sensitive to temperature and grows well between 20°C and 30°C. The soils for marquisa should be deep, well drained, and sandy loam to sandy clay loam in texture. From six to nine months after planting, the first fruits may be harvested. The flowers are produced at the end of the wet season so that the fruits will be harvested in the dry season.

Rambutan is popular in Indonesia. It has a good nutritive value as a source of ascorbic acid or vitamin C. Rambutan is strictly a tropical lowland crop. It thrives best in humid and hot regions where rainfall is well distributed. Annual precipitation ranging from 2,000 mm to 5,000 mm is generally suitable for rambutan cultivation. Rambutan grows well in areas with an elevation up to 600 m above sea level, having the groundwater table depth of not more than 2 m, and deep loamy soils with good drainage. Vegetative plantlets will be fruiting from two to five years after planting, while budded or grafted trees will be fruiting from four to five years, and air-layering from two to three years. As rambutan starts flowering at the end of dry season, harvesting time will be in wet season every year.

Salak known as "snake" fruit by foreigners is a rain forest palm native to Indonesia. Salak grows well in humid lowland areas with an elevation of up to 500 m, where rainfall is distributed all the year. In the dryer areas, with six dry months, salak plant may tolerate to grow well if groundwater table is not more than 1.5 m in depth. Young and bearing salak plants need heavy shade. As salak is dioecious, both male and female trees must be present in a planting. From three years after planting, the fruits of salak can be harvested. It takes seven months from female flower pollination to fruit harvesting.