STUDY REPORT

ON

THE POSTHARVEST LOSSES

IN

THE REPUBLIC OF INDONESIA

NOVEMBER 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

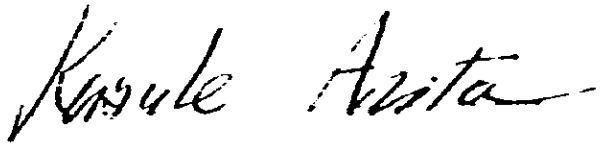
In response to the request of the Government of the Republic of Indonesia the Government of Japan decided to conduct a survey on the problem of post-harvest losses of rice and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to Indonesia a survey team headed by Mr. Hidekazu Komuro from September to November, 1981 and from February to May, 1982.

The team exchanged views with the Indonesian authorities concerned and conducted a field survey in eight provinces (Aceh, South Sumatra, Lampung, West Jawa, Central Jawa, East Jawa, South Sulawesi, South Kalimantan). After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will contribute to the achievement by Indonesia of self-sufficiency in rice and to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the team.

November, 1982



Keisuke Arita
President
Japan International Cooperation Agency

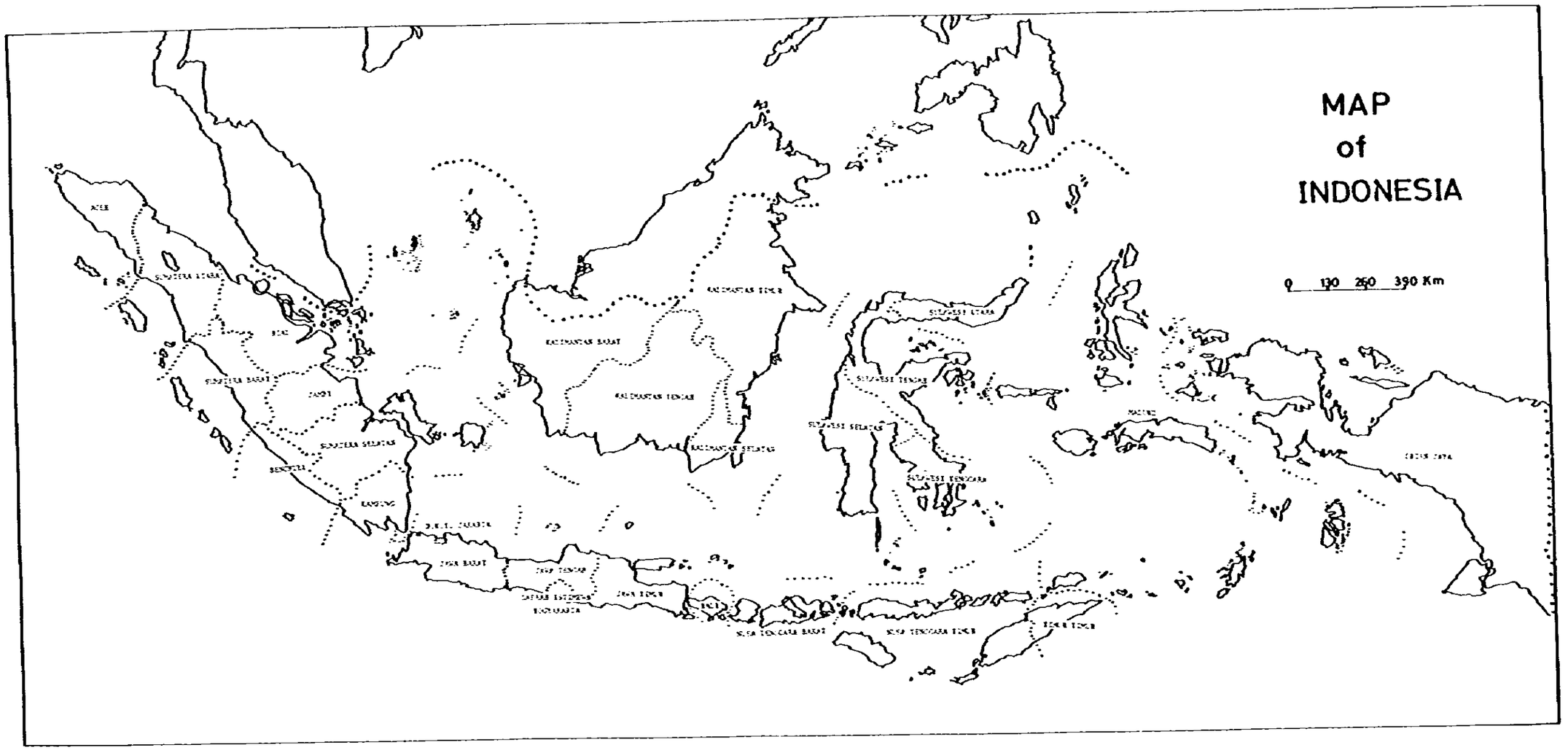

MAP
of
INDONESIA
0 130 260 390 Km

Photo 1 People gathering in paddy field for harvesting at Karawang, West Jawa

(It is not rare in this area to have 150 - 200 harvesters per one hectare)

Photo 2 Conducting survey in the field

(Collecting shattered kernels and paddy Panicls)

Photo 3 Test for reaping with Power Reaper

(Survey employed harvesting machinery)

Photo 4 Paddy piling after harvest in field at Aceh

(Quality deterioration is remarkably in this piling)

Photo 5 Threshing by beating at Bekasi, West Jawa

(Heavy losses are always observed in this work)

Photo 6 Test for threshing with power thresher

Photo 7 Harvesters receiving their Bawon for work

Photo 8 Drying paddy at the farm level

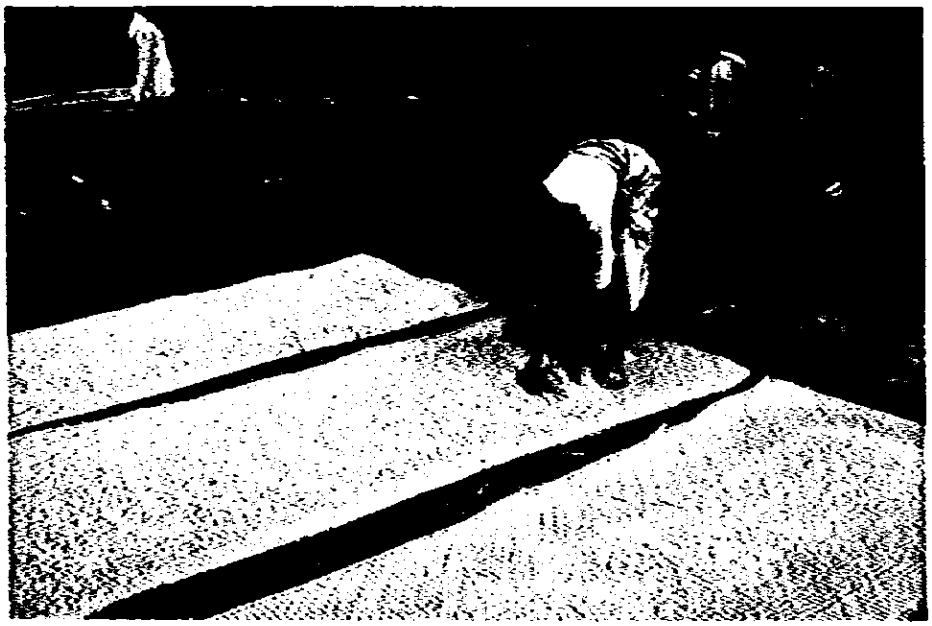


Photo 9 Engelberg milling machines are still employed at custom mills in villages

Photo 10 Test for husking with test huller

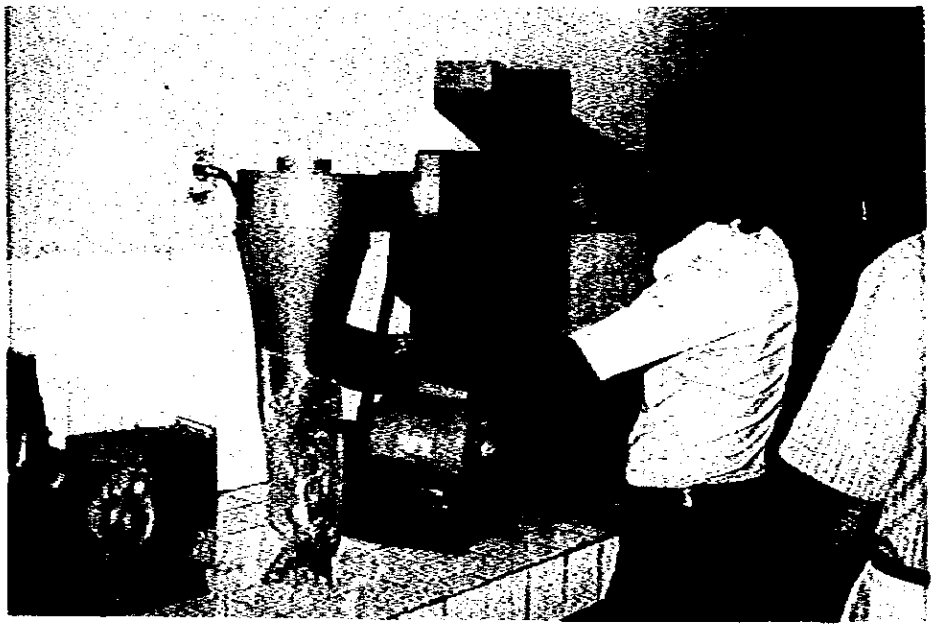


Photo 11 Simulation Test for Storage

(A self-recording hygrothermometer is placed on top)

Photo 12 Damaged condition of wet paddy during temporary storage

(Occurred at farm and KUD level in rainy season)

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ABBREVIATION AND GLOSSARY

Ani-ani	Small finger knife to cut the rice stalk
BIMAS	Bimbingan Masal (Intensification Program)
Beca	Bicycle propelled rickshaw
Benih or bibit	Seed
Beras	Milled rice, uncooked
Beras bersih	Clean rice
Beras giling	Milled rice
Beras kepala	Whole rice (0.6 of a kernel or larger)
Beras ketan	Glutinous rice
Beras kuning	Yellowish rice
Beras merah	Red rice
Beras patah	Broken rice (less than 0.6 of a kernel)
Beras putih	White rice, sometimes broadly used to refer to rice of first quality
Beras sosoh	Polished rice
Beras tumbuk	Hand-pounded rice
BRI	Bank Rakyat Indonesia (Rural Bank)
BULOG	Badan Urusan Logistik (The National Food Stock Authority)
BUUD	Badan Usaha Unit Desa (Village pre-cooperative)
CBS	Central Bureau of Statistics
CRIA (CRIFC)	Central Research Institute for Agriculture, the predecessor of Central Institute for Food Crops
Dalal	Broker
Dedak	Chaff
Dedak besar	Course bran
Desa	Village
DOLOG	Depot Logistik (Regional Food Depot)
FAO	Food and Agriculture Organization

Gabah	Threshed paddy or paddy
Gabug	Empty rice kernel
Goni	Gunny sack (jute or plastic)
Grossier	Wholesaler
Dudang	Warehouse or godown
Harga	Price
Hasil	Yield
HYV	High yielding variety
Ijon	Purchase of field products before harvest
Ijuk	Palm fiber
INMAS	Intensifikasi Masal (Informal Intensification Program)
INSUS	Special Intensification Program
IR	International Rice (variety) bred at IRRI
IRRI	International Rice Research Institute
Kabupaten (Pemda)	District
Katul	Bran
Kecamatan	Sub-District
Kelompok Tani	Farmers group
Kepala	Head, Chief
Kontak tani	Leading farmer
Koperasi Unit Desa (KUD)	Village Cooperative Unit
LP3	Lembaga Pusat Penelitian Pertanian (Central Agricultural Research Institute)
LRM	Large rice mill
Lumbung	Storage building for rice at farm level
Makelar	Broker
Mendong	Fine polishing
Menir	Very small broken rice

Merang	Straw from stalk paddy
Nasi	Cooked rice
Ojek	Trader with bicycle
Padi basah	Wet stalk paddy
Padi gogo	Stalk paddy from upland dry cultivation
Padi kering	Dry stalk paddy
Padi ladang	Stalk paddy from shifting cultivation
Padi-padian	Staple foods
Padi sawah	Stalk paddy from wet cultivation
Padi Sentra	Paddy Center, a form of farmer's cooperative
Paceklik	The season before harvesting of paddy
Palawija	Non-rice staples or secondary crops
Pasar	Market
Pasar Pusat	Central market
Pasar Induk	Central wholesale market
Pecah kulit	Husked or brown rice
Pedagang	Merchant
Padagang bearas	Rice merchant
Padagang berkeliling	Circulating merchant
Pedagang besar	Large merchant
Pedagang eceran	Retailer
Padagang kecil	Small merchant
Padagang keliling	Peddler
Padagang pengumpul	Gathering trader
Penggilingan beras	Rice mill
Pengijon	Preharvest lender - usually on green rice
Petani	Farmer
Pikulan	Carrying pole
REPELITA Rencana Pembanguan Lima Ta un	Five Year Development Plan

REPELITA I Rencana Pembangunan Lima Tahun I	Five Year Development Plan I (1968/69 - 1973/74)
REPELITA II Rencana Pembangunan Lima Tahun II	Five Year Development Plan II (1973/74 - 1978/79)
REPELITA III Rencana Pembangunan Lima Tahun III	Five Year Development Plan III (1978/79 - 1983/84)
PKG	Padi Kering Giling paddy dried at 14% moisture content and cleaned at 3% foreign materials
PPK	Cooperative Service Center
PPL Penyuluh pertanian lapangan	Agricultural extension worker
PPS Penyuluh pertanian spesialis	Agricultural extension specialist
Propinsi (Pemda)	Province
PUSKUD Pusat Koperasi Unit Desa	Central Village Cooperative
Rata-rata	Average
Rendemen	Conversion ratio, for example, conversion of paddy to milled rice
Sandang	Carring pole
Sawah	Wet rice field
Sosohan	Rice polishings
RMU	Rice milling unit
RRH	Rubber roller huller
SRM	Small rice mill
Tanah	Soil
Tebasan	A system where the farmer sells his paddy in the field for harvesting purposes to a businessman

Tengkulak	Merchant/trader of farm produce including stalk paddy or gabah, usually a middleman collecting between the farmer and the market
Usaha tani	Farm
Warung	Roadside shop
Wereng	Brown plant hopper

Unit of Measurements

mm, m/m	:	millimeter
cm	:	centimeter
m	:	meter
km	:	kilometer
cm^2	:	square centimeter
m^2	:	square meter
km^2	:	square kilometer
ha	:	hectare
l	:	liter
m^3	:	cubic meter
m^3/sec	:	cubic meter per second
m^3/min	:	cubic meter per minute
m^3/sec. km^2	:	cubic meter per second per square kilometer
g	:	gram
kg	:	kilogram
kg/ha	:	kilogram per hectare
kg/cm^2	:	kilogram per square centimeter
ton, t	:	metric ton
ton/hr	:	metric ton per hour
ton/day	:	metric ton per day
sec	:	second
min	:	minute
hr	:	hour
%	:	per-cent
%/hr	:	per-cent per hour
°C	:	degree centigrade

hp	:	horse power
kcal	:	kilo calorie
kcal/hr	:	" per hour
V	:	volt
A	:	ampere
kW	:	kilowatt
kWh	:	kilowatt hour
kVA	:	kilo volt ampere
Rp	:	Rupia
¥	:	Yen
US$	:	US dollar
Max.	:	maximum
Min.	:	minimum
Ubinan	:	$6.25 m^2$ (2.5m x 2.5m)

SUMMARY

SUMMARY

1. Background of Postharvest Losses of Rice in Indonesia

The first and second five-year development plans undertaken in the Republic of Indonesia (hereinafter called Indonesia) for the increase of rice production (1968/69 - 1978/79) and the current third five-year plan (1979/80 - 1983/84) have given good results. Production has steadily grown. For instance, when Indonesia became an independent nation in 1945, its national rice product calculated on the basis of milled rice was 7.84 million tons. In 1968, at the commencement of the first five-year development plan, it was 11.67 million tons; and in 1981, during the third five-year plan, it was estimated to be 21.30 million tons.

These production increase plans were steadily developed with the following policies under the BIMAS scheme, namely intensified programs through which new technology of rice cultivation and also intensive implementation of Floor Price as for assured rice price; (1) Use of improved cultivation method (2) Extension of high yielding varieties (3) Improvement of control water resources (4) Proper application of fertilizer (5) Intensive pest control. Among the above technologies, the extension of high-yielding varieties introduced by the International Rice Research Institute (IRRI) in the latter part of the 1960s has had an especially powerful influence on the increase of rice production.

In traditional rice-producing countries, the farming work is based on traditional cultivation and harvesting methods in compliance with such local conditions as rainfall, temperature, and sunlight. Indonesia is no exception to this general rule. Introduction of new high-yielding varieties has required not only different cultivation ways with regard to irrigation, fertilizing, and pest control but also for innovation of postharvest practices.

Appropriate practices for almost all postharvest works such as harvesting, drying, cleaning at farm level have become necessary as well as providing postharvest machines and farming implements. Nevertheless, the Government policies were apt to incline toward pre-harvest for the increase in rice

production. In addition, the farming size of Indonesian rice farms is rather small, and a fundamental system for postharvest practices has not been statisfied yet. All of this means that Indonesia now faces difficult problems in trying to ensure that harvested paddy/rice is processed with minimum losses.

Nor are the farmers the only ones affected by these difficulties, the new system has brought confusion into the ranks of rice milling, storage and transport too, since they continue to cling to old habits and to work with rickety, outmoded equipment. In short, as production steadily increases, it accelerates at the same time the gravity of problems connected with milling, storage, and transportation.

Namely, as production of rice grows, inadequate procedures are causing growing quantitative and qualitative losses during the various stages of post-harvest practices.

2. Current State of Affairs

This survey investigates the losses occurring during postharvest practices in the dry season and the rainy season in four provinces. Tables 1 and 2 show the results of the survey. The values in the chart are based on assessments already formulated and listed in the Inception Report and are the outcome of surveys conducted from September, 1981, until May, 1982, by specialists in the fields of farms, transportation, storage, milling, and farm equipment with the cooperation of the Indonesian government.

Table 1 Quantitative Losses

(%)

Province / Stage	Aceh			West Java			South Sulawesi			South Kalimantan		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
Reaping	1.3	0.1	0.5	6.4	0.6	1.8	3.2	0.2	1.2	4.9	0.8	1.6
Threshing	2.0	0.0	0.4	4.7	0.1	0.5	7.4	1.5	3.5	4.2	0.0	1.0
Cleaning	2.3	0.0	0.3	-	-	-	-	-	-	0.5	0.0	0.1
Drying	0.1	0.0	0.0	-	-	-	-	-	-	1.0	0.0	0.0
Storage	2.1	0.2	0.3	4.2	0.8	0.6	0.9	0.3	0.4	5.9	0.4	0.5
Transportation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rice Milling	4.5	0.0	0.8	4.5	0.0	0.7	4.5	0.0	3.5	4.5	0.0	1.9

Notes: 1. The amount of losses in the provinces have been obtained from the subject districts and shown by areal pattern.

2. The amount of losses are the actual results of the survey, and all weight measurement of rice are based on 14% of moisture content and 3% of foreign materials.

3. Transportation means the carrying stage between the rice field and farm in the survey.
4. 0.0% means a figure less than 0.025%.
5. The total number of farms surveyed are 96.
6. Though there are some problems in view of the statistics, total losses from each stage may be considered to be the followings:

(%)

	ACEH			WEST JAVA			SOUTH SULAWESI			SOUTH KALIMANTAN		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
Arithmetical Total	12.3	0.3	2.3	19.8	1.5	3.6	16.0	2.0	8.6	21.0	1.2	5.1
Cumulative Total	11.8	0.3	2.3	18.3	1.5	3.6	15.2	2.0	8.6	19.4	1.2	5.0

Table 2 Qualitative Losses

(%)

Province / Stage	Aceh			West Java			South Sulavesi			South Kalimantan			Feature of Defects
	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	
Storage	100	6	23	100	2	4	100	3	6	100	8	10	Colored Kernels Damaged Kernels Broken Kernels
Drying	The qualitative loss which is caused by the different drying method between mechanical drying and sun-drying is 7.0% (consists of the milling recovery and broken kernels), then considering the differential of the cost and expense between the both way of drying, the average loss is found to be 4.4%.												Broken Kernels
Rice Milling	The qualitative loss,namely the differential between the kind and combination of each rice milling machine was found to be 1%, 1%, 2.5% and 5% respectively and total loss was max. 9.5%.												Broken Kernels

Notes:
1. Figure for qualitative losses during storage are based on an examination of rice stored for six months in the warehouses of KUD, DOLOG and farms and the total number of tests are 27.
2. Slight, but not major, differences were observed in qualitative loss during drying depending on the layer of paddy dried in the sun, the kind of floor used, the number of times the paddy was turned, sunlight intensity, and drying time.
3. Price evaluations for discolored, damaged, or broken kernels depreciated by 1 rupiah per 1% and the average price of milled rice at the time of the survey has been applied as the standard price to the evaluation.
4. The quality evaluations were based on the qualities of milled rice and milling recoveries after the milling test was conducted.

3. Causative Factors in the Emergence and Increase of Losses

At the Production Level

Remarkable differences occurred among regions between loss and such factors as harvest practice, irrigation, drainage conditions, seed varieties, traditional harvest practices and harvest time in the cropping system for raising high-yielding varieties.

Confusion and disorder at harvest time plague much of the 12.26 million rice farming households throughout the country but are worse in all rice-growing districts. Especially, the situation becomes disordered in the extreme when rainy-season harvests.

The majority of the farmers in the major rice producing areas sell paddy as undried and uncleaned condition to buyers immediately after harvest. But in farm-village areas where facilities for transport and processing are poor, and under the severe conditions of temperature and humidity in an oceanic tropical environment, the paddy, which has a high moisture content, spoils rapidly and extensively.

At Processing Level

Since IR varieties were introduced in this country, it seems that farmers have become rather responsible for production. Most farmers do not dry, clean nor transport the paddy. Consequently, under the system required for the production of such paddy, in short periods of time, huge volumes of undried and uncleaned paddy are transported to small-scale private processing plants or KUDs. Facilities for buying, transportation, drying, and milling have not kept pace with the increase in crops; and, under the extremely severe conditions already mentioned, when huge volumes are brought in at one time, great qualitative and quantitative loss occurs.

At the Marketing Level

The paddy/milled rice being marketed is of the ideal kind that has high quality characteristics in ways that would make it suitable for storage. Otherwise, serious deterioration may take place during the storage period in a tropical climate. In Indonesia, most private warehouses are found at rice mills and BULOG/KUD are recently in the process of erecting a considerable amount of new warehouses throughout the country. The use of trucks in

recent years has greatly improved the transportation situation. Still some loss continues to take place during transportation and storage in major consumer centers, like cities, and especially in transport to other islands.

4. Proposal for Improvements in Postharvest Handling Methods

The following points were emphasized in working out improvement policies for the harvesting, drying, cleaning, milling, storage, and transport stages.

At the Farmer Level

The handling is the starting point for the finishing into high-quality and storable paddy or milled rice. This policy aims to strengthen the individual farmer and also farmers groups and to improve their postharvest practices in order to stimulate bargaining power and regional employment conditions.

At the Processing Level

Whether at private mills or at the KUD/PUSKUDs level, processing (drying, cleaning, and milling) is of the utmost importance in preparing commercially viable rice. The improvement plan of processing aims to turn out more storable milled rice by developing and equipping both private groups and KUDs and by strengthening their organizations.

At the Marketing Level

KUDs and BULOG are responsible for purchasing, drying, milling, transporting, storing, and distributing rice. They must therefore accept fundamental responsibility for reducing loss during these activities. The proposed improvement would employ strict standardization to implement grading, expand storage and transportation facilities, evolve a suitable administrative program, and devise a proper supply-and-demand procedure.

As for the concrete ways to improve the postharvest practices, the harvesting, threshing, drying, cleaning, transportation storage and quality control are mentioned in detail in each process, and it has been considered that the following items are urgent and important for Indonesia today.

1. Establishment of Research and Development Center for Postharvest Technology
2. Increase of storage and transportation capacities for surplus rice in South Sulawesi.
3. Elimination of discoloured kernels in Aceh.
4. Improvement of Methods for Drying and Cleaning of Paddy in West Java.

5. Technological Transfer

Measurements and forecasts of losses during postharvest processing should continue after the completion of this team's survey. During the survey period it was desirable to give guidance to counterparts, assistants and other concerned parties in direct survey methods in order to determine whether the improvement proposals were practical and effective. Then, further technological follow-up steps virtually included training courses and seminars on postharvest losses.

CHAPTER I INTRODUCTION

CHAPTER I INTRODUCTION

This is a report on a survey and its recommendations for improvement made by a team of specialists organized by the Japan International Cooperation Agency formed in accordance with the document called "Scope of Works," which represents an agreement concluded between the Japanese and the Indonesian governments on June 30, 1981. It deals with "The Study on Postharvest Losses," as drawn up in accordance with the Indonesian government's annual request for foreign aid, Code Number ATA 207.

1-1 Background

The Indonesian government's efforts to promote national rice production programs have shown excellent results. But official policies have stressed such preharvest aspects of improvement as the introduction of new techniques, the provision of chemical fertilizers and other agricultural chemicals, and the supplying of group guidance and credit, and have not necessarily provided adequate guidance on postharvest procedures.

From the standpoint of Indonesian farmers, conforming to a new rice-cultivation system has entailed various difficulties. Many problems have emerged in connection with increased crop volumes and operational transformations demanded by new harvest techniques. Small management scale and persistence of traditional work habits increase the number of problems requiring solution. Growth in crop output and the need to handle concentrated volumes in short periods of time put a strain on an already inadequate system of processing and marketing. When to this are added the high temperature and humidity of an equatorial region, great losses occur at all stages including harvesting, processing, transport and storage.

In spite of the government's success in increasing harvests, continued crop fluctuation from year to year, the steady high rate of national population growth mean that, until recently, the nation has had to spend valuable foreign currency for importing an average of two million tons of rice a year.

Ever since the introduction of the high-yielding IR varieties -- that is, ever since the so-called green revolution -- losses in all stages of postharvest practices have been causing problems in many of the rice-growing regions of the world, especially have been troublesome in tropical zones. At a special United Nations meeting held in 1975 it was decided that efforts must be expended to reduce such losses by half in countries where there is a shortage of food in the decade ending in 1985.

In connection with the postharvest losses, the Indonesian government must take the following steps as quickly as possible and has requested the cooperation of the Japanese government in doing so:

a. Establish investigation systems

b. Assess losses.

c. Adopt solutions to reduce losses.

1-2 Survey

1-2-1 General Survey

By "general survey" is meant survey of postharvest losses occurring during harvesting, transport, processing and storage. As is set forth in "Scope of Works," the survey group whose work is covered in this report conducted such investigations in Aceh, West Jawa, South Sulawesi and South Kalimantan. The following standards were employed in selecting the (Kabupaten) district, the (Kecamantan) subdistrict, and the (Desa) village for survey.

a. Dry-season and rainy-season harvests would be actually taking place during the survey period.

b. Within the project region, it was desirable to select places that would best represent local harvest, processing, storage and transport practices.

-2-2 Surveys Employing Postharvest Machines

During the dry-season survey, the survey team introduced reapers (power: binder style) and threshers (power: throw-in type) and mechanical dryers (flat-bed type). The machines of each type were employed to assess losses and, by comparing the results of traditional methods with modern mechanized ones, to provide basic data for improvements. This survey method was used in North Aceh and in Pidie in Aceh and Karawang in West Jawa, where serious problems occur in relation to threshing and drying.

-2-3 Observation Survey

The purpose of these surveys was to gain a broad understanding of actual patterns of postharvest practices according to region and through that understanding to evolve broad-scope improvement ways for reducing quantitative and qualitative losses. These surveys were conducted in South Sumatra, Lampung, Central Jawa, and East Jawa, principle rice-producing areas where crop increases have already been effected or are now in the process of being effected.

Table 1-1 shows the output of each of the regions submitted to these surveys. Rice production in Aceh, West Jawa, South Sulawesi and South Kalimantan, where general surveys and surveys employing postharvest machineries were carried out, is about one-third that of all of Indonesia. The rice output of all eight project provinces including the four mentioned above and South Sumatra, Lampung, Central Jawa and East Jawa accounts for roughly three-quarters that of the entire nation.

Table 1-1

Province	Harvested Area (ha)	Production (PKG/ton)
Aceh	250,421	797,900
West Java	1,944,750	7,252,566
South Sulawesi	332,310	789,761
South Kalimantan	596,260	2,055,711
Total in General Survey Areas	3,123,741	10,895,938
South Sumatra	365,180	921,675
Lampung	290,476	764,057
Central Java	1,414,617	5,755,158
East Java	1,518,816	6,930,502
Total in observation Survey Areas	3,589,089	14,371,392
Total in Subjected Survey Areas	6,712,830	25,267,330
Total of 27 Provinces of Indonesia	9,375,944	32,775,807

Notes: 1) Figures quoted from estimation by Ministry of Agriculture for 1981 and included upland rice.

2) PKG; Padi Kering Giling, dried (at 14% moisture content) and cleaned (at 3% foreign materials) paddy.

1-3 Surveying Period and Specialists Involved

1-3-1 Period of the Survey

The survey was conducted in two phases; first, or dry-season phase from September 1, 1981 until November 30, 1981; and second, or rainy-season phase from February 1, 1982 until May 30, 1982. In other words, the first phase was three months long; and the second was four months.

First phase survey concentrated on quantitative losses during post-harvest practice, mainly in the dry reason, in Aceh, West Jawa, South Sulawesi and South Kalimantan, where general surveys were conducted.

In the second phase, surveys were the same as those in the first phase except that they were carried out to determine quantitative losses in the rainy season. To them, furthermore, were added surveys to determine qualitative loss. In addition, the survey team employed mechanical harvesting and processing equipment in these investigations in Aceh and West Jawa and conducted observation surveys in South Sumatra, Lampung, Central Jawa and East Jawa.

3-2 Specialists in the Survey

The tables below show the specialists participating in the survey as well as the regions and fields for which they were responsible.

Dry season survey

Name	Assignment	Survey Area (province)
Hidekazu Komuro	Team Leader	D.I. Aceh, West Jawa
Toyojiro Masumoto	Rice Milling	"
Koji Fukuchi	Storage	"
Seijiro Takahashi	Transportation	"
Makoto Yamada	Team sub-leader	South Sulawesi South Kalimantan
Yoshizo Takata	Storage	"
Hiroshi Tomari	Rice Milling	"
Harunobu Yoshino	Transportation	"

Rainy season survey

Name	Assignment	Survey Area (province)
Hidekazu Konuro	Team Leader	All survey areas
Makoto Yamada	Team Sub-leader	"
Toyojiro Masumoto	Rice Milling	West Jawa, Central Jawa, East Jawa
Hiroshi Tomari	Rice Milling Machinery	D.I.Aceh, South Sulawesi
Isamu Yamazaki	Rice Milling Machinery	D.I. Aceh, South Sumatra Lampung, West Jawa
Kozo Yamakawa	Postharvest Machinery	West Jawa, South Kalimanta
Ichiro Nanba	Field Survey	D.I. Aceh, South Kalimanta
Harunobu Yoshino	Field Survey	West Jawa, South Kalimanta
Yoshizo Takata	Transportation Storage	West Jawa, South Kalimanta
Masatoshi Kono	Transportation Storage	D.I. Aceh, South Sulawesi

CHAPTER II GENERAL SITUATION IN SURVEY AREAS

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2-1 General Situation in Indonesia

(1) Natural Features

Indonesia is located 6°08'N - 11°15'S and 94°45'E - 141°05'W and consists of 13,667 islands, of which 6,044 have names and the remaining 7,623 no names. People live on 992 islands which accounts for less than 7% and there are no inhabitants on the remaining 12,675 islands. Indonesia has a total area of 191,944,300 ha, consisting of many islands scattered in a territory spreading 5,110 km from east to west and 1,888 km from north to south.

The areas of the big islands are as follows:

Name of Island	Area (km^2)	%
Sumatra	473,606	24.67
Jawa and Madura	132,187	6.89
Bali and Nusa Tenggara	88,488	4.61
Kalimantan	539,460	28.11
Sulawesi	189,210	9.86
Maluku and West	496,486	25.87

The branch mountain range of the Himalaya creation zone makes the Bukit Barisan mountain range, the Central mountain ranges from Sumatra to Jawa and Nusa Tenggara, while the Pan-Pacific Ocean channel creation zone makes a channel running down Sulawesi from north to south and most of the 216 mountains are active volcanoes. There are 59 big rivers which flow with a 1,000,000 m^3 water volume and originate from these mountains.

(2) Meteorology

Indonesia is located in the middle of the Asian continent and Australia, and June - September is the dry season due to the east monsoon, December - March is the rainy season due to the wet west monsoon.

It has an oceanic tropical temperature averaging 27°C, with the average highest temperature at 33°C and the average lowest temperature at 22°C in low-land areas but it is not so high compared with continental tropic regions in spite of belonging to the tropical zone. However, the relative humidity is 60 - 100% and the average humidity is 78%. Precipitation has a relation connection with the direction and the velocity of the wind on the surface of the ground. The west wind and northwest wind blow in the rainy season and the direction of the wind is uncertain in April - May. The east wind mainly blows in June - September and the east wind and south wind blow in the dry season. The direction of the wind is uncertain in October - November. The velocity of the wind is generally 5 - 15 knots.

Precipitation is different by region, above sea level, topography, and the data collected at the main observatories are shown in the appendix s

(3) Soil

The mountainous land of Kalimantan consists of layers of Palaeozoic Mesozoic era containing gneiss and granite. The lower reaches of the rivers and the low-land areas are alluvial layers, and the volcanic group of the new tertiary period are active in Indonesia with most of the soil volcanos being andesite. On the other hand, there are diluvium and alluvial layers on flat lands, river basins and coastal areas. There are organic soil, alluvial soil, and red-yellow podosolic soil on the step hills, table land and hilly land in the vast swamp areas of the east coast.

There are alluvial soil, red-yellow podosolic soil in step hills, and ferralsols and andosol in the mountainsides of West Java. There are alluvial soil in river basins, then Grumsol, red-brown soil and mediterranean soil come next and ferralsols from foots of high mountains to middle hill-sides in mideastern Java.

There are large organic soil and alluvial soil on the west coast and the low-lands of the east coast and red-brown soil Podzols in the table land of the internal continent and hilly districts.

The soils of Sulawesi are mostly alluvial soil in coastal areas and ferralsols in hilly districts.

The alluvial soil in Jawa contains a lot of extrusion in piles in ri and it is more fertile than the alluvial soils in Sumatra which have a lot of these piles brought from weathered step hills.

The organic soils are distributed in the lower streams of rivers, coastal areas and swamp areas and it is very hard to used as farm land if the land is not drained, the acidity of the soil is too high for use as farm land.

Grumosal is found in areas with definite rainy seasons and is consists mainly of weathered limestone or basic valcanic rock and is found. The color is black or dark-gray and it is sticky in the rainy season and hard in the dry season and handling is difficult.

Reddish brown soil consists of weathered neutral or basic rocks and its fertilily is comparatively high. Weathered reddish brown Podzols consisting of acidity materials is found in step hills and hilly land.

Ferralsols is the most weathered soil in the tropical zone and fertility is low, but there are comparatively young layers in Jawa and their fertility is relatively high compared with that of many other districts.

(4) Land Utilization

The latest actual condition of land utilization is shown in tables below. As mentioned in the table, 16,370,000 ha which accounts for about 8.5% of the land area of this country is utilized as farm-land and various kinds of crops are cultivated, then 4,840,000 ha of which is low-land fields and 9,320,000 ha is up-land fields, namely, the total area cultivated by farmers except estate farming is 14,160,000 ha, and 5,300,000 ha which accounts for about 32% of farm-land is used as irrigated land in the year 1978.

Land Utilization Conditions in Indonesia

(1,000 ha)

	1901 - 1965	1968	1973	1978
Total Area	190,435	190,435	190,435	190,435
Land Area	181,135	181,135	181,135	181,135
Farm Land	14,367	15,050	15,985	16,368
Cultivated Area	12,240	12,900	13,800	14,168
(Irrigated Area)	4,100	4,230	4,700	5,314
Perrenial Crop Cultivated Area	2,127	2,150	2,185	2,200
Permanent Pasture	12,550	12,450	12,300	12,046
Forest	123,800	123,200	122,227	121,800
Others	30,418	30,435	30,624	30,921

Farm Land Area

(1,000 ha)

	Land Area Cultivated by Farmers			Estate	Total
	Law-land Field	Up-land Field	Total		
Jawa and Madura	2,632	2,872	5,505	678	6,183
Outer Jawa	2,209	6,454	8,663	1,548	10,211
Total	4,841	9,326	14,168	2,226	16,394

2-2 General Situation in Survey Areas

2-2-1 Special Province of Aceh

(1) Natural Features

Aceh is located at Lat. 2°N - 6° and Long. 95°E - 98° in the north edge of Sumatra Island and the east, west and south side are surrounded by the Malacca Strait, Indian Ocean and North Sumatra respectively. The total area is 5,539,000 ha and is divided into east and west by the Bukit Barisan Mountain Range and the plain created by rivers flowing from each mountain is utilized for agriculture. There are Mt. Gayoleuser (3,466 m), Mt. Bandahara (3,012 m), Mt. Abongabong (2,985 m) and another 5 mountains which are over 2,000 m excepting 3 active valcanoes in the Bukit Barisan mountain range.

Many rivers Peusangan, Jamboaye, Tamiang, Kluet, Teripa, Woyla which start from mountainous districts flow into the Malacca Strait and Indian Ocean. The alluviated plain created by these rivers is utilized as low-land fields for rice cultivation, and the surrounding areas of river mouths are swamps or mangrove areas and some part of them are used as fish culture ponds.

(2) Meteorology

The meteorology of Aceh is mainly controlled by the monsoon as well as other provinces and there are great differences in precipitation and relative humidity by district due to the location of the province and the central mountain range. In other words, November - March is the rainy season and April - October is the dry season on the west coast due to the influence by the west monsoon. The east side of the central mountain range is influenced by the west monsoon, however, the precipitation is small due to the central mountain range. As for the annual average precipitation for the most recent 10 years 1,308 mm for Pidie and 1,276 mm for Aceh Utara are small as compared with 2,952 mm for Aceh Barat.

The annual average number of rainfall days for the most recent decade is 137 days for Aceh Barat but it was 85.6 days and 68.3 days, respectively, in the above two places on the east side.

The monthly average relative humidity is 78% and the average daily differe is about 15% in the low lands. The average annual highest temperature is 32.8°C and the average lowest temperature is 22.6°C with the average daily difference being 10.2°C.

(3) Soil

Kind of Soil	Region
Organosal/Alluvial	From Tamping to east coast to Pidie - on the north coast
Podosolik/Merah Kuning	From Pidie to Kabupaten and Bate in Acehbe
Organosol/Alluvial	From Batee to Wrelen
Red Yellow Podosolik	From Wrelen to the foot of Mt. Grutee
Podosolik Merah Kuning/ Litosol and Regosol	From the foot of Mt. Grutee to Kualatonon (Aceh Barat)
Organosol and Alluvial	From U. Jahu (Aceh Barat) to U Raja (Aceh Barat)
Podosolik Merah Kuning Litosol and Regosol	From Kuhla Torippa (Aceh Selatan) to Tapatoan (Aceh Selatan)
Organosal and Alluvial	From Tapatoan (Aceh Selatan) to Ujung Singil (Aceh Selatan)

In the middle mountainous district

i) Podosolik Merah Kuning/Litosol/Regosol Podosolik Coklot).

ii) Kelabu/Podosolik Ronzina/Litosol in Pidie in Kabupaten.

iii) Orgarosal/Alluvial Tengah in Aceh.

Above is the structure of soil and the largest part of low-land rice fields is alluvial clay layers or accumulated volcanic ash layers.

The swamp area is covered with clayey soil and tropical peat.

(4) Land Utilization

Land	Area (ha)	%
I. Forestry	4,130,000	74.6
II. Farm Land	557,340	10.1
(1) Large estate	126,034	2.3
(2) Inhabitant estate	180,959	3.3
(3) Low-land rice field	210,767	3.8
(4) Up-land field	22,931	0.4
(5) Fish culture land	16,649	0.3
III. Grass Land	432,000	7.7
IV. Community Land	55,000	1.0
V. Others (Lake and river)	364,660	6.6
VI. Total	6,539,000	100.0

2-2-2 Province of South Sumatra

(1) Natural Features

South Sumatra is located at Lat. 1°S - 4° and Long. 102°E - 108° and the north-side, southwest side, south-side and northeast side border Province, Bengkulu Province, Lampung Province and Jawa-Sea, respectively. The total area is 10,925,400 ha accounting for about 21% of Sumatra Island, and the mountain range Bukit Barisan runs in the southwest area of the Province with Mt. Dempo (3,159 m), Mt. Bunyuk (2,125 m) and Mt. Patah (2,107 m) and Mt. Suminum (1,964 m) being included in this range. The lower reaches of the River Musi Komerin, Ogan, Rumatan, Kuringgi, Rakitan, Rupitt and Kawas are vast swamp-lands and the area within 100 km from the beach is tidal land.

(2) Meteorology

The meteorology of South Sumatra is similar to that of Lampung Province, and influenced by the west monsoon. September - April is rainy season and May - August is the dry season. But precipitation in January and February in the plain areas is as small as to be called an intermediate season. This tendency is generally the same as the west side area of Sumatra Island.

In other words, the largest precipitation by month is divided into two categories, namely, December (October, November are included) and March (April is included). The annual average precipitation at the observatory of the province is 3,644 mm and the above mentioned 6 months which belong to the two large-precipitation periods account for 68.5% of the whole year's precipitation. The average temperature is 26.3°C and the difference by month is ±8°C which is almost stable. The average highest temperature is 31.6°C and the monthly difference is 0.4°C. The average lowest temperature is 22.9°C and the monthly difference is almost stable. The average annual humidity is 85.5% and the monthly difference is only 3% stabilizing greatly at a high level. Both the monthly average humidities in November and December are 86% and the average humidity in May is 83%. The difference is only 3%, and such a small difference is not observed in other provinces except Lampung Province. The reason why humidity remains at a high level throughout the year is uncertain.

(3) Soil

Kind of soil	Region
Organosol	Swamp land spreading on east coastal area
Litosol	Slope of Bukit Barisan Mountain Range.
Alluvial	Basin of rivers which flow from Bukit Barisan Mountain Range
Hidromerk	Mura area and Liot area
Hums	Swamp land
Regosol	Land of lakes and marshes spreading around east coastal area
Andosol	The land over 100 m above sea level in the province
Rendzine	Surrounding area of Baturaja
Latsol	Generally, extremely dry area
Lateritic	Mattanpura and Bangke district
Reddish Yellow Rodzolic	Low area of slope of Bukit Barisan mountain range

(4) Land Utilization

Land		Area (ha)	%
1. Agricultural Land		1,089,620	10.01
	(1) Low land field	303,692	2.78
	(2) Inhabitant estate	615,620	5.64
	(3) Rainfed low-land rice field	108,396	1.00
	(4) Up-land field	48,662	0.45
	(5) Estate	13,250	0.14
2. Forest		5,474,000	50.07
	(1) Forest land	565,877	5.17
	(2) Protection forest	2,208,708	20.21
	(3) "	333,652	3.05
	(4) Forest	1,959,800	17.93
	(5) Wild animal protection land	405,963	3.71
3. River Basin Land		3,971,662	36.35
4. Others		390,157	3.57
5. Total		10,925,400	100.0

2-2-3 Province of Lampung

(1) Natural Features

Lampung is the south edge of Sumatra Island and is located 40°0'S - 60°0' and 103°30'E - 106°00'. The north and northwest side abut South Sumatra and Bengkulu Province, respectively, and the east, southeast and southwest sides face the Jawa Sea, Sunda Channel and Indian Ocean. The total area is 3,537,650 ha which accounts for about 7% of Sumatra Island. The Bukit Barisan Mountain Range runs through the southwest district of the province and 11 mountains including Mt. Pusaki (2,262 m), Mt. Tebac (2,115 m) Mt. Tumbi and other mountains whose average height is 1,500 m approach the Sunda Channel. Most rivers starting from those mountains flow into the Jawa Sea. Rivers Sekampung, Semangka Seputih, Jepara, Tulangbowang and branch streams of these rivers make a basin which is 15,755 square meters in area (44.5% of the area of the province). The western coastal area is tidal swamp (4.8% of the area of the province).

(2) Meteorology

The meteorology of Lampung is controlled by the monsoon and Novem March is the rainy season due to the west monsoon, July - August is the season due to the southeast monsoon and April - May and September - Octo are neutral and moderate seasons which have much precipitation as compar with other provinces. In mountainous areas, 4,243 mm is the greatest ar 3,500 mm is the average rain fall and even the smallest precipitation in the low lands is about 1,500 mm because the mountains are comparatively low for the west monsoon. The temperature is 26° in average, the highes is 33°C and the lowest is 21°C in the low lands and the average humidity is 82.6%. The average humidity as of 7 A.M. is 93% and that of 1 P.M. is 63.3%. The reason for the high humidity as compared with that of other provinces has not been ascertained.

(3) Soil

Kind of Soil	Region
Organosol/Alluvial	Surrounding area of river mouth on east coast and a part of west coast
Reddish Yellow Podzolic	Surrounding area of middle basins of rive flowing into east coast.
Latosol	Foot of Mt. Bukit Barisan
Andosol	Bukit Barisan Mountain range area and a part of foot

(4) Land Utilization

Land	Area (ha)	%
Community Land	120,871	3.4
Low-land Rice Field	137,070	3.9
Up-land Field	283,814	8.0
Estate	519,771	14.7
Other Estate	42,474	0.1
Grass land	286,258	8.1
Bush Forest	720,843	20.4
Forest	952,108	26.9
Mountain	265,801	7.5
Others	208,640	5.9
Total	3,537,650	100.0

2-2-4 Province of West Jawa

(1) Natural Features

West Jawa is located at 5°50'S - 7°50' and 104°48'E - 108°48'. The north side, east side, south side and west side of the province face the Jawa Sea, Middle Jawa, Indian Ocean and Sunda Channel. The total area is 4,200,884 ha and it accounts for 35% of the total area of Jawa and Madura Island. The Bukit Barisan, the Mountains of Sumatra Island, extend to Krakatau Island and create the most part of the mountainous area of West Jawa.

Located there are 25 mountains over 2,000 m in height between Mt. Pangrango (3,018 m) and Mt. Gireway (3,078 m). Mountain ranges approach districts which face the Indian Ocean and arable land is small; however, more than 20 rivers including the Cilontar, Cisadane, Sunral, Bekasi and Cimanuku flow into the Jawa Sea creating a big plain in the northern district, and there are plains on the Bandung Plateau surrounded by mountains, and in the basin of the River Citandug bordering on Middle Jawa.

(2) Meteorology

The meteorology of West Jawa is controlled by the monsoon and Nove - June is the rainy season due to the west monsoon and July - October i dry season. The rainy season is longer than that of other provinces an precipitation is relatively large. The season is, that West Jawa is lo in the west of Jawa Island and receives much rain due to the west monso and precipitation in mountainous areas is larger than that of flat-land and the Indian Ocean side area has much more precipitation than the Jav Sea side area.

The annual average precipitation for the most recent 5 years of Sel where precipitation is smallest in the areas of West Jawa is 1,542 mm, though that of Bogor is 4,339 mm. There are great differences in temper among the observatories. The comparison of temperature between Cipanas which is 1,100 m above sea level and Cirebon which is 3 m above sea leve is as follows. Annual average highest temperature is 23.6°C - 32.6°C, annual average lowest temperature is 16.6°C - 22.5°C and the annual aver temperature is 20.5°C - 27.4°C respectively.

As for the monthly average humidity, it is low in September - Octob and high in November - June. Bandung is regarded to be a comparatively cool place on Jawa Island and the observatory is located at a place 791 above sea level with the monthly average humidity being 74%, 77% for Cir and 83% for Bogor, called the City of Rain, which is located 250 m above level.

(3) Soil

Generally speaking, the soils are divided into three categories i.e. limestone areas in the west of Cisarua of Bogor Kabupaten, volcanic area in Bandung Height and alluvial areas in the north plain.

Most of the north plain is alluvial soil, and in the vicinity of the river mouth there is organic soil and this soil is tropical peat; therefore, the acidity is so high that it is not suitable for rice culti tion. The soils of Bandung Height are andosol or Mediterranean soil.

(4) Land Utilization

Land	Area (ha)	%
Low-land Field	1,195,165	28.45
Up-land Field	1,269,539	30.63
Inhabitant estate	311,922	7.43
Large estate	342,827	8.16
Pond	26,042	0.62
Fish culture	14,264	0.34
River	80,592	1.92
Swamp	24,024	0.57
Forest	702,163	16.71
Others	217,346	5.17
Total	4,200,884	100.0

2-2-5 Province of Central Jawa

(1) Natural Features

Middle Jawa is located 6°30'S - 8°30' and 180°30'E - 111°30' and north, west, east and south districts face the Jawa Sea, West Jawa, East Jawa and Indian Ocean, respectively. The southeast district surrounds the Special Province Yogyakarta, and the total area is 3,450 ha with Mt. Slamet (3,428 m) Mt. Sundoro (3,135 m), Mt. Sumbing (3,371 m) and Mt. Merbaba (3,142 m) belonging to the central mountain range. Many rivers which run to the northside flow into the Jawa Sea while rivers which run to the southside flow into the Indian Ocean, but the rivers are not big, perhaps because the central mountainous area is very high. Rivers,Serang Solo, Lukula, Serayu and Pemali create plains, Pekalongan, Purwodadi, Solo and South plain consists of alluvial plains.

(2) Meteorology

The meteorology of Middle Jawa is also greatly controlled by the monsoon, and October - March is the rainy season and April - September is the dry season due to the west monsoon. The annual precipitation is different by year, being 1,882 mm for 1976, 2,563 mm for 1978 and the average annual precipitation for the most recent 5 years is 2,122 mm, which is a little

larger than that of East Java. Precipitation in the mountainous areas is larger than that of the plains, and precipitation in the district along the Indian Ocean is larger than that of the coastal district of the Java Sea. The highest temperature in the most recent 6 years is 31.9°C, the average lowest temperature is 22.8°C and the average temperature is 27.2°C while the average humidity is 75%.

(3) Soil

There are fertile soils in the Pakalongan plain, Pati plain and the basins of the River Solo, and some rivers flow into the South Indian Coast and these soils are used for rice cultivation. There is Grumsol soil in the Kudus Plain, Kapur Plateau, Wonogiri Plateau and Baryumas Plateau and there is Mediterranean Soil in a part of Wonogiri Plateau, Ando Soil in the Central Mountainous Area and surrounding areas of Mt. Semeru, and Gromosal in the surrounding areas of the Central Mountainous Area.

(4) Land Utilization

Land	Area (ha)	%
Cultivated Land	2,656,849	30.15
Paddy Field	1,045,638	11.86
Up-land Field	783,328	8.89
Garden	581,176	6.59
Others	245,707	2.79
Productive Forest	50,188	0.57
Total Agricultural Land	2,707,037	30.72
Forest, Urban Area Others	743,223	8.43
Total	8,813,146	100.00

2-2-6 Province of East Java

(1) Natural Features

East Java is located at Lat 7°12'S - 8°48' and Long. 111°E - 114°4'. The west side of this province is Middle Java, the north side abuts the Java Sea and the south side faces the Indian Ocean. Madura Island is located at the north of the Madura Channel belonging to this province. The total area of the province is 4,792,000 ha and Mt. Wilis (2,563 m) Mt. Arjuno (3,339 m), Mt. Semeru (3,676 m), Mt. Argopuro (3,088 m) and Mt. Lawu (3,332) and located in the central distract of the province, while

the River Bengawan Solo, and the River Madium, which flow into the River Solo, and River Brantas which flows from the mountainous area of Arjuno create an alluvial plain located in the northwest district; in addition, many rivers from the central mountainous area create the Lamongan, Banyuwangi and Probolinggo plains.

(2) Meteorology

The meteorology of East Jawa is controlled by the monsoon and October - March is the rainy season, and April - September is the dry season due to the west monsoon. Precipitation is small as compared with the other three provinces of Jawa Island.

This is because the East Jawa Province is located on the eastern edge of Jawa Island and the west monsoon delivers less rain to the other three provinces. The annual precipitation is different by year, but the average annual precipitation for the last 5 years of the 36 observatories was 1,872 mm. As for the precipitation on the plains, it is much in the southern district and less in the northern district. For example, average precipitation for the 5 years in Pasuruan on the north side was 1,527 mm, while that of Lamongan was 2,306 mm. Usually, precipitation in the mountainous areas is greater than that of the plain areas but it is this characteristic which is the small difference between the two. The average highest temperature for the most recent 5 years is 33.2°C, the lowest is 22.2°C and the average is 26.8°, while the average highest humidity is 96.2% and the lowest is 55.0 %, making an average of 78%.

(3) Soil

Kind of Soil	Region
Alluvial	Madiun Plain, Malang Plateau, Kediri Plain, which are the alluvial area of basins of Brantas River, Modium River and Lamong River and Lamongan Plain, Banyuwangi Plain and Plain and Plains of the east coast.
Grumsol	Area along Kendes hill continued from Middle Jawa
Red Yellowish Rodsol	Area around the step hill of the Central Mountain range
Andosol	High land area of the Central Mountain range

(4) Land Utilization

Land	Area (ha)	%
Low-land Rice Field	1,247,421.75	26.02
Up-land Field	1,187,695.50	24.78
Settlement	641,792.75	13.39
Estate	164,254.50	3.42
Farm in Farmer's Lot	61,866.00	1.28
Forestry	1,208,058.00	25.23
Lake and Swamp	52,149.50	1.10
Set-aside Farming	186,134.00	3.89
Mangrove-growing Land	7,230.25	0.15
Fish Culture Area	22,500.75	0.47
Others	13,029.25	0.27
Total	4,792,201.75	100.0

2-2-7 Province of South Sulawesi

(1) Natural Features

South Sulawesi is located at Lat 0°55'S - 7°30' and its north side, east side, south side and west side face Middle Sulawesi, Bone Bay the Flores Sea and the Makassar Channel, respectively. The whole area of the province is 6,281,000 ha.

In the northern mountainous area, there are three mountain ranges, namely, Quarles, Hullbeck and Latumojang with 4 high mountains, Mt. Monte (3,440 m), Gandadiwata (3,074 m), Aruan (3,073 m) and Baleace (3,016 m) which are over 3,000 m in height.

Mt. Lompobattong (2,871 m) in the southern mountainous district, and the mountainous district which starts from this mountain, reaches the central part of the province.

Lake Towty and Lake Matana are on the northeast edge of the province and Lake Tempe and Lake Sidenreng are in the central plain district.

Most of the rivers such as the River Sadan, Chenlana and Kalumpang are concentrated in the northern mountainous district and there are no big rivers except for the River Geneberan in the southern district.

(2) Meteorology

The meteorology of South Sulawesi is much influenced by the monsoon and the middle mountainous district because of its geographical situation, being located between the Asian Continent and Australia.

The west side district of South Sulawesi becomes the rainy season in October - March due to the west monsoon which contains much moisture coming from the Indian Ocean. The east side district along Bone Bay would be the dry season in the same period but the west monsoon is hindered by the central mountainous district. While, in April - September the dry east monsoon starts from the Australian Continent and crosses over the Java Sea with its wet atmosphere and attacks South Sulawesi, therefore the east side district along Bone Bay becomes the rainy season.

It is the dry season in the same period on Java Island due to the short distance from the Australian Continent.

It is clear that there is a great difference in precipitation between the west side and east side. Precipitation in the plains is, 3,239 mm for Parepare, 3,268 mm for Ujung Pandang and 3,243 mm for Maros. The annual precipitation is mostly over 3,000 mm, but it is 1,176 mm for Palopo, 1,639 mm for Sopeng and 1,639 mm for Watanpone. The annual precipitation is very small as compared with that of the west side district. On the other hand, the annual precipitation in the mountainous areas, where the monsoons hit, rises greatly. 4,822 mm for Malino and 3,953 mm for Minasabaggi is about 4,000 mm. On the contrary, the southern edge area along the Makassar Channel, where no mountains exist, the monsoons hit and rise and the annual precipitation is 765 mm for Burukumba and 635 mm for Bontongsunggu, where precipitation is extremely small. The rate of annual sunshine for the most recent 5 years in Ujung Pandang is 67.9%. The annual highest temperature in plain areas is 33°C, the lowest is 22°C and 26°C is the average, with the highest in mountainous areas being 31°C, lowest 15°C, and 24°C in average.

The reason why the highest temperature is comparatively low in spite of it being a tropical area is that the island belongs to the Oceanic tropical zone.

The annual average humidity in the most recent 6 years for the plain areas is 77.4%. Humidity in the dry season and in daytime is naturally low and high in the rainy season and at night. The difference of humidity in a day in the plain areas is 15% in average.

(3) Soil

Kind of Soil	Area (1,000 ha)
Alluvial	680.0
Mediterranean	1,055.0
Grumosal	75.0
Hensine	95.0
Andosal	55.0
Glei	125.0
Litosol	90.0
Podsolic	1,260.0
Latosol	525.0
Regosol	157.5
Lateritic	17.5
Total	4,135.0

The northwest area of the mountainous district in the province is not contained in the above table and this area accounts for about 34% of the province.

(4) Land Utilization

Land	Area (1,000 ha)	%
Forest	3,222	51
Grass-land	590	10
Movable Farming Area	258	4
Low-land Rice Field	909	14
Up-land Field	509	8
Mangrove Growing Area	50	1
Fish Culture Pond	46	1
Others	709	11
Total	6,293	100

2-2-8 Province of South Kalimantan

(1) Natural Features

South Kalimantan is located 1°30'S - 4° and 114°19'E - 116°33' and its north-east, north-west and south is surrounded by East Kalimantan, Middle Kalimantan and the Jawa Sea respectively.

The total area is 3,698,479 ha and it is divided by the Meratas Mountain Range into east side and west side with the most part of the east side being mountainous district. On the other hand, the most part of the west side is the basin of the River Barito except for the plains in the north and east. The irrigation and soil conditions of the river basin surrounding Amuntai in the northern area are severe for agriculture due to high acidity of soil. And there are a vast swamp in the surrounding areas of Marabahan and Negara, and it is located 100 - 200 km from the river-mouth, and water stays all the year round due to flooding and the tides. The area was once sea in olden times, but it became land by the accumulation of materials in the river. The basin of the lower reaches, namely the area which is about 80 km from the river mouths of Baryto, Kapuas and Kabajan resembles low swamp which is effected by tides.

(2) Meteorology

South Kalimantan near the equator is located between the Asian Continent and Australia and it is influenced by both east and west monsoons. The rainy season from November to April is caused by the West monsoon, and the dry season from May to October is caused by the east monsoon. The annual average precipitation in the plains is different by observatory, from 1,600 mm to 3,500 mm, and the average precipitation is 2,600 mm.

The precipitation in the rainy season accounts for 70% of the annual precipitation and great differences from year to year seem to be a characteristic, with the local heavy concentration of rain being another special feature of the tropical zone. The average high and low temperature is 3[illegible] - 22°C, and the average relative humidity by month is 63 - 88% with the annual average being 80%.

(3) Soil

Kind of Soil	Region
Organosol/Alluvial	Surrounding area of basin of River Barito
Latosol	East and west foot of Meratas Mountain ra[illegible]
Andosol	Surrounding area of Meratas Mountain ran[illegible]

(4) Land Utilization

Land	Area (ha)	%
Low-land Rice Field	295,259	8.0
Up-land Field and Swamp	1,442,441	39.0
National Forestry	1,602,150	43.3
Estate	221,677	6.0
Others	136,952	3.7
Total	3,698,479	100.0

CHAPTER III CIRCUMSTANCES IN AGRICULTURE

CHAPTER III CIRCUMSTANCES IN AGRICULTURE

3-1 Share of Agricultural Production in GDP

Agricultural, forestry and fishery production occupies so large a share in the GDP of Indonesia as to call it an agricultural country. However, it has been developing in its secondary and tertiary industries such as manufacturing, construction, transportation, communication and national defense as well as the petroleum industry. Although the development of those industries has been pushing down the position of agriculture, the latter still accounts for one third of its GDP, of which the major part about one fifth of GDP comes from the production of food consumed within the country.

Table 3-1 Constitution of GDP by Economic Sectors
(1973 fixed price)

Unit: Million Rupias

Sector	1973		1978		
	Amount of Production	%	Amount of Production	%	Index (73=100)
Agr., Forest & Fish Industries	2,710	40.1	3,204	34.1	118
Food Production	(1,573)	(23.3)	(1,901)	(20.2)	(121)
Industrial Crops Produced by Small Size Farmers	(323)	(4.8)	(401)	(4.3)	(124)
Production by Estates	(152)	(2.3)	(214)	(2.3)	(141)
Animal Production	(173)	(2.6)	(184)	(2.0)	(106)
Forest Production	(355)	(5.3)	(339)	(3.6)	(95)
Fishery Production	(134)	(2.0)	(165)	(1.8)	(123)
Mining	831	12.3	1,040	11.1	125
Manufacturing	650	9.6	1,159	12.3	178
Construction	260	3.9	494	5.3	190
Commerce	1,118	16.6	1,563	16.6	140
Transportation & Communication	257	3.8	451	4.8	175
Administration & National Defense	405	6.0	756	8.0	187
Others	522	7.7	725	7.7	139
Total GDP	6,753	100.0	9,392	100.0	139

Source: Tabel - Tabel Pokok Pendapatan Nasional Indonesia, 1973 ~ 1978

Table 3-2 Share of Agricultural, Forestry and Fishery Production in GDP

(%)

	1965	1968	1971	1974	1977	1979
Agr., Forest & Fishery Industries	58.8	51.5	44.8	32.7	31.3	29.8
Mining and Manufacturing Industries	14.1	14.9	20.3	34.8	34.3	32.5
Service and Others	27.2	33.6	34.8	32.6	34.3	37.7

Source: Biro Pusat Statistik, Jakarta, 1980

3-2 Agricultural Production

Indonesia consists of Jawa and Madura Islands, and many other islands such as Sumatera, Kalimantan and Sulawesi as the outer Jawa and Madura. Jawa has very dense population while the outer Jawa and Madura is sparsely populated. Jawa and Madura grow mainly food crops such as rice, corn and cassava with arable land area reaching 65% of the total land area and a lit of environmental conservation. On the contrary, the rate of arable land area to the total land is only 4% in the outer Java and Madura where traditional plantation crops such as rubber and coconut are produced on scatter fields in addition to food crops. Indonesian agricultural production is shown in the two tables below by dividing it into two groups. The first is 7 major products including food crops such as paddy rice, corn, cassava an others and the second is 9 items including estate products such as sugar cane, rubber, palm and others.

	Jawa & Madura			Outer Jawa and Madura			All Indonesia		
	Harvested Area (1,000 ha)	Amount of Production (1,000 ton)	Yield per ha (100 kg)	Harvested Area (1,000 ha)	Amount of Production (1,000 ton)	Yield per ha (100 kg)	Harvested Area (1,000 ha)	Amount of Production (1,000 ton)	Yield per ha (100 kg)
Paddy Rice	4,147	13,354	32.20	3,064	8,555	27.93	7,210	21,909	30.39
Upland Rice	245	348	14.22	932	1,186	12.72	1,177	1,534	13.03
Corn	1,710	2,136	12.49	840	894	10.64	2,550	3,030	11.88
Cassava	1,005	8,937	88.91	351	3,232	92.21	1,356	12,169	89.76
Sweet Potato	152	1,202	79.19	164	1,251	76.45	315	2,453	77.77
Peanut	364	285	7.83	142	118	8.28	506	403	7.96
Soybean	517	409	7.91	145	118	8.15	663	527	7.96

* Dried paddy (gabah kering giling) base

Source: Statistical Pocketbook of Indonesia 1977/1978

Table 3-4 Production of Nine Major Estate Agricultural Products, 1977

(Figures in parentheses are percentages)

	No. of Plantations	Planted Area (1,000 ha)	Amount of Production (1,000 tons)	
Rubber	584 (55.6)	465.6 (51.6)	252.2	Dried rubber
Tea	121 (11.5)	67.7 (7.5)	62.8	Dried leaves
Coffee	131 (12.5)	38.0 (4.2)	17.1	Dried beans
Oil Palm	52 (4.9)	181.7 (20.2)	589.7	Total of oil palm and palm kernel
Quinine	18 (1.7)	3.4 (0.4)	0.7	Dried bark
Sugar Cane	55 (5.2)	121.6 (13.5)	1,104.8	Refined sugar
Tobacco	39 (3.7)	10.1 (1.1)	9.4	Dried leaves
Manila Hemp	1 (0.0)	0.4 (0.0)	0.2	Hard fibers
Cacao	50 (4.8)	13.0 (1.4)	3.9	Dried beans
Total	1,051 (100.0)	901.5 (100.0)	-	

Source: Statistical Pocketbook of Indonesia 1977/1978, Biro Pusat Statislik, Jakarta, 1978

The land area of Jawa Island amounts to 130,000 Km^2 or less than 7% of 1,900,000 Km^2, which is the total land area of all Indonesia. So large an amount of agricultural production in so small a land area as Jawa indicates that the farming on this island is carried on with a high rate of land utilization, and is very intensive. On the other hand, however, extensive cultivation is performed at a low rate of land utilization in the other islands.

3-3 Production and Marketing of Rice

3-3-1 Production

It is important to know how significant the increase in production of rice is for Indonesia because this is necessary for the analysis of the Indonesian economy in the future. The significance may be summarized as follows:

(1) Improvement of the national economy and welfare through securing staple food;

(2) Establishment of national economy through recovery in the balance of payments of foreign currency for imported rice; and

(3) Increase of employment in rural areas.

First, rice is the staple food of Indonesians and accounts for one fifth of the GDP. Therefore, variation in the price and demand for rice affect much in national economic life and even in the national welfare in respect of providing sources of nutrients. Second, the export of primary products such as lumber, rubber, palm oil and other products is contributing to the earning of foreign currency. On the contrary, however, annual imports of rice amounted to more than a million tons and in 1977/78, a peak year, Indonesia imported 2.30 million tons, about 23% of the 8.7 million tons which is the world rice trading quantity. It has to pay several hundred million dollars for rice importation every year. Therefore, increased production of rice would replace a large part of imports. Third, rice production will be very helpful for increasing employment in rural villages. Agricultural employment now accounts for 66% of the total working population. In rice producing areas, labor intensive practices are common, pushing up the rate of employment to a level of 65 to 70% higher than in any other crop production in the agricultural sector. Therefore, it is not too much to say that about 40% of total population is engaging in rice production in Indonesia. Although the mining and industrial sector may develop much in the future, a notable growth of employment will not be expected from it. Anyway, the agricultural sector, especially rice production definitely promises a large increase in employment opportunities.

Under these conditions, the three successive 5 year development plans (1969 ∿ 1973, 1974 ∿ 1978 and 1979 ∿ 1984) focussed their main objective on production increases in rice. Among others, improvement of rice yield through technical advancement and expansion of arable land areas have been taken up as the main target of the 5 year plans.

Rice production of 11.67 million tons was recorded prior to 1969, however, in the period of the first 5 year plan (1969 ∿ 73, it increased to 13.24 million tons. The second plan (1974 ∿ 78) achieved rice production of 17.52 million tons, 95% of the target year.

Table 3-5 Change in Rice Production Area and Yield

Year	Rice Production (1,000 tons)			Harvested Area (1,000 ha)			Yield (ton/ha)		
	Jawa	Outer Jawa	Total	Jawa	Outer Jawa	Total	Jawa	Outer Jawa	Total
1968	7,043	4,263	11,666	4,264	3,756	8,020	1.65	1.23	1.45
1969	7,481	4,768	12,249	4,294	3,720	8,014	1.74	1.28	1.53
1970	7,868	5,272	13,140	4,302	3,832	8,135	1.83	1.38	1.62
1971	8,416	5,308	13,724	4,416	3,908	8,324	1.91	1.36	1.65
1972	8,061	5,230	13,291	4,332	3,655	7,987	1.86	1.43	1.66
1973	8,864	5,743	14,607	4,567	3,836	8,403	1.94	1.49	1.74
1974	9,438	5,838	15,276	4,730	3,777	8,509	2.00	1.54	1.80
1975	9,330	5,855	15,185	4,650	3,845	8,495	2.01	1.52	1.79
1976	9,562	6,283	15,845	4,466	3,903	8,369	2.14	1.61	1.89
1977	9,334	6,542	15,876	4,378	3,982	8,360	2.13	1.64	1.90
1978	10,607	6,918	17,525	4,750	4,179	8,929	2.23	1.66	1.96
1979	10,678	7,194	17,872	4,628	4,175	8,803	2.31	1.72	2.03
1980	12,605	7,641	20,246	4,778	4,240	9,018	2.64	1.80	2.24

Source: Lampiran Pidato Kenegaraan Presiden Republic Indonesia, 1974, 1979, 1981

It is generally considered that such increase in rice production would be attributed to higher yields brought about by intensive farm management under the BIMAS/INMAS Projects rather than by expansion of the rice area.

Learning a lesson from the results of the first and second 5 year plans, the third one put emphasis on acquisition of foreign currency through increased production of commercial crops especially food crops, creation of employment opportunities, supply of industrial materials, and improved standards of living for farmers. A rice production program is prepared as shown in the table below and self-sufficiency of rice is expected to be achieved by the end of the third 5 year development plan.

Observing the table of production of milled rice, the crop has developed to successfully in recent 4 years and nearly 10% of the increase of rice production has been anually realized and it is said that 22,290,000 tons of milled rice was produced in Indonesia in 1981.

However, the conversion rate between paddy and milled rice has been made by the rate of 0.68, and it seems to be higher than the real value. According to the estimation by the team, production of milled rice is as follows;

PKG year 1981 Rate of Conversion

32,775,807 ton x 0.65 = 21,304,000 tons

Table 3-6 Target of Rice Production and Plan for Self-Sufficiency in Indonesia

Year	Consumption per Person per Year		Estimated Population* (1,000)	Total Consumption (1,000 ton)	Rice Production for Consumption** (1,000 ton)	Target of Production (1,000 ton)
	kg	Growth Rate (%)				
1979	121.70	-	135,286	16,464	15,378	17,525
1979	124.47	2.28	135,004	17,177	15,723	17,918
1980	126.49	1.62	140,778	17,807	17,540	17,989
1981	128.06	1.24	143,609	18,391	18,207	20,749
1982	129.64	1.23	146,490	18,991	18,899	21,537
1983	131.21	1.21	149,421	19,606	19,617	22,355
1984	132.79	1.20	152,412	20,239	20,362	23,204

Source: Pelita III

Note: * Mid-year estimate
** Balance after losses of 2.25% in marketing, and losses of 10% during transportation of milled rice and seeds were deducted from total production

Rice production in Indonesia has been on an upward trend at an annual rate of increase of about 10% recently. This success can be attributed to the following facts:

(1) That intensive rice cultivation by farmers groups such as the INSUS was successful;
(2) The weather condition was favorable for rice production with adequate rainfall during the rice growing period;
(3) The extension of disease resistant varieties of rice (V.U.T.W.) and natural control of insects,pests and diseases contributed much to the reduction of their occurrence

Even though Indonesian rice production looks bright at present, there could be many factors which would reverse this view. The history of Indonesian agriculture, especially of rice production tells us a number of instances. It is not unusual that a year of good crops is followed by that of a bad one. Among the factors mentioned above, some will be further shown below. Firstly it is financially difficult to develop many new paddy fields furnished with irrigation facilities; there would be a technical and financial limit to advancing intensive rice production further; a tremendous increase in rice consumption would be expected from an expanding population and the rising income of consumers. It would probably be reasonable to think that all these factors would not promise that Indonesia could proceed with stable rice production further, keeping its self-sufficiency in rice constantly.

3-3-2 Marketing

(1) Supply of Domestic Rice

It is estimated that about 65% of rice produced by farmers is consumed by them while the remaining 35% is put on the market. If this estimation is correct, 21.30 million tons x 35% = 7.46 million tons will be distributed to consumers through markets and the KUD/DOLOG. The amount of rice handled by markets, and KUD/DOLOG is roughly estimated to be divided as follows:

Amount handled by markets:	5.50 mil. t. (75%)
Amount handled by DOLOG:	1.90 mil. t. (25%)
	7.40 mil. t.(100%)

From the above, it is learned that the amount of rice on ordinary markets accounts for about 25% of the total national rice production while that marketed through the DOLOG accounts for about 8.8%.

But the above figures show that of Indonesia as a whole which of course consists of several provinces, some of which are short of rice supplies while others have enough to consume. In these provinces, however, the amount of rice on the market changes suddenly due to the relation between the size of the population and the amount of rice production.

(2) Imports of Food

The government policies for increasing rice production seemed to be successful in achieving self-sufficiency in rice only a short time ago. As mentioned above, however, the productivity which is able to maintain self-sufficiency now looks very precarious, therefore, Indonesia has imported a large amount of food equivalent to some hundred million dollars annually for the past several years as shown in Table 3-7 below.

Table 3-7 Imports of Foods

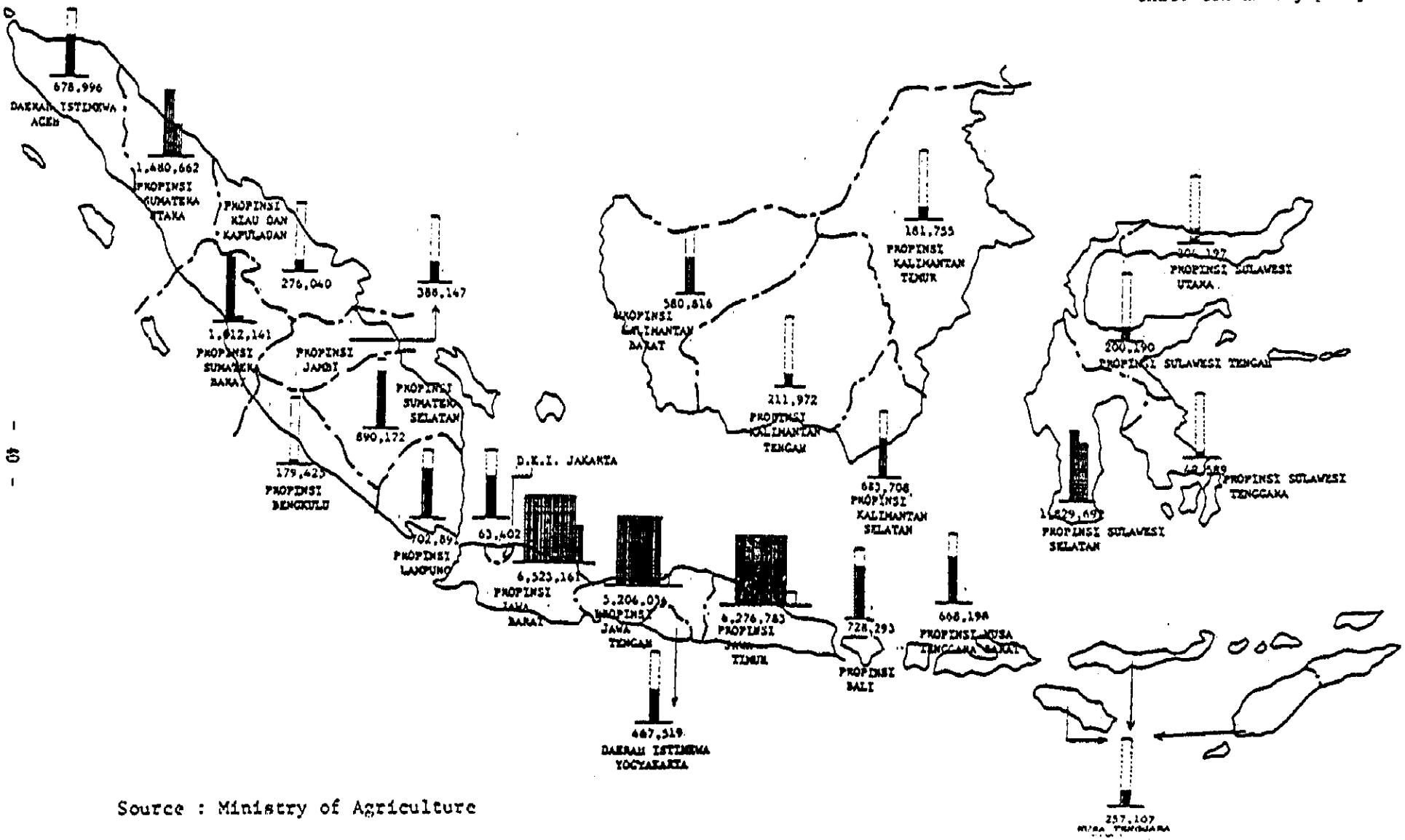
(1,000 ton)

Year	Rice	Wheat	Maize	Soybean	Sugar
1977/78	1,850	1,002	23	52	481
1978/79	1,950	1,239	0	33	489
1979/80	2,050	1,358	34	45	395
1980/81*	1,213	1,280	22	74	549
1981/82**	532	1,430	-	34	825

Source: BULOG

* Preliminary
** Forecast

Unit: ton in dry paddy



Source : Ministry of Agriculture

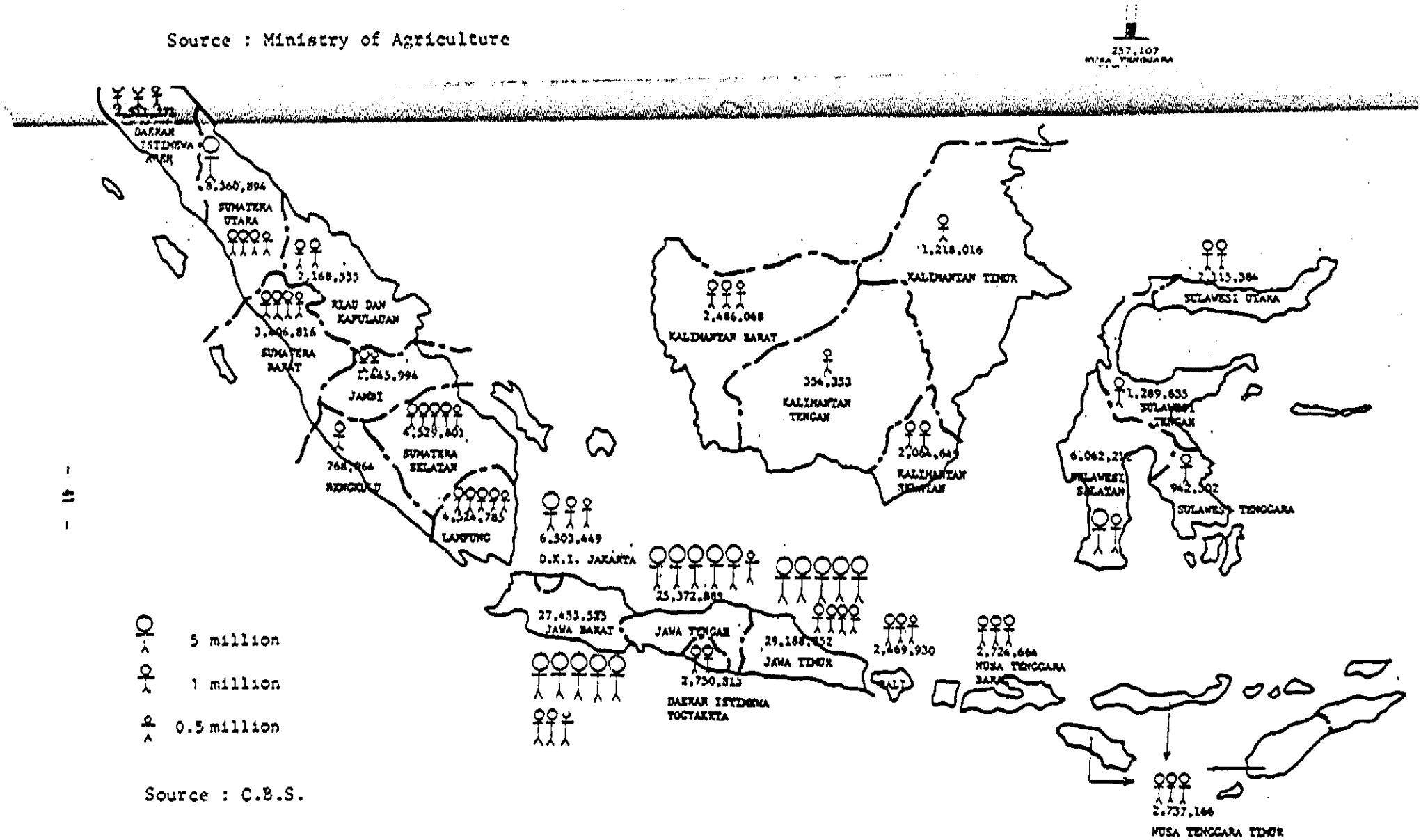
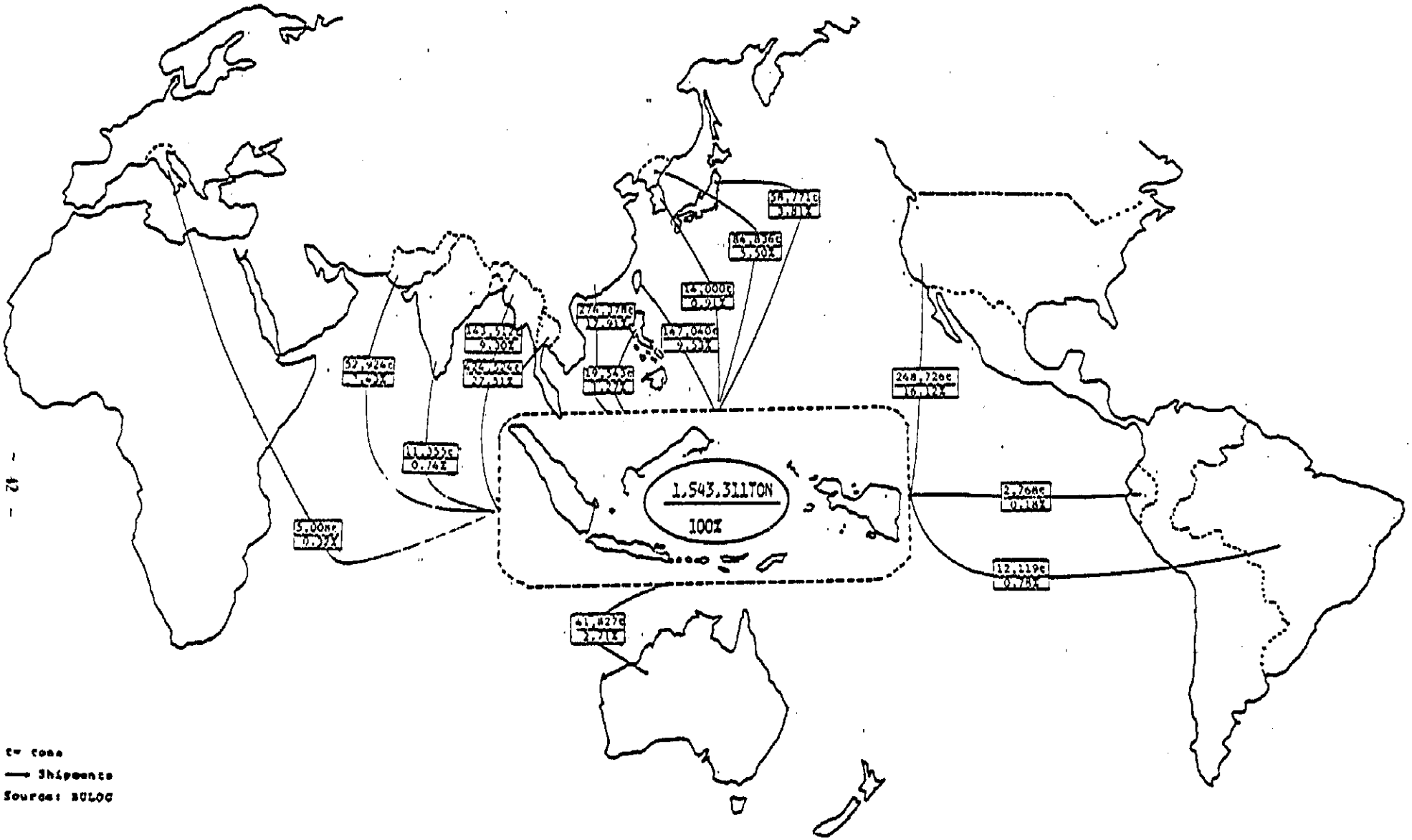
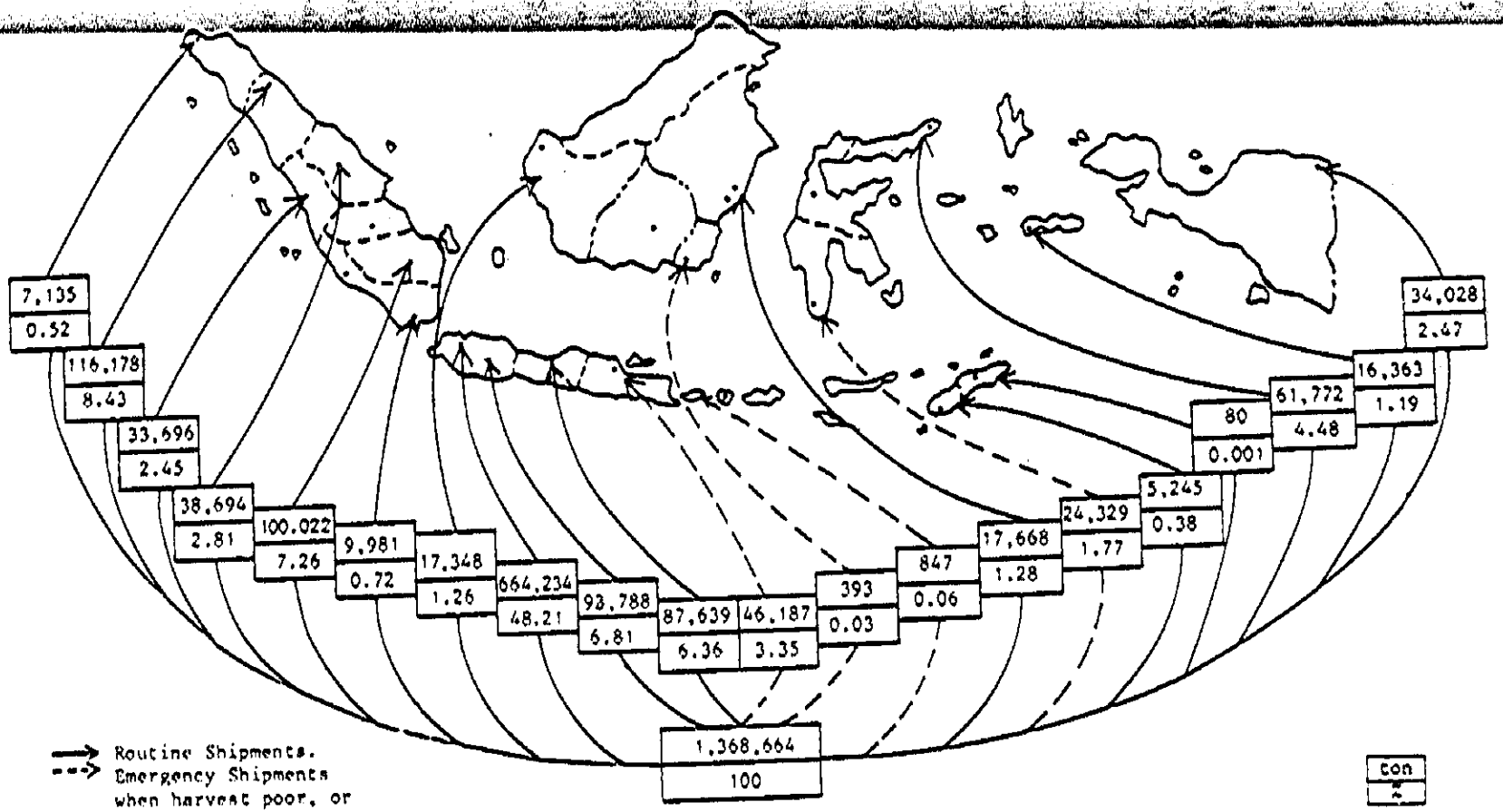


Fig. 3-2 The Population in Indonesia by Province (1980 Census)


1,543,311TON
100%
t= tons
Shipments
Source: BULOG



Source: BULOG

Fig. 3-4 Pattern of Rice Import Distribution
Average 1974/75 - 1978/79

As seen from the table 3-2, 10% of all rice consumed in this country has long been supplied from foreign countries and the imports have risen as much as 2 million tons these past several years.

Table 3-8 Imports of Rice and Their Rate to Total Consumption

(1,000 tons)

Year	Imports	Rate(%)	Year	Imports	Rate(%)
1949	333		1965	203	2
1950	334		66	308	3
51	529		67	354	4
52	766		68	628	6
53	372		69	604	5
54	261	4	1970	956	8
55	127	2	71	490	4
56	763	11	72	735	6
57	554	7	73	1,657	11
58	921	11	74	1,071	7
59	891	11	75	673	5
1960	893	9	76	1,281	8
61	1,064	11	77	1,964	12
62	1,025	10	78	1,850	11
63	1,043	11	79	1,950*	10
64	1,010	10	1980	2,050*	10

Source: 1949 - 56 CBS
1957 - 80 Badan Urusan Logistik

*Preliminary

Note: Excludes glutinous rice

(3) Per Head Consumption of Rice

Immediately after independence, the consumption of rice per head per year was only 88 kg when the total population was 82.82 million and total production of rice amounted to 7.84 million tons. In 1968/69 when the first 5 year plan for development started, the annual per head consumption of rice was 98 kg from a total rice production of 11,687 million tons and a total population of 111.17 million. Recently, however, rice production has been keeping an upward trend and has reached a level making possible such per head consumption as shown in the table 3-9 below.

Table 3-9 Change in Consumption of Rice per Year per Head

Million Ton

Year	Production	Seeds and Others	Imports	Carry over of BULOG	Total Effective amt.	Population (million)	Per Year Per Head Consumption(kg)
1975	15.18	1.24	0.67	+0.22	14.83	130.29	114
76	15.84	1.27	1.28	+0.08	15.93	133.34	119
77	15.88	1.27	1.96	+0.03	16.60	136.46	122
78	17.52	1.39	1.85	-0.67	17.31	139.65	124
79	17.87	1.43	1.95	+0.37	18.76	142.92	131
1980	20.25	1.62	2.05	-0.94	19.74	147.21	134

Source: BULOG, CBS

In the 10 years (1968/69 ∿ 1977/78) when the first and second 5 year plans for development were put into force, the consumption of rice per head rose at a rate of 2.2% per year. In the meantime that of wheat and cassava also went up while that of corn and potatoes declined a little. As seen in Table 3-10 the calorie intake from rice was 70% of that from all other carbohydrate foods.

Table 3-10 Average Annual Availability of Calories in Selected Foods in Indonesia

(000 Kcal/capita/ye

Food	Kcalories/ kg.	1969	1971	1973	1975	1977
		Starchy Staple Foods				
Rice	3,660	388	403	432	414	450
Maize	1)	67	74	99	81	78
Sweet Potatoes	950	17	16	16	16	15
Cassava	2)	55	47	56	60	76
Wheat Flour	3,500	10	14	14	14	14
Starchy Staples Total/year		537	554	617	598	633
Rice as % of Starchy Staples		72	73	70	69	71
	Kcalories/capita/day					
Total Starchy		2,019	2,089	2,209	2,142	2,278
Imports Rice and Wheat		78	75	169	89	159
Availability from Domestic production		1,941	2,014	2,040	2,053	2,119

1) Maize pipilan dry 3,490 Kcalories, maize dry on cob, 1,684 Kcaloric maize wet on cob, 1,281 Kcalories/kg.

2) Fresh roots 980 Kcalories, gaplek and tapioca 3,630 Kcalories/kg.

Source: CBS

(4) Seasonal Movement of Rice

The Indonesian farmers have long experience of their own farming practices under favorable natural conditions. Although they produce rice mainly in the rainy season, it was practicable all the year round. Since some varieties of IR with a shorter growth period were introduced, the cultural control helpful for prevention of pests and diseases and development of irrigation have been performed intensively by groups of farmers especially in rice producing regions. As a result, rice is mainly harvested from March to May in the rainy season and from August to October in the dry season. Consequently, the movement of rice from farmers centers on these two periods.

Table 3-11 Monthly Rice Crops Compared between Two Districts (Klaten and Cirebon, West Jawa)

	Klaten (%)	Cirebon (%)
Jan.	6.1	0.2
Feb.	8.8	1.6
Mar.	12.8	7.9
Apr.	9.5	35.0
May	11.3	14.6
Jun.	12.7	1.2
Jul.	10.7	4.4
Aug.	5.2	21.3
Sept.	4.8	11.4
Oct.	8.3	1.3
Nov.	5.7	0.4
Dec.	4.0	0.5
Total	100.0	100.0

Source: CBS of Central Jawa (1980)

(5) Diagram of Rice Movement

A diagram illustrating rice movement from producer to consumer is shown in Fig. 3-5. Though the movement is slightly different among vari districts, it is generalized into such as shown in this figure by elimin ing insignificant differences.

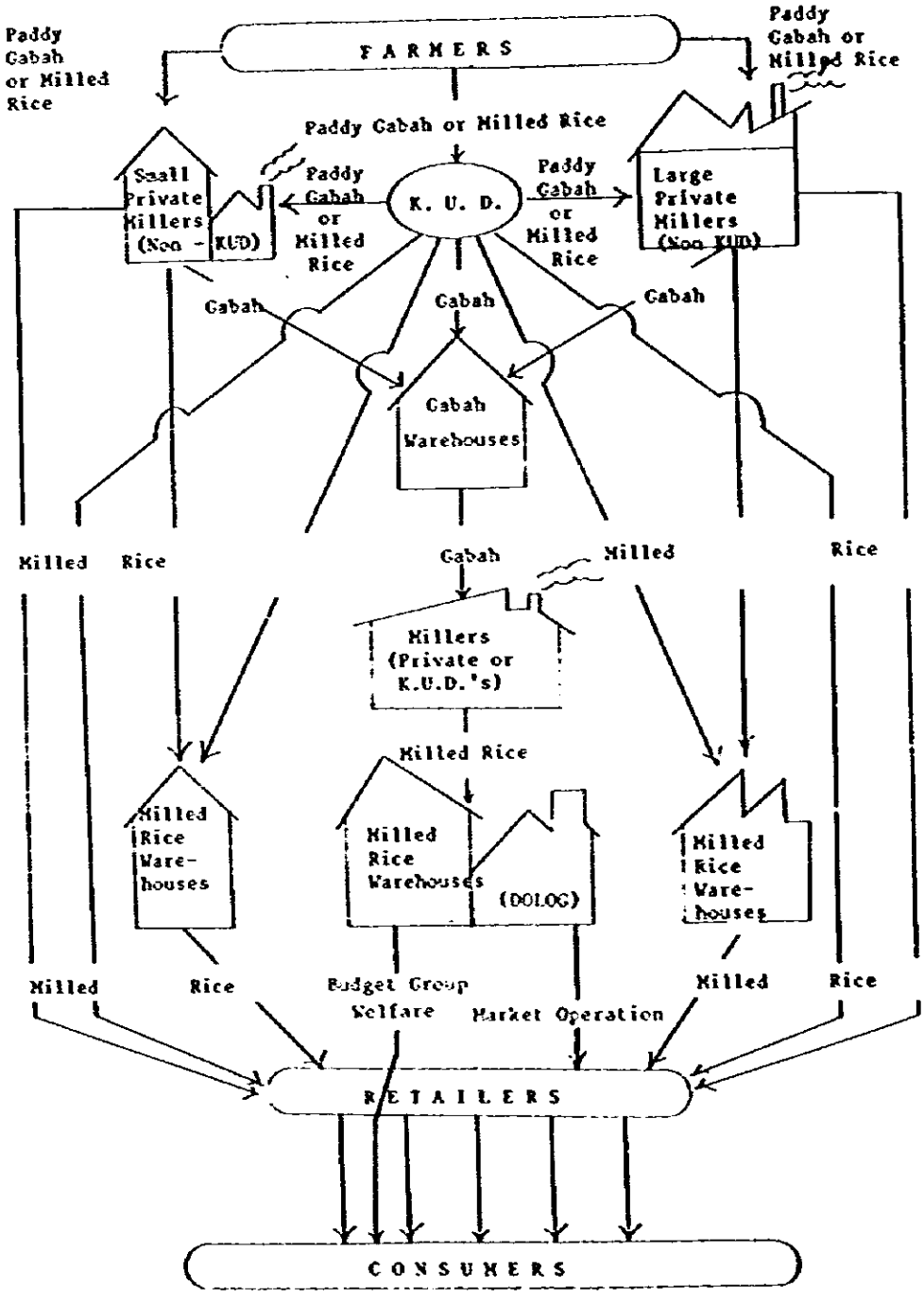


Fig. 3-5 Flow of Commodity Domestic Rice

(6) Those Who are Concerned with Rice Marketing

1) Commission Merchant in the Village

Many commission merchants in farm villages play a leading role in making a connection between rice farmers and rice millers or small or large sized rice merchants.

The commission merchant in farm villages is called a "small paddy trader" that is "Pedagang" or "Tengkulak" in Indonesian. In view of his way of transacting business, he may be a village merchant, middleman, broker or advocator.

The village merchant who is called a Pedagang Pengumpul or Pedagang Keliling in some districts visits farmers one by one directly to collect paddy. As a merchant, he is on the lowest level of commission. Commonly he was formerly a petty or landless farmer. He usually uses a bicycle for visiting farmers and carries the collected rice, he may be called an Ojek in West Java. He buys paddy for cash from farmers, which is borrowed from a Pedagang or village grocer who is also a village broker on a higher level. The Pedagang Besar, gathers all paddy collected little by little by the Pedagang Pengumpuls in his village.

As the village grocer and broker generally do not have rice drying and milling facilities, paddy collected by them are delivered to the Padagang Besar, a broker on a much higher level who has a motor truck and a rice mill near his home. It is interesting that both Pedagang and Pedagang Besar are mostly members of KUDs and are under the financing of the KMKP (Permanent Working Capital Credit) or the Kredit Mini (Small Short Term Loan). Those called Warungs who buy paddy at the roadside are also included in such groups.

2) Small Rice Mill

The mills here mean "small private rice milling units", which can process rice only as much as 6.5 tons or less a day. They mill rice only to be consumed by farmers in the neighborhood, but sometimes they do the same for Padagang, Warungs and Pengecer or retailers on consignment. In the case they have trucks and warehouses, they actively buy paddies directly from farmers and sell the paddy to mills, markets and other Pedagang in the neighborhood.

3) Large Rice Mill

Large private rice mills should have a daily milling capacity more than 6.5 tons in addition to the capacity for cleaning, hulling and milling. They do their job on consignment from the KUDs or the DOLOG. Although speculative transactions are restricted, they act buy and process paddies on behalf of big rice merchants in large c as they have large warehouses and drying and other processing faci Therefore the bulk of milled rice supplied to large consuming cent are processed by them, whose role in the rice market is thus extre active and important.

4) Rice Dealer

Large rice traders are called Pedagang Besar or Tengkulak Ba among Indonesians. While Pedagang Kecil as mentioned above engage mostly in their business within a village (Desa) or a subdistrict (Kecamatan), the large traders' sphere of business activities some covers the whole province. They sell a large quantity of rice to retailers and wholesalers. Some of them carry rice actively to ma islands other than Jawa in ships. They also engage in shipping fr island to island under contract with the DOLOG.

5) KUD

KUD is the abbreviation of Koperasi Unit Desa which means the federation of village cooperative units. It supplies not only fertilizer, agricultural chemicals and other productive means, but also engages in cooperative collection and processing of farm prod Though it may purchase paddies directly from farmers at a floor price and sell them to the DOLOG after processing, it has not been furnished enough facilities enabling it to perform such functions for instance, transport, storage and rice milling. Therefore, this work is in the hands of large private mills as mentioned above.

Some of the KUDs have been fully equipped with milling facili GLK Program (warehouse; 200 ton capacity, cemented floor for dryi shop for input materials such as fertilizer, pesticide etc.) will continued further in various districts to help the KUDs' activiti the number of all those facilities is still too small for the cou

whole, the introduction of more facilities is now under way through financial and by foreign countries.

It depends upon the managerial ability and responsibility of all the KUDs whether they can be successful in deriving the most fruitful results from their topographical conditions, their extremely favorable loans given by the government and especially their business management funds borrowed at low rates of interest.

6) DOLOG

DOLOG is a regional organization of BULOG and takes an important role in conducting with market operations. Modern warehouses built all over the country store a large amount of rice both domestic and imported, which have various uses, for instance, feeding military forces, employees of public corporations and estates and immigrants, for urgent release in times of disaster, for welfare purposes, and for manipulating the market price of rice. The amount of rice bought by the BULOG through the DOLOG-KUD or non-KUD was 1.9 million tons equivalent to 8.8% of total national production.

4 BIMAS/INMAS Program and Introduction of High-Yielding Varieties

In Indonesia with its large population, it has been a very important policy to increase food production especially rice crops since independence. The policy became extremely acute and significant around 1962 when the population exceeded one hundred million and above all imports of rice over million tons brought about a large deficit in its balance of international accounts. Thus, the BIMAS programs started in 1964/65 as key policies for the increase in food production. BIMAS (Bimbingan Massal) means mass guidance which is to give mass guidance for increasing rice production. Farmers who participate in this program may procure fertilizer, agricultural chemicals and improved seeds on credit from the government. In Indonesia, agricultural production has been expanded mostly in parallel with the development of farmland. Technical progress had almost nothing to do with its agricultural development. Immediately after independence, however, development of arable land had already reached the limit. Therefore, the BIMAS, an intensive cultivation program was epochmaking in giving mass guidance on agricultural technical improvements which are as follows:

1) Use of improved cultivation method
2) Extension of High Yielding Varieties
3) Improvement of control water resources
4) Proper application of fertilizer
5) Intensive pest control

It was towards the end of the 1960's when vicious inflation and political disturbances were coming to an end and the program began to function effectively as a long term plan for increase in production.

The program aimed at first to increase the yield per unit area th application of chemical fertilizer while farmers still stuck to the lo variety in rice production. In the meantime, the advent of INMAS (Intensifikusi Massal) was seen in the rainy season of 1967/68. This i a system under which farmers who have paid back their credit loans can supplies with their own money. Around 1967 when the INMAS was establis the International Rice Research Institute developed high yielding vari of rice (called HYV herein-after) and for the first time IR varieties introduced to Indonesia. The new varieties introduced spread widely a Indonesian farmers after 1973 and contributed much to increase the pro tion of rice in this country as shown in Table below.

Table 3-12 Implementation of BIMAS/INMAS 1968 - 80

(1,000 ha.)

	BIMAS			INMAS			INTENSIFIKASI	
	Local Variety	HYV Variety	Total	Local Variety	HYV Variety	Total	Local Variety	HYV Variety
1968	745	18	736	834	-	834	1,579	18
69	926	383	1,309	722	99	821	1,648	482
70	803	445	1,248	571	334	845	1,374	779
71	827	569	1,376	867	525	1,393	1,694	1,034
72	621	582	1,203	1,166	800	1,966	1,787	1,352
73	662	1,170	1,832	1,076	1,080	2,156	1,738	2,259
74	474	2,202	2,676	410	638	1,093	884	2,849
75	425	2,258	2,683	343	611	954	768	2,869
76	321	2,108	2,424	370	817	1,189	691	2,922
77	272	1,787	2.059	669	1,512	2,181	940	3.309
78	236	1,724	1,760	800	2,088	2,888	1,036	3,812
79	197	1,274	1,571	851	2,601	3,452	1.048	3,795
80	132	1,242	1,374	808	3,421	4,229	940	4,663

Source: Lampiran Pidato Kenegaraan Presiden Republic Indonesia, 1974, 1979, 1981

As shown in the table, the increased production of rice is characterized by intensive production (Intensifikasi Produksi Padi) based on the BIMAS/INMAS programs and HYV has played the leading part in the development of new rice technology.

In the history of HYV in Indonesia, C4-63 and others were brought in 1969 after the introduction of IR5 and IR8 in 1967 and early in 1970's, Pelita I and II were developed by crossing a local variety (Syntha) with a HYV (IR-5). However, those high yielding varieties introduced early to Indonesia had little resistivity to insects and diseases particularly some kinds of virus diseases and plant hoppers called Wereng and caused serious damage to the program for intensive production of rice. On account of this bitter experience, an improved and higher disease resistant variety of IR-26 (called V.U.T.W.= Varitas Unggul Tahan Wereng) was developed and then IR-32, 36, 38, 42 and others followed and spread until IR-54 appeared most recently. Among the improved varieties domestically developed are Cimandiri, Cisadane and others, of which Cisadane is now very popular among rice producers because of its good taste and other excellent qualities although it is rather susceptible to some kinds of virus disease and pests.

The introduction of new techniques by the BIMAS/INMAS program has brought about a revolutionary new method of cultivation in rice production and, at the same time, has had a strong impact on traditional Indonesian rural society.

The increase rate of rice-growing land for the decade 1965 ∿ 1974 in Indonesia was 14%, production per hectare has risen by 46% and rice production has developed by 66%.

However, the population is increasing year by year at a high rate and the country has had to depend on imports of around two million tons of rice from foreign countries every year.

Therefore, since the year 1979, a new policy of food production of with an intensification in the input of fertilizers, extension of productive seeds, utilization of agricultural chemicals and good irrigation service has been implemented under INSUS (Special Intensification Program).

Moreover, OPSUS (Operational Khusus) started in 1981 as the Extensive and Intensified Intensification Program in 5 regions in Indonesia as well as the Lappo-Ase implemented in South Sulawesi.

3-5 Number of Workers in Agricultural Sector

3-5-1 Number of Workers in Agricultural Sector

It is nearly impossible to accurately determine the number of worke in the agricultural sector of Indonesia. For instance, it is difficult to determine the annual working days of farm wives and elderly people. The working hours of minors helping in farming are substantial, and that figure presents a problem when minors are not included in the number of workers at all as is the case with other countries.

In the case of farm workers who have no land, it is difficult to determine their family labor force, and their actual number even if a strict definition is set and a survey is made.

An estimate of the number of workers based on existing data is give in the following. First, the number of farms in the 1980 census was 17,4 At least the bulk of the householders can be considered as workers in th agricultural sector. In the 1980 census, farm workers totaled 7,230,741. When workers engaged in fishery and livestock are added, workers engage in agriculture total 8,012,232. The minimum number of workers in the agricultural sector can be estimated to be 25,480,792 after adding farm householders and farm workers.

The average family size in 1980 was 4.9 persons. (The family size farming households is considered slightly larger than that of non-farmi households. However, there is no data to support it, and the national average number was used.)

The farming population is 17,468,560 x 4.9 + 8,012,232 = 93,608,17 accounting for 63.5% of Indonesia's total population of 147,331,823 in

3-5-2 Number of Farms and Their Situation

According to the 1973 census, farms totaled 14,373,542. In only se years, farms have increased as much as 12.15%.

The numbers of tenant and owner farmers in 1973 and 1980 are compare in the following:

Table 3-13

	1973		1980	
	Number of Households	%	Number of Households	%
Owner Farmer	10,746,522	74.8%	12,849,467	73.6%
Tenant Farmers	456,346	3.2%	2,601,791	14.9%
Owner-Tenant Farmer	3,170,674	22.0%	2,017,302	11.5%
Total	14,374,542	100.0%	17,468,560	100.0%

The number of owner farmers increased 2,102,945 in absolute terms. However, their overall proportion decreased 1.2% as the number of tenant farmers increased greatly. The number of tenant farmers increased as high as 11.7%. This means that 2,145,445 farms (this includes the increase in the number of farms) in the landed and tenant farmer group had fallen to tenant farmers.

According to the 1973 agricultural census, the number of rice farms among farms totaled 10,929,521, broken down into 9,084,493 rice farms and 1,845,028 up land farms. Rice farms account for 76% of all farms.

The number of rice farms in 1980 is not available. Assuming that the ratio of increase in rice farms is the same as that for farms in the seven years between 1973 and 1980, the number of rice farms in 1980 can be estimated at 12,257,458, of which 10,188,259 farms were rice farms. Therefore, these are the farms that become subject to improvements in rice processing after harvesting. The diference between the numbers of rice farms is up land rice farms.

The fact that there was an increase of more than 3 million farms in the seven years compared with a small increase in farming land can be attributed to the land inheritance custom in Indonesia. If this situation is allowed to continue, tenant farmers will continue to increase, and the scale of farms will become excessively small. As a result, farm workers (burutani) having no land will increase. This will become an issue when a study on improvements to be made in processing after harvesting is made.

Next, the size of farms in 1980 is given in the following:

Below 0.25 ha	5,964,354 farmers	34.1%
0.25 0.50 ha	5,063,299	29.0
Above 0.50 ha	6,440,907	36.9

In the size ratios of the 1973 farm census, 45.6% were 0.50 ha and belo 24.7% were 0.50 to 1.0 ha and 29.7% were more than 1.0 ha Farms culti ing less than 0.50 ha increased 17.5%. These represent increases and decreases in the number of farms. In terms of actual land size broken by farming scale, 11.8% represented less than 0.5 ha 17.1% represented between 0.50 and 1.0 ha and as high as 70.3% represented more than 1.0 in the 1973 census. This clearly shows how small the farming scale of small farms with less than 0.50 ha is.

A similar analysis for recent actual land size cannot be made until the results of the next farm census are announced.

What is extremely important is the existence of farming workers (burutani) who have no land to cultivate. One prominent situation in Indonesia recently is that farms are becoming smaller in size due to Indonesia's Land Inheritance Law. There is a limit to making land small by inheritance. Management of farms is no longer possible for land smal than 0.1 to 0.2 ha As of October 31, 1980, there were 7,230,741 burut to increases in those who allow their brothers and sisters to actually cultivate land while subdividing names to the land (therefore, virtually possessing no land), those inheriting other than land, and those selling land being unable to manage the farm because the land is too small. Th burutani in Java (including Madura Island) total 6,023,079. As many as 82.3% of the burutani in all Indonesia live on Java. Burutani living o other islands can be broken down as follows:

Sumatra	705,283 persons
Nusa Tenggra	235,106
Kalimantan	116,350
Sulawesi	135,821
Maluk/Irian	15,102

These burutani closely affect postharvest activities.

3-6 Governmental Organization Related to Postharvest Handling

3-6-1 Ministry of Agriculture

This Ministry consists mainly of the Secretariat General, the Directorate General for the supervision of all businesses concerned with the Ministry , two Agencies and 5 Directorates General as shown in the Organization Chart below.

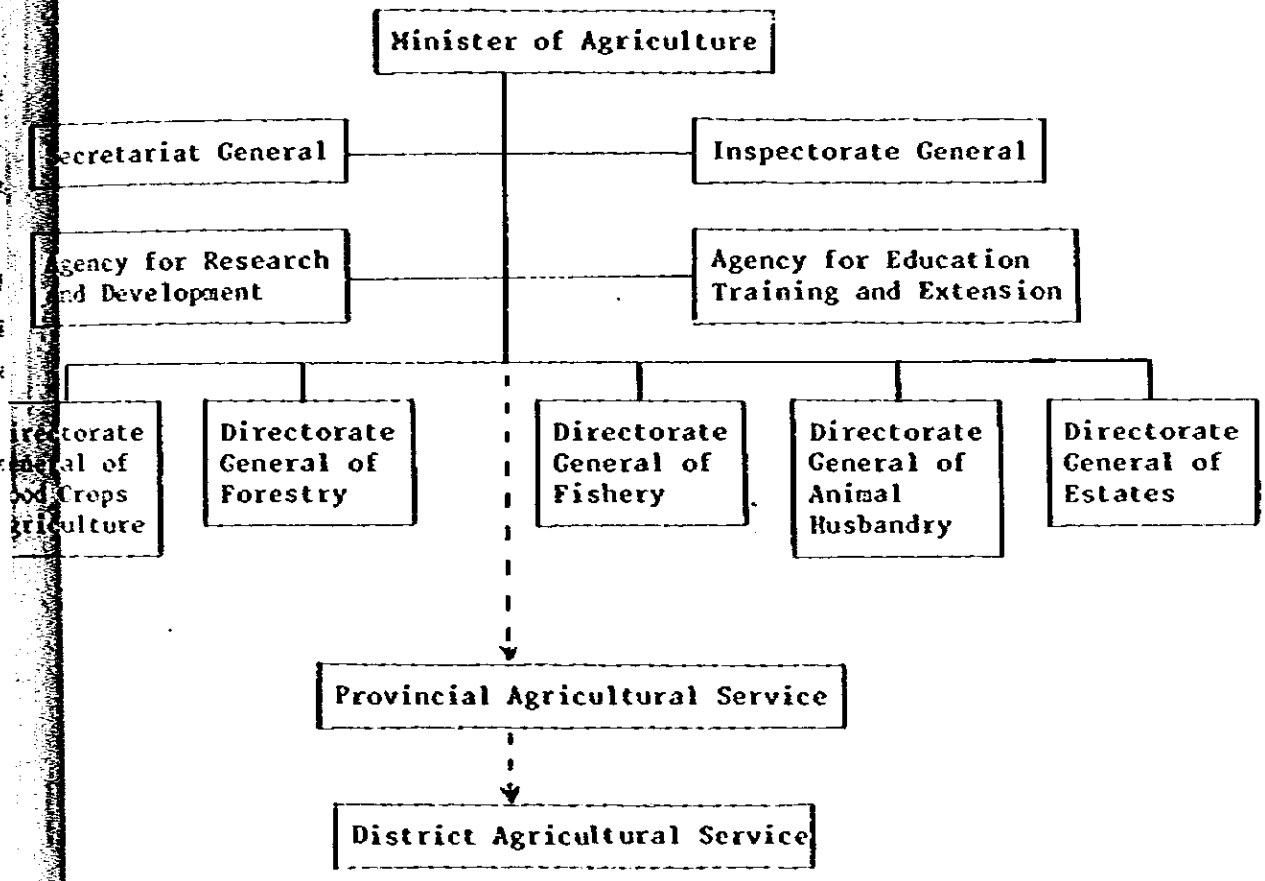


Fig. 3-6 Organization Chart of The Department of Agriculture

In the organization, the two Agencies for Research and Development and for Education, Training and Extension, and the Directorate General of Food Crops Agriculture have been closely rerated with the improvement of postharvest handling and processing of food crops.

The Agency for Research and Development engages mainly in research and experiments on new rice technology; The Central Institute for Food Crops under the Agency, the Center for Statistics and Agricultural Data, the Central Agricultural and Biological Library, etc. The Agency for Education, Training and Extension deals with extension, education, training and technical guidance concerning rice and other crops.

The Directorate General of Food Crops Agriculture has 4 offices under its control and is concerned with the production of food crops such as rice, maize, cassava, soy bean, etc.

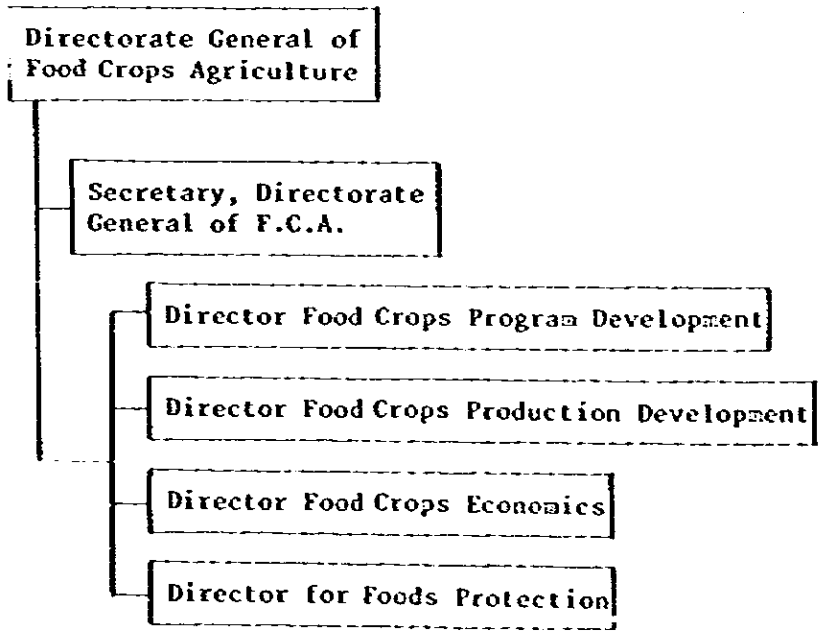
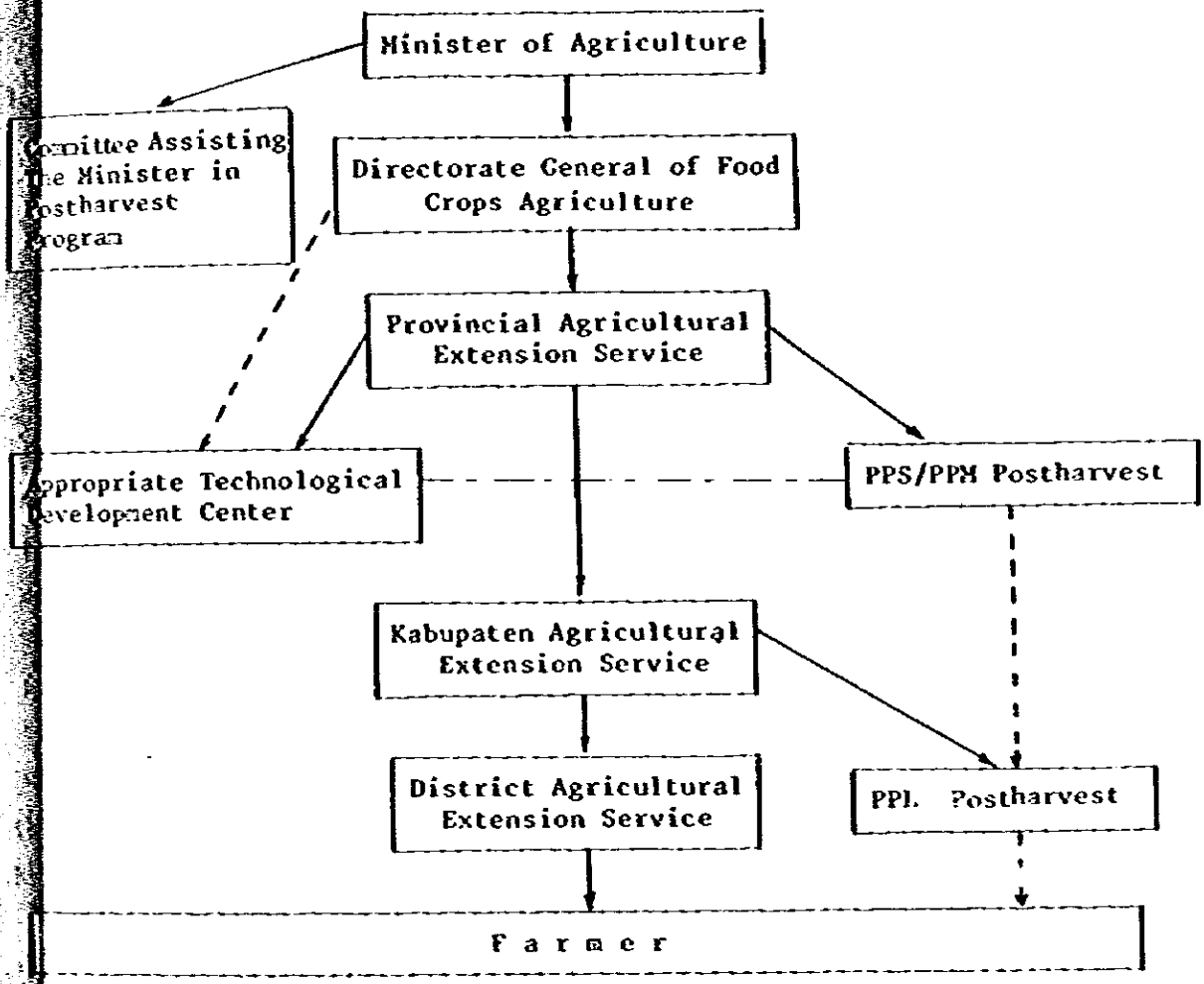


Fig. 3-7 Organization Chart of The Directorate General of Food Crops Agriculture

In the Directorate of Food Crops Economimics, there is a section which specializes in postharvest handling and processing of crops. This section consists of 3 sub-sections which are in charge of postharvest processing techniques, mechanization of postharvest works and standarization and inspection of crop quality. These subsections also make research and give guidance on matters in their respective fields.



Remarks: ——— : Direct Hierarchy Connection Line
— - - — : Consultative Connection Line
- - - - - : Indirect Connection Line
PPS : Subject Matter Specialist
PPL : Field Extension Worker

Fig. 3-8 Organizational/Institutional Scheme of the Postharvest Project

The extension service for increase in production of rice in each p is performing with the provincial department of agriculture under the administration of the Agencies and Directorates General of the Departm of Agriculture. Each provincial and district department of agricultu consists of 5 divisions of planning, production, extension, management and crop protection. Among them, the extension division administers th Rural Extension Centers (hereinafter called REC) which directly give ex sion services to farmers.

There were 1,206 REC in all throughout Indonesia in 1981, which ga guidance and demonstrations on farming practices to farmers according t the standard rice cultivation of the BIMAS by the provincial department agriculture. A Rural Extension Center usually employs 2 or 3 PPH (mid class extension workers, college graduates) and about 10 PPL (general extension workers, high school graduates) under the director; PPS (subj matter specialist, university graduate). The sphere of activities of e centers covers 10 working village units (Badan Usata Unit Desa). Each unit is made up of 3 villages (Desa) whose areas total 200 to 300 Therefore a rural extension center has 5,000 to 10,000 ha under its infl

A general extension worker (PPL) performs his services according t the guidelines called "Training and Visit System". For instance, he has to work for Farmers Groups (KELOMPOK TANI) in 16 villages. On such oc- casions, he makes use of field belonging to a key farmer of a group to demonstrate the standard farming practices of the BIMAS and also gives advice on group cooperative farming to farmers in the neighborhood, and investigates the growth and yield of rice at the same time.

These farmers groups consist of 20 progressive farmers centered around the key farmer, and each progressive farmer has several (usually followers i.e., farmers to whom extension service is mainly to be direct Therefore, a PPL has to work for

16 key farmers x 20 progressive farmers x 5 followers = 1,600 farm

In 1980, however, the number of PPLs was only 13,211 throughout th country. Out of this absolutely small number of extension workers, many of whom are said to be not well qualified, it can hardly be expected that the proper guidance and extension services will be fully executed.

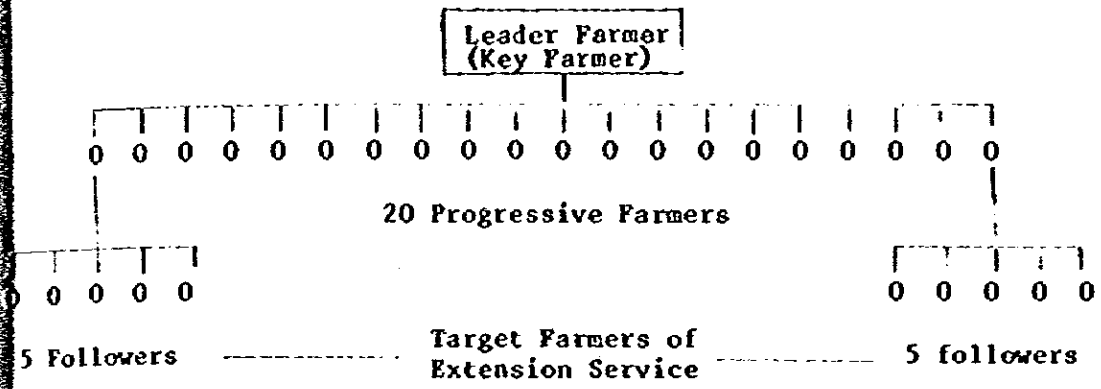


Fig. 3-9 Constitution of Farmers' Group
(KELOMPOK TANI)

3-6-2 Ministry of Trade and Cooperatives

The agricultural cooperative association in Indonesia has quite a long history in which various kinds of political and economic problems have arisen. At the beginning, progressive colonial magistrates and some leaders of the national movement joined together to farm agricultural cooperatives of farmers mainly engaged in the production of cash crops such as rubber, copra and sugar cane. Then the cooperative movement began to spread widely over the rural areas. Under the Soekarno Administration after independence, Dr. Hatta, the Vice-President took the initiative in consolidating the cooperative movement with the principle of "solidarity of self-sufficient farmers", increasing the number of cooperatives. However, in the political disturbances thereafter, various political parties began to make use of the cooperatives as a way of expanding their political power. In addition, the monetary value dropped drastically due to the aggravation of the inflationary trend in the 1960s and brought about a crisis for the cooperatives. In consequence, the government had to reorganize or integrate many cooperatives in 1967.

In 1972 when a serious nationwide drought hit Indonesia, Presidential Decree No. 4/1973 for revision of the Agricultural Cooperative Law was issued to the effect that control of the rice market should be transferred into the hands of native farmers from Chinese merchants in order to relieve food shortages. Prior to the issuance of this Decree, a pilot project of the Unit Desa performed in Jogjakarta under the DEMAS program

was successful in the cooperative supply of productive means and selli of agricultural products.

In those days, however, a village cooperative unit, BUUD (Badan Usaha Unit Desa) had to be organized at first in a transitional form w so small a sphere of activities as to cover only 600 to 1,000 ha and it was expected to develop gradually into a more complete form of village cooperative system of the KUD (Koperasi Unit Desa).

On March 31, 1979 when the second 5 year development plan came to end, the national total of the BUUDs and KUDs amounted to 4,465. Abou of them had their own warehouse with a capacity of 100 tons and one fourth of the BUUDs owned a small rice milling plant. In the period o the second 5 year development plan, however, Indonesia was under adve circumstances with the oil shock and vicious inflation, and its rice production went through hard times with severe damage to crops by pest and disease in 1975, and by pests, disease and drought in 1976 and 197

In the meantime, various relief measures were taken to help the farmers. The procedures for credit from the BIMAS was simplified and t Credit for Small Farmers (KCK), the Credit for Small Investment (KIK), the Credit for Working Capital (KMKP) were set up for the improvement o the rural economy. In addition, Presidential Decree, No. 2/1978 was is in 1978. Its aim was to develop and consolidate the BUUD and the KUDs as cooperatives for integrating agricultural management of rural socie and to encourage farmers to produce more. If it was achieved, farmers c sell more rice under the BIMAS/INMAS Programs to the BUUD/KUD at a flo price and these buyers could sell after processing and milling to the BULOG. Thus the government intended to consolidate the rice marketing route from farmers to the BULOG through the KUD in order to stabilize t demand and supply relation of rice and to improve the income of farmers

Under the third 5 year development plan, the government extended t floor price to corn, soybeans, green beans and peanuts. As a result, t KUDs' business was diversified. At the same time the government also s the G.L.K. program to set up 1,000 drying centers (with cement floors), 1,000 farm supplies shops, and 1,000 warehouses with 200 tons in capac at the level of KUDs throughout the country. These facilities are no under construction.

As existing facilities are inadequate for the drying, cleaning an milling of rice, the KUDs have made use of the PPK (Cooperative Service

which has old large mills lying idle. In light of the above situation, 20 new PUSKUDs, Pusat-Pusat Palayanan Koperasi (Center for Cooperative Service) were established in Jawa in the year of 1981, enlarging the rice processing capacity.

The floor price system for rice was established in Indonesia in 1970, when the BULOG purchased rice exclusively from merchants or mills. But after the BUUD and the KUD were set up, in 1973, the government began to buy rice mainly through the KUD. The results of such purchases are as shown below.

1974	348,645 tons
1975	369,976 "
1976	216,077 "
1977	212,178 "
1978	277,370 "
1979	235,523 "
1980	1,446,363 "

3-6-3 The National Logistics Agency (BULOG)

Stabilization of the rice price should be one of the basic principles of the government price policy, especially in Indonesia where the population is very large, the marketing force is weak, the annual difference between good and poor crops is so remarkable and seasonal or regional changes in the rice price is very considerable.

After independence, the YUBM (Yayasan Urusan Bahan Makanan Food Procurement Agency) was responsible for the stability of the rice price. Then the KOLOGNAS (Komando Logistics Nasional: Headquarters of National Logistics) took the place of the above agency. In spite of these Agencies, their work produced little result because the rice marketing was completely under the control of a private commercial enterprizing system made up mainly of Chinese merchants.

In 1969 the Government organized the BULOG (Badan Urusan Logistik The National Logistics Agency) under the direct control of the President's Office. It was authorized to take all possible measures for stabilizing the rice supply and price and improving the farm household economy.

Initially, this Agency was to take responsibility for the subjects mentioned as follows:

(1) Procurement of rice to be given as an allowance in kind to govern employees, military people, and employees of national enterprises; and

(2) Procurement of buffer stock to be released for balancing demand a supply of rice in off-crop seasons or at times of poor crops and stabilizing the rice price in consuming area.

To fulfill the responsibilities, it has branch offices such as DO (Depot Logistics) and Sub-DOLOG in every province.

The BULOG manipulates domestic and imported rice and its main business is to procure, reserve and release rice and to make studies o how to improve these functions and on the market situation.

The BULOG has recently monopolized importation of wheat, sugar a soybeans in addition to rice and purchases through the KUDs corn, soyb green beans, peanuts, etc. domestically produced as secondary crops.

Rice purchased in the country is mostly of HYV produced by the BI and the INSUS, and procured through the KUDs in each producing center (with an added price incentive) or through ordinary commercial channels. Other than the domestic ones, rice is also imported under various conditions such as the Kennedy Round, PL480, Japanese soft loan, US loan aid, grant in aid and commercial transactions.

Rice is released mainly for the Budget group, welfare purposes an market operation. Those objectives are broken down as follows:

Budget group:

1. Army, navy, air force, police army and military police
2. Government employees
3. Jails
4. Employees of government corporations including the Petroleum Corporation and DOLOG

Welfare purposes:

1. Relief to devastated areas
2. Immigrants

Market operation:

1. Market in consuming center
2. Market in refuge

Business results of the BULOG relating to purchase, import and release of rice these past 5 years are as shown in Table 3-14.

Table 3-14 Business Results of the BULOG 1975/76 - 1979/80

(1,000 ton)

	75/76	76/77	77/78	78/79	79/80
Carried over	783	536	579	459	709
Procured					
Purchased Inland	539	410	404	881	364
Imported	667	1,506	2,308	1,268	2,643
Total	1,989	2,452	3,291	2,592	3,717
Released					
Military Gov't Employees	660	669	663	613	708
Employees Gov't Corp.	90	87	82	106	91
Market Operation	559	979	2,021	1,053	2,033
Others	101	84	50	82	25
Total	1,410	1,819	2,786	1,854	2,856
Consumed	43	54	45	46	42
Balance at The Term End	536	579	459	709	817

Source : Bulog