Fertilizer use by crop in Indonesia

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Acknowledgments

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The background photograph is courtesy of Fahmuddin Agus of ISORI. The other photographs are from EcoPort: Arnoldo Mondadori Editore S.p.A. (tomatoes and cloves) and J. Flémal (coffee).

Abstract

The agricultural sector is of crucial importance for the economy of Indonesia. It accounts for 18 percent of the national gross domestic product, provides the staple foods and employs 70 percent of the population of 215 million people (or 44 percent of the work force). About 127 million (59 percent of the total population) people reside in the more fertile areas of the densely populated inner islands of Java, Madura, Bali and Lombok, which together account for only 8 percent of Indonesia's land area. The remaining 88 million inhabitants occupy the less fertile soils in the more sparsely populated outer islands, of which the larger are Sumatera, Kalimantan, Sulawesi and Papua. Similarly, the most intensive (food) cropping systems have been developed on the inner islands and the less intensive perennial crops on the outer islands.

Six fertilizer plants provide the country's fertilizer requirements. Five of them produce urea, one produces superphosphate (TSP/SP-36) and ammonium sulphate (AS). During the period from 1998 to 2002, 6.5 million tonnes urea were produced annually, mostly for domestic use. The raw materials for TSP production and the potassium chloride have to be imported.

Large increases in the use of mineral fertilizer during past decades resulted in a substantial increase in crop production, especially of lowland rice. They also improved the phosphorus and potassium status of large areas of lowland rice soils. However, fertilizer use has tended to decline in recent years and generally to become less balanced. This has resulted in a deterioration of the food security situation. The supplies of rice, maize, soybean and sugar have become critical food security issues and the importation of each of these commodities amounts to around 0.5 to 1.0 million tonnes annually.

Although fertilizer use has a long history and has made an important contribution to agricultural development, the last official fertilizer recommendations for the economically important crops date from 1984.

Despite the economic crisis, the production of rice has remained constant. Rice is the major staple food in Indonesia and its stable

production contributes meaningfully to economic stability. However, the production of seven food and vegetable crops (upland rice, maize, soybean, sweet potato, potato, cabbage and mustard green) has fallen. Apparently, the decreases were due to a reduction in the harvested areas rather than in crop yields per unit area. On the other hand, the production of most fruit, plantation and industrial crops increased. The increases were mainly a result of larger harvested areas, but the yields per hectare of some fruit and industrial crops (banana, papaya, rambutan, oil-palm, sugar cane and clove) also increased considerably. The production of oil-palm and sugar cane has risen substantially due to significant increases in both their harvested areas and yields per hectare. However, the production of rubber has fallen due to a reduction in the area, presumably due largely to the conversion of substantial areas to oil-palm production.

The governmental regulations concerning the production, distribution and use of fertilizers have been modified frequently in recent years, in order to adjust to the prevailing conditions. The consistent objective has been to provide adequate and affordable supplies of fertilizers for farmers. The fertilizer subsidy was an important policy tool for this purpose but became too great a burden on the government's finances, especially during the economic crisis. Also, subsidized fertilizers frequently did not reach the intended beneficiaries. Subsidies on certain fertilizers have been reinstated but only for use on food crops and smallholder plantations. The dual pricing system is inefficient and leads to a distortion of the marketing systems. The provision of fertilizers of the appropriate type, available at the place and time required, with guaranteed quality and affordable prices, should be the objective.

Research has shown that integrated plant nutrient management (IPNM) systems based on soil and plant analyses, with the application of appropriate types of fertilizer integrated with the use of available organic materials, and with proper application techniques, are keys to increased agricultural productivity.

It is estimated that the national fertilizer manufacturers are able to satisfy the domestic fertilizer requirements until 2006, the time period of the assessment.

Preface

This study, commissioned by the Food and Agriculture Organization of the United Nations (FAO), is one of a series of publications on fertilizer use on crops in different countries.

The aim of the series is to examine the agro-ecological conditions, the structure of farming, cropping patterns, the availability and use of mineral and organic plant nutrients, the economics of fertilizers, research and advisory requirements and other factors that have led to present fertilizer usage. The reports examine, country by country, the factors that will or should determine the future development of plant nutrition.

During the past two decades, increasing attention has been paid to the adverse environmental impact of both the underuse and the overuse of plant nutrients. The efficient use of plant nutrients, whether from mineral fertilizers or from other sources, involves the shared responsibility of many segments of society, including international organizations, governments, the fertilizer industry, agricultural research and advisory bodies, traders and farmers. The publications in the series are addressed to all these parties.

Fertilizer use is not an end in itself. Rather it is a means of achieving increased food and fibre production. Increased agricultural production and food availability can, in turn, be seen as an objective for the agricultural sector in the context of contributing to the broader macroeconomic objectives of society. A review of the options available to policy-makers is given in the FAO/IFA 1999 publication entitled *Fertilizer Strategies*.

The contents of the series of studies differ considerably from country to country, in view of their different structures, histories and food situation. In each case, the aim was to arrive at a better understanding of the nutrition of crops in the country concerned.

List of Acronyms

AAF	ASEAN Aceh Fertilizer
AS	Ammonium sulphate
ASEAN	Association of South East Asian Nations
BIMAS	*Bimbingan Masal*, mass guidance programme
CBS	Central Bureau of Statistics
CPO	Crude palm oil
DOA	Department of Agriculture
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GOE	Government owned estate *(Perseroan Terbatas Perkebunan)*
GPP	Government purchasing price
HRP	Highest retail price
IFPA	Indonesian Fertilizer Producers Association
IPNM	Integrated Plant Nutrient Management
ISORI	Indonesian Soil Research Institute
KCl	Potassium chloride, muriate of potash
KUD	*Koperasi Unit Desa*, village cooperative units
LE	Large estates
MOA	Ministry of Agriculture
MOIT	Ministry of Industry and Trade
MMBTU	Million British Thermal Units
n.a.	not available
PE	Private estate
PKC	*PT Pupuk Kujang* (Kujang Fertilizer Company)
PIM	*PT Pupuk Iskandar Muda* (Iskandar Muda Fertilizer Company)
Pusri	*PT Pupuk Sriwijaya* (Sriwijaya Fertilizer Company)
PKT	*PT Pupuk Kalimantan Timur* (Kalimantan Timur Fertilizer Company)
Rp	Rupiah
SHE	Smallholder estate

SP-36	Superphosphate (36 percent P_2O_5)
TSP	Triple superphosphate (46 percent P_2O_5)
tpy	tonnes per year

N:	Nitrogen
P_2O_5 or P:	Phosphate*
K_2O or K:	Potash*

* Phosphate and potash may be expressed as their elemental forms P and K or as their oxide forms P_2O_5 and K_2O. Nitrogen is expressed as N. In this study, phosphate and potash are expressed in their oxide forms.

Chapter 1
Introduction

This report provides information on the various agro-ecological zones and farming systems; the supply of fertilizers, their distribution and systems of payment; recommended rates of fertilizer application for the economically important crops; the harvested area and yield of crops by province and island; and fertilizer policy and future fertilizer requirements. The data used in this study mainly were derived from the statistics of the Central Bureau of Statistics (CBS) and Department of Agriculture (DOA) of Indonesia.

The Indonesian archipelago consists of 17 435 islands with a total land area of 192 million hectares. Agriculture is a key sector of the Indonesian economy. In the early 2000s, more than 70 percent of the 215 million population of Indonesia or 44.3 percent of the labour force were in the rural sector. Agriculture provides 17.5 percent of the gross domestic product (GDP). Two thirds of Indonesia are surrounded by ocean. Of the total land area, 51.0 million ha are used for agriculture and forestry, 7.8 million hectares (4.2 percent) are planted with lowland rice, 13.2 million hectares (7 percent) with upland crops, 19.9 million hectares (10.5 percent) with plantation and industrial crops and 10.1 million hectares (5.3 percent) are under forest (CBS, 2002). Rice and maize are the major food crops and rubber and oil-palm are the major plantation crops.

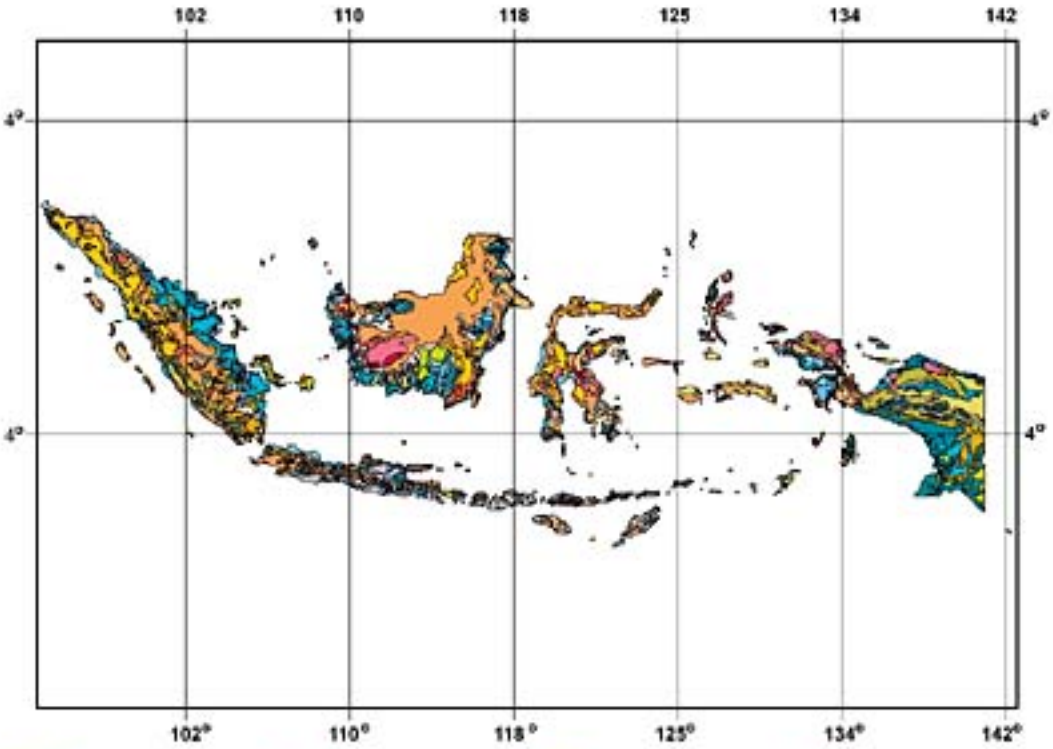
Agricultural development in Indonesia has followed closely the growth of population and its geographical distribution. Out of 215 million inhabitants, about 59 percent (127 million) reside in the inner islands of Java, Madura, Bali and Lombok, which together compose only about 8 percent of Indonesia's land area. The remaining 87.8 million people occupy the outer islands, of which the larger are Sumatera, Kalimantan, Sulawesi and Papua.

The uneven distribution of the population reflects the long-term effects of contrasting soil fertility conditions in the various parts of the country. The inner islands that have more fertile and high base saturation

soils, such as Inceptisols, Mollisols, and Vertisols (Figure 1), are densely populated. The outer islands that are dominated by Ultisols, Oxisols and Histosols, are sparsely populated. In their natural state, the latter three soils are acid with a low plant nutrient status. They require higher fertilizer inputs in order to achieve the high crop yields that are obtained in Java and the other inner islands. However, fertilizer use in the outer islands is generally lower and, as a result, yields are generally lower than those achieved on Java.

The high use of mineral fertilizers in the past decades, reflecting the

FIGURE 1
Dominant soil map of Indonesia



requirements of high yielding rice varieties, accounts for the success in increasing rice production, the staple food for the ever-growing population of Indonesia. However, during the last five years (1998 to 2002) fertilizer use has tended to decrease and generally, to become less balanced. Inadequate supplies of rice, maize, soybean and sugar have become critical food security issues. Imports of these commodities have become substantial amounting to around 0.5 to 1.0 million tonnes for each commodity.

This report presents data during the 1998 to 2002 period derived from studies of fertilizer use, harvested areas, average yields per ha of the economically important crops and fertilizer use profitability. During the period in question, rates and types of fertilizer applied have changed. The impacts of these changes on crop productivity are discussed. Lastly, fertilizer policy and future fertilizer needs are considered.

Note: The islands listed in the tables in this publication comprise the following provinces:

Java: Jakarta, West Java, Central Java, Yogyakarta, East Java and Banten.

Sumatera: N. A. Darussalam, North Sumatera, West Sumatera, Riau, Jambi, South Sumatera, Bengkulu, Lampung and Bangka Belitung.

Bali and Nusa Tenggara: Bali, West Nusa Tenggara and East Nusa Tenggara.

Kalimantan: West Kalimantan, Central Kalimantan, South Kalimantan and East Kalimantan.

Sulawesi: North Sulawesi, Central Sulawesi, South Sulawesi, South East Sulawesi and Gorontalo.

Maluku and Papua.

Chapter 2
Agro-ecological zones and farming systems

AGRO-ECOLOGICAL ZONES

Most parts of the country have a wet humid tropics climate with a rainy season, the west monsoon, between October and March and a dry season, the southeast monsoon, between April and September. The annual rainfall ranges from about 1 500 to 3 000 mm. However, some parts of the country, i.e. the eastern part of West Nusa Tenggara and most of the East Nusa Tenggara provinces, have a drier climate with annual rainfall of about 1 000 mm or less in the three months period between December and February.

Most of the lowland rice and of the upland food crops are concentrated in Java. The areas of perennial crops are concentrated in the outer islands, mainly in Sumatera. Java accounts for slightly more than 50 percent of the harvested area of lowland rice and the average yields per hectare are higher than in the other regions. Java produces about 60 percent or more of the total rice production. More than half of the total area of most upland food crops, i.e. maize, groundnut, soybean, cassava, and sweet potato, are also concentrated in Java.

The majority of Indonesian farmers are smallholder, subsistence farmers cultivating small areas of land, particularly in Java. In 1983, 10.9 million households (52 percent) cultivated land areas of less than 0.5 ha and 8.1 million households (74 percent) lived in Java (Table 1). This situation remained almost unchanged at least until 1993 and although there is as yet no published census it is assumed that the proportion of smallholder farmers has not changed much. Java is predominant in the country's food crop production despite the fact that the amount of land owned by each household in Java is much smaller than in the outer islands. In general, the farm size in Java is about a quarter of a hectare or less per farm household,

TABLE 1
Number of households and farm size

Island	Number of households			
	Less than 0.5 ha		More than 0.5 ha	
	1983	1993	1983	1993
Java	8 070	7 616	3 494	2 957
Sumatera	1 384	1 446	3 080	3 095
Bali & Nusa Tenggara	557	565	766	697
Kalimantan	242	280	965	867
Sulawesi	425	467	1 240	1 115
Maluku & Papua	204	228	306	256
Indonesia	***10 882***	***10 602***	***9 851***	***8 987***
Excluding Java	2 812	2 985	6 357	6 030

Source: CBS, 2003.

while in the outer islands it is about one hectare or more for each farm household. In new settlement schemes or transmigration areas in the outer islands, one hectare of food cropland plus two hectares of perennial cropland and a quarter hectare for the site of the farm house are granted to each migrant family. Many native people in the outer islands own larger areas of land, which they have inherited from their ancestors.

FARMING SYSTEMS

The farming systems practiced by Indonesian farmers can be classified into three major systems: lowland, upland and perennial crop farming systems.

The lowland farming system, with rice as the single crop, provides the staple food for the ever-growing population of Indonesia, a population that in early 2000 amounted to more that 200 million people. Lowland farming is a source of food, wealth and job opportunities for most of the Indonesian people living in rural areas. Irrigated lowland rice is the most appropriate system in terms of sustainability and year-to-year yield stability. High rates of fertilizer use and improved crop protection practices have contributed to the high yields of rice. In recent years, rice farming has become less attractive since the price has frequently fallen during peak harvest seasons and this has greatly reduced farmers' incomes. Considerable amounts of rice are now imported.

Upland farming is practiced mostly under rainfed conditions in the outer islands. Upland soils are dominated by highly weathered acid soils, Ultisols, Oxisols and Inceptisols, whose phosphorus deficiency is usually a major constraint to crop production. Upland areas are abundant in the country and have a high potential for agricultural development. To date these resources have been underutilized and their productivity remains low, partly due to inadequate fertilizer application. The low level of fertilizer use for upland farming is resulting in the depletion of soil nutrients in the upland crop areas (Santoso, 1996).

Perennial farming systems, practiced mostly in the outer islands, are sustainable under the inherently acid soils of low fertility in these areas. Rubber and oil-palm are the two major perennial crops, produced both in large estates and by smallholders. The large plantations are both government and privately owned. Because of the favourable income obtained from oil-palm, the area planted with oil-palm has increased significantly during the past ten to fifteen years and the total harvested area has reached more than four million hectares. Large areas of plantation crops are owned and managed by smallholder farmers. Unfortunately, due to a lack of knowledge of appropriate fertilization technology and the fact that fertilizers are sometimes not available at village level on time and of the right type, the use of fertilizers is inadequate and unbalanced in many plantations. If these farmers use fertilizers, they normally apply low, unbalanced rates, mostly just urea, and only for the food crops.

In addition to the above systems, a traditional shifting cultivation, the slash and burn system, is still practiced by some farmers, particularly in the remote areas on the islands outside Java. The system is characterized by the felling of old rubber trees or secondary forest, followed by burning and then planting new rubber trees mixed with food crops, generally upland rice and maize, for subsistence purposes. After two to three years of cultivation, when the rubber trees have started to cover the ground and the productivity of the food crops begins to decline, the shifting cultivators move to another area of land, waiting until the rubber trees are ready to be tapped. Under this system, the use of fertilizers is uncommon.

About 70 percent of the lowland rice area in Indonesia produces two crops per year. The first crop, the rainy season crop, is planted in November-December and harvested in January-February. The second

crop, the dry season crop, is planted in February-March and harvested in May–June. The third crop in an annual rotation is usually one of the upland food crops, *palawija* crops, such as maize, soybean, groundnut and mungbean. This crop is planted in June-July and harvested in August-September. A very good irrigation system may permit a third lowland (flooded) rice crop to be grown. Since most fertilizers (urea and SP-36) are applied to lowland rice crops, they should reach village level before the rice-planting season, in October for the rainy season and in April for the dry season. Apart from maize, *palawija* crops such as soybean and mungbean are usually not fertilized since it is assumed that they benefit from the residual effects of fertilizers applied to the preceding (lowland) rice crops.

Chapter 3
Fertilizer use studies in Indonesia

FERTILIZER USE

Numerous studies have been carried out on fertilizer use in Indonesia. At the International Conference on Nutrient Management for Sustainable Food Production in Asia held in Bali, Indonesia, in December 1996 Karama *et al.* (1996) and Santoso (1996) concluded that Indonesia had become self sufficient in rice thanks to fertilizer use. Today only a small increment of rice production can be expected from the shrinking area of lowland rice. The main challenge is to develop productive agricultural systems in the underdeveloped, rainfed uplands, which are currently poorly fertilized.

The official fertilizer recommendations date from 1984. Some overall estimates of fertilizer use by crop in Indonesia are given in the publication *Fertilizer use by crop*, FAO *et al.* (2002). According to this publication, 52 percent of the fertilizers consumed in Indonesia are applied to rice, 12 percent to maize, 13 percent to oil-palm, 5 percent to vegetables and 4 percent to fruits, the remaining 14 percent to various other crops. Information on the quantities of fertilizer used by each crop in each province and island is not available. In the absence of reliable information on fertilizer use on crops and up-to-date recommendations, it is not possible to assess reliably the relationships between fertilizer use and development of crop production.

Lowland rice

There was a substantial increase in the productivity of lowland rice in Indonesia between 1960 and 1990. The development of the planted area and yields of lowland rice since the beginning of the intensification programmes in the early 1960s are presented in Table 2. During the period between 1960 and 1975, the area of lowland rice increased from 6.5 to 8.5 million ha and the yield increased by 26 percent, an average annual increase of 1.7 percent per year. Between 1975 and 1990, the planted area increased

TABLE 2
Development of the planted area, production and yield of lowland rice

Year	Planted area ('000 ha)	Production ('000 tonnes)	Yield (tonnes/ha)
1960	6 567	14 302	2.18
1975	8 532	23 443	2.75
1990	10 502	45 179	4.30
1998	10 681	46 291	4.33
1999	11 963	50 870	4.25
2000	11 794	51 900	4.41
2001	11 500	50 461	4.39
2002	11 521	51 490	4.47

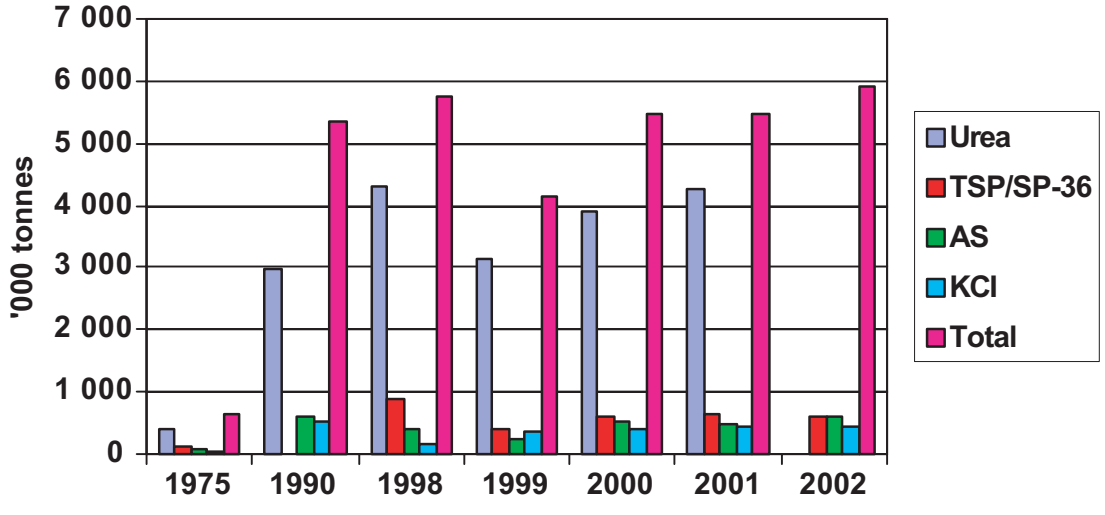
Source: IFPA, 2004.

from 8.5 to 10.5 million ha and the average yield increased by 56.4 percent, an average increase of 3.8 percent per year. These large increases were due to consistent governmental support of increased national food production by means of a good supply of agricultural inputs (i.e. fertilizers, pesticides), capital and guaranteed prices, accompanied by extension efforts to encourage the implementation of improved technologies.

Between 1975 and 2002 fertilizer consumption increased more than nine-fold (Figure 2), from 635 to 5 931 thousand tonnes, an average increase of 49.6 percent per year (IFPA, 2004).

Between 1990 and 2002, the rice area increased only slightly, from 10.5 to 11.5 million ha. The yield increased by a total of four percent, an average increase of just 0.3 percent per year. This small increase in rice yields coincided with a falling trend in fertilizer consumption, apart from urea that still increased at an average annual rate of 0.9 percent. It has

FIGURE 2
Development of fertilizer consumption in Indonesia



Source: IFPA, 2004.

been suggested that the decreases in fertilizer consumption were due to the following factors (IFPA, 2004):

1. Removal of fertilizer subsidies i.e. for potassium chloride in October 1991, TSP/SP-36 in October 1994 and urea in December 1998.
2. A policy to reduce phosphorus fertilization on Java Island due to the accumulation of residual phosphorus.
3. A reduction in the extension services.
4. The low purchasing power of farmers.

Upland crops

Unlike fertilizer use for lowland rice, that increased considerably in the period of 1960-1990, fertilizers remain underused on upland crops. For example, 67 percent of the more than 1.1 million tonnes of TSP consumed in 1985 was used in Java, mainly for lowland rice, while Java accounts for only 16 percent of the total cultivated land area of Indonesia. A reasonable strategy for future agricultural development is therefore the development of upland areas. The upland areas in the humid tropics of Indonesia are capable of producing high yields of a wide range of food crops, including root and tuber crops, pulses, and beans. The integration of livestock into this productive system of upland farming would make it more viable and sustainable (Santoso, 1996).

SOIL FERTILITY STATUS AND FERTILIZER RECOMMENDATIONS

Phosphorus buildup on lowland rice soils

In the early 1970s, it was estimated that as much as one-third of the lowland rice soils on Java were deficient in phosphorus (Table 3).

However, the phosphorus status of lowland rice soils has increased considerably as a result of the seasonal (twice in a year) application of about 100 kg TSP/ha since the mid-1960s, in the context of the

TABLE 3
Phosphorus deficient lowland rice soils in Java in the early 1970s

Province	Total lowland rice	P deficient lowland rice soils	
	('000 ha)	('000 ha)	(percent)
West Java	834	228	27.3
Central Java	821	308	37.5
Yogyakarta	52	17	32.6
East Java	945	294	31.1
Total Java	2 652	847	31.9

Source: Santoso and Sudjadi, 1974.

TABLE 4
Phosphorus status of lowland rice soils in the early 2000s

Island	Lowland rice area ('000 ha)			
	Low P	Medium P	High P	Total
Java	543	1 658	1 452	3 653
Sumatera	428	1 080	771	2 279
Bali & Lombok[1]	2	27	184	214
Kalimantan[2]	146	164	155	465
Sulawesi	152	312	433	896
Indonesia	***1 271***	***3 241***	***2 995***	***7 507***
Percent of total	17	43	40	100
Excluding Java	728	1 583	1 543	3 854

[1] Does not include the whole West and East Nusa Tenggara Provinces.
[2] Does not include West, Central and East Kalimantan Provinces.
Source: Setyorini *et al.*, 2004.

rice production programme of the Mass Guidance Program (*Bimbingan Masal*, BIMAS). As a result, in the early 2000s it was estimated that only about 15 percent of the rice soils in Java were deficient in phosphorus (Table 4), despite the fact that the lowland rice area had expanded from 2.65 million ha in the early 1970s to 3.65 million ha in the early 2000s.

Figure 3 provides an illustration of Table 4 for West Java Province.

Soil potassium status

A study of the potassium status of lowland rice soils in Indonesia was carried out together with the study of the phosphorus status. It was estimated that out of the 7.5 million ha of lowland rice, about 0.9 million ha (12 percent) were deficient in K (Table 5).

TABLE 5
Soil potassium (K) status of lowland rice soils in the early 2000s

Island	Lowland rice area ('000 ha)			
	Low K	Medium K	High K	Total
Java	473	1 172	2 008	3 653
Sumatera	247	1 176	856	2 279
Bali & Lombok[1]	0	0	214	214
Kalimantan[2]	66	261	138	465
Sulawesi	89	197	610	896
Indonesia	***875***	***2 806***	***1 818***	***7 507***
Percent of total	12	37	51	100
Excluding Java	402	1 634	3 826	3 854

[1] Does not include the whole West and East Nusa Tenggara Provinces.
[2] Does not include West, Central and East Kalimantan Provinces.
Source: Setyorini *et al.*, 2004.

FIGURE 3
Phosphorus status of lowland rice soils in West Java Province

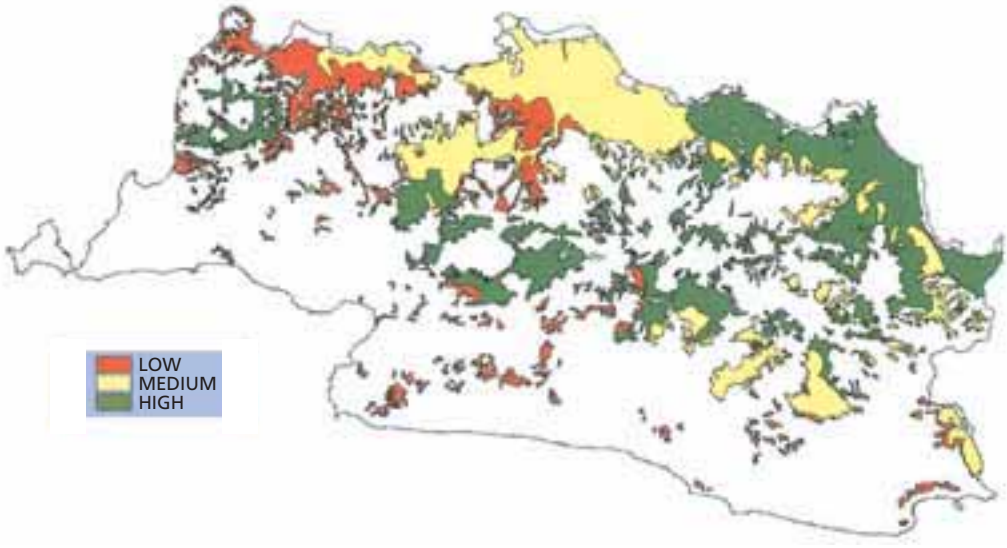


FIGURE 4
Potassium status of lowland rice soils in West Java Province

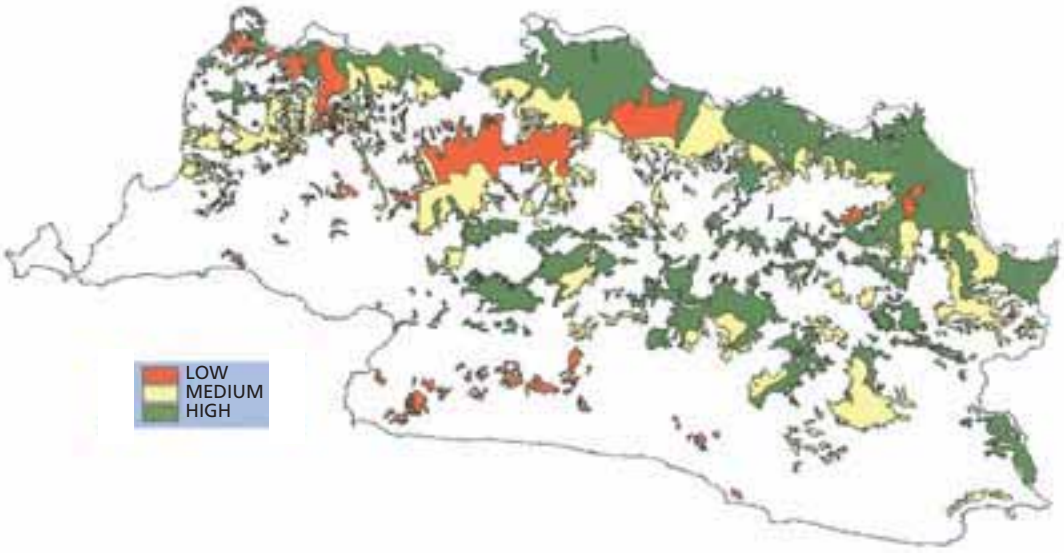


Figure 4 illustrates Table 5 for West Java Province.

FERTILIZER USE RECOMMENDATIONS

There are three major crop sectors (food, horticultural and plantation sectors), each with a number of economically important crops. In this

report, 34 crops are selected. The wide variations in soil characteristics existing in the country, each with different nutrient imbalances and deficiencies, combined with the large number of crops, presents a challenge for the development of fertilizer recommendations for each specific soil and crop combination. Much research has been carried out to study crops' responses to fertilization. One of the latest reviews is the study by Hanson *et al*. (1994).

The fertilizer use recommendations have not been changed for the past 20 years and should be considered as general guidelines (Tables 6, 7 and 8). In practice, farmers tend to apply fertilizers mainly according to their own experience and financial means.

New, up-to-date recommendations, incorporating more recent information on crop responses and soil nutrient status, are greatly required.

TABLE 6
Range of fertilizer rates recommended for food and horticultural crops

Crop	N° of provinces*	Fertilizer rate (kg/ha/season)		
		N	P_2O_5	K_2O
Cabbage	14	60 – 110	40 – 80	5 – 35
Cassava	14	55 – 75	20 – 40	20 – 40
Chili	17	60 –100	35 – 75	20 – 40
Groundnut	24	20 – 30	30 – 50	0 – 20
Long bean	19	35 – 65	30 – 70	10 – 30
Lowland rice	24	65 – 95	40 – 50	5 – 25
Maize	25	65 – 95	30 – 50	10 – 30
Mungbean	18	20 – 30	25 – 45	0 – 15
Mustard green	11	70 – 120	30 – 50	0 – 20
Potato	12	85 – 125	50 – 90	20 – 40
Shallot	10	70 – 150	40 – 75	10 – 60
Soybean	24	20 – 30	35 – 45	0 – 20
Sweet potato	5	50 – 70	20 – 40	20 – 40
Tomato	13	65 – 110	45 – 75	10 – 50
Upland rice	13	60 – 100	35 – 60	0 – 40

* Total of provinces surveyed /analyzed
Source: Anonymous, 1984.

TABLE 7
Range of fertilizer rates recommended for perennial crops

Crop	Growth stage	Fertilizer rate (kg/ha)				
		N	P_2O_5	K_2O	Kieserite	Borax
Clove	mature	110	110	140		
	immature	10	15	10		
Cocoa	mature	130	120	190		
	immature	65	60	95		
Coconut						
Hybrid variety	mature	150	100	105	190	
	immature	65	70	155	125	
Tall variety	mature	75	50	55	95	
Coffee	mature	175	70	165		
	immature	90	50	90		
Cotton		55	45	45		
Oil-palm	mature	120	50	345	145	5
	immature	45	55	130	175	5
Rubber	mature	70	45	60	50	
	immature	40	40	30	35	
Sugar cane		125	75	180		
Tea	mature	125	20	45		
	immature	45	10	10		
Tobacco		60	45	55		

Source: Anonymous, 1984.

TABLE 8
Estimates of fertilizer practices

	Fertilizer rate (kg/ha)						t/ha
Crop	Urea	AS	SP-36	KCl	NPK	Guano	FYM
Red onion	400	800		150			
Garlic	250	250	75		50		5–7
Chilli	150	450	200	200			
Potato		500			1 000	1 200	20
Cabbage	100	120	160	80			7

Chapter 4
Plant nutrient supply, distribution and systems of payment

PLANT NUTRIENT SUPPLY AND CONSUMPTION

Inorganic fertilizers

The dominant fertilizers produced and used in Indonesia are urea, TSP (triple superphosphate, 46 percent P_2O_5), AS (ammonium sulphate, 21 percent N and 24 percent S) and KCl (potassium chloride, 60 percent K_2O). More recently Indonesia replaced TSP with SP-36 (superphosphate, 36 percent P_2O_5) and produced the compound fertilizer Ponska (15 percent N, 15 percent P_2O_5 and 15 percent K_2O).

There are six fertilizer-producing companies in Indonesia. Five of the six companies are government-owned and one is a joint venture with governments of other Asian countries. This joint venture produces urea and ammonia for export. Indonesia owns 60 percent of the shares, Singapore, Malaysia, Philippines and Thailand 40 percent. All six companies produce urea. Only one plant produces also AS, TSP, SP-36, and Ponska. The total production capacity of the six factories is more than 6.5 million tonnes/year (tpy). Between 1998 and 2002, the capacities of all the companies were expanded and reached 7.55 million tpy (Table 9).

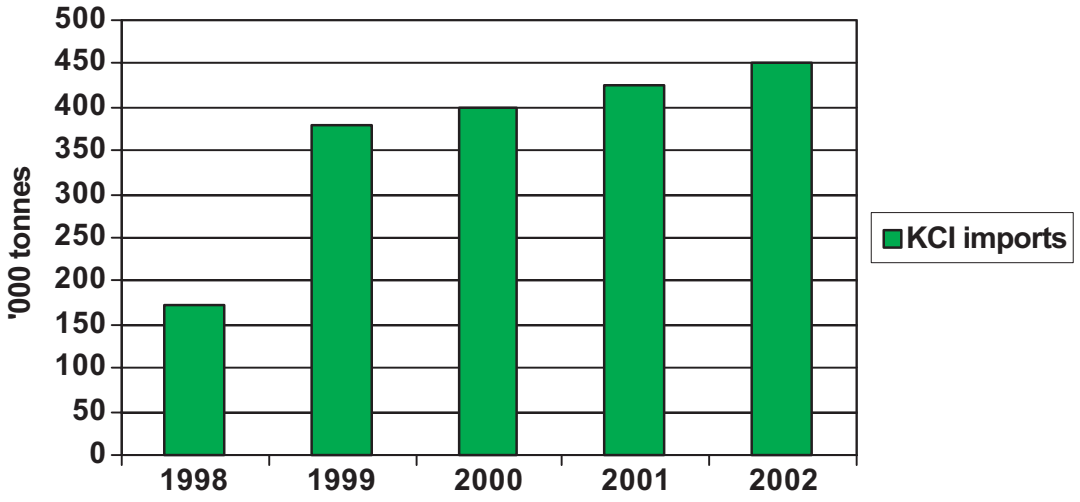
Urea is produced from indigenous raw materials and Indonesia is a net exporter of urea. Indonesia is a net importer of the other fertilizers because of a lack of domestic sources of raw materials for AS, TSP or SP-36. Potassium chloride is imported as a finished fertilizer. The importation of fertilizer and fertilizer materials is handled by state trading companies,

TABLE 9
Ammonia and fertilizer production capacities

Year	Production capacity ('000 tonnes)				
	Ammonia	Urea	TSP/SP-36	AS	NPK
1998	4 595	6 412	1 000	650	300
1999–2001	4 595	6 982	1 000	650	300
2002	4 925	7 552	1 000	650	300

Source: IFPA, 2004.

FIGURE 5
Indonesian imports of potassium chloride



Source: IFPA, 2004.

which sell the materials to the factories. The imports of potassium chloride are shown in Figure 5.

Two major urea producers account for 60 to 70 percent of the annual production. However, during the 1998-2000 period, production amounted to only about 6 million tpy or about 90 percent of total production capacity (Table 10). In 2001/02 the utilization of capacity fell to about 80 percent of the total, due to a shortage of gas and damage to one of the plants (IFPA, 2004).

TABLE 10
Indonesian production of nitrogen, phosphorus and compound fertilizers

Product	Production ('000 tonnes)				
	1998	1999	2000	2001	2002
Ammonia	4 353	4 200	4 395	3 687	4 032
Percent of capacity	95	91	96	79	82
Urea	6 156	5 971	6 333	5 333	6 006
Percent of capacity	96	86	91	76	80
TSP/SP-36	643	854	520	654	595
Percent of capacity	64	85	52	65	60
AS	284	457	491	448	420
Percent of capacity	44	70	76	69	65
Ponska	0	0	30	56	66
Percent of capacity			10	19	22

Source: IFPA, 2004.

TABLE 11
Domestic consumption of fertilizers, agricultural and industrial sectors

Year	Consumption ('000 tonnes)					
	Urea		AS	TSP/SP-36	KCl	Total
	Agriculture	Industry				
1998	4 290	479	408	869	172	6 217
1999	3 140	358	244	395	380	4 517
2000	3 960	366	507	623	400	5 856
2001	3 935	300	511	645	327	5 719
2002	4 273	n.a.	607	601	450	5 931

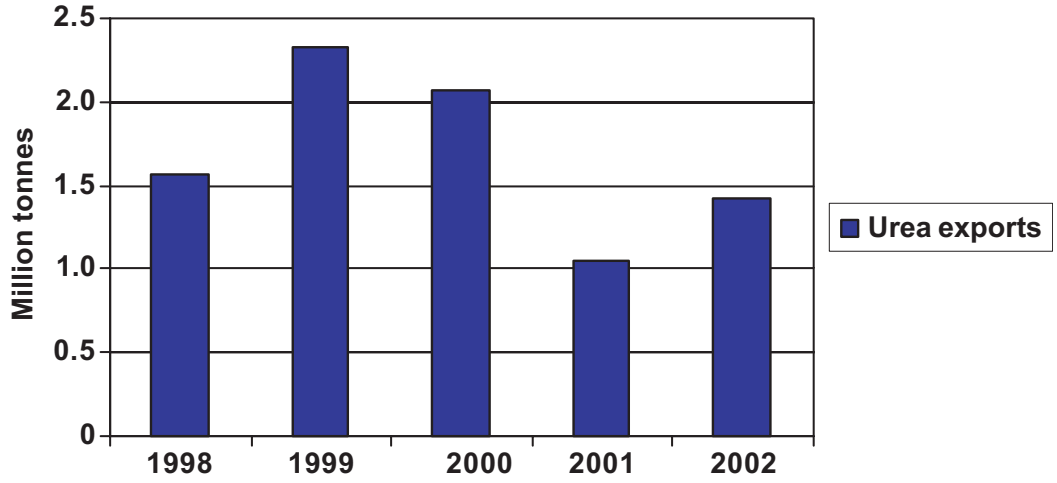
n.a. = not available
Source: IFPA, 2004.

Consumption in the agricultural sector decreased from 4.3 million tonnes in 1998 to 3.1 million tonnes in 1999, but increased again in the following years to reach 4.3 million tonnes again in 2002 (Table 11).

Most of the urea is consumed domestically. The total consumption of urea for the agricultural and industrial sectors is less than the total production, and the surplus urea is exported to a number of countries. During the 1998-2002 period, urea exports fluctuated between 1 and 2.3 million tpy (Figure 6).

In addition to the six state-owned fertilizer producing companies, there are two privately owned ammonia plants. The total exports of ammonia

FIGURE 6
Indonesian exports of urea



Source: IFPA, 2004.

averaged 0.85 million tonnes of product per year during the period under consideration.

Organic manures

Organic materials are very important for maintaining soil fertility in a tropical country such as Indonesia. Livestock wastes, particularly chicken manure and cattle manure, have been applied by farmers for decades, especially in the livestock producing areas. For example, chicken manure has been widely used for maize cultivation in Central Lampung and Sukabumi Districts. In Central Lampung farmers purchase manure from other districts, including Serang, Palembang and South Lampung (Insan Mandiri Konsultan, 2003).

There is no record of the amount of manure produced and used in each province or region. The only available data concern the number of livestock present in each region (Table 12).

Evidently, not all livestock are housed and thus a substantial proportion of the manures is not readily available.

In practice, farmers are not aware of the rates of manure that should be applied and often do not have a rational basis for estimating them. Field-testing is needed to estimate the rates of organic fertilizer that should be recommended to farmers.

There has been considerable progress in understanding the role of organic materials in soil-nutrient availability and the maintenance of soil organic matter. Research institutions have developed models simulating

TABLE 12
Distribution of livestock, 2002

Island	Livestock ('000 head)						
	Beef cattle	Dairy cattle	Buffalo	Goat	Sheep	Pig	Horse
Java	4 269	346	581	7 375	7 061	164	57
Sumatera	2 630	8	1 240	3 311	499	1 438	17
Bali & Nusa Tenggara	1 430	0	300	742	74	2 232	165
Kalimantan	406	0	69	328	9	821	1
Sulawesi	1 517	0	222	959	9	940	183
Maluku & Papua	184	n.a.	24	330	9	518	23
Indonesia	***10 436***	***354***	***2 436***	***13 045***	***7 661***	***6 113***	***446***
Excluding Java	6 167	8	1 855	5 670	600	5 949	389

Source: CBS, 2002.

nutrient release patterns according to the quality of the resource and soil and climatic conditions. Implementation of these models would provide a means of making initial recommendations for testing by farmers.

FERTILIZER DISTRIBUTION SYSTEMS

The regulation of fertilizer distribution

Concerning the period under review in this report, between the mid 1990s and the early 2000s there have been a number of decrees regulating fertilizer distribution, some of which were inconsistent with earlier decrees. The efficient supply and distribution of fertilizers were a permanent concern of the government but events limited its capability to act.

The changes since the mid-1990s in the governmental regulations regarding the supply and distribution of fertilizers are illustrated by the following decrees.

1995

Decree No. 182/KP/VIII/95 was issued by the Ministry of Trade, on the Supply and Distribution of Fertilizers for Food Crops. This decree replaced the Ministry of Trade's decree No. 60/KP/IV/1989 on the Supply and Distribution of Subsidized Fertilizer. The fertilizers regulated were urea, TSP/SP-36 and AS. PT Pusri was made responsible for the supply and distribution of urea, while PT Petrokimia Gresik was made responsible for the supply and distribution of TSP/SP-36 and AS, from Line I (the plant gate) down to Line IV (the village). PT Pusri and PT Petrokimia Gresik worked together with fertilizer producers/importers on the supply and distribution of fertilizer.

1996

Decree No. 38/MPP/Kep/3/96 designated PT Pusri as responsible for the supply and distribution of urea, TSP/SP-36 and AS from Line I to Line IV for the Food Crops Sub-Sector. Under this decree, the KUD (*Koperasi Unit Desa*, village cooperative units) distributors would be appointed by PT Pusri, whereas KUD retailers and private retailers would be selected by KUD distributors with the agreement of PT Pusri.

1997

According to regulation No. 28/1997, a government holding for fertilizer was formed, consisting of PT Pusri, PT Pupuk Iskandar Muda, PT Pupuk Kujang, PT Petrokimia Gresik and PT Pupuk Kaltim. Distribution and marketing activities remained the responsibility of PT Pusri.

1998

Government Statement No. 207/KMK.016/1998 announced that AS and SP-36 for the agricultural sector would no longer be subsidized by the government.

Decree No. 378/MPP/Kep/1998 announced that PT Pusri would be responsible for the supply and distribution of subsidized fertilizer (urea, SP-36, AS and KCl) from Line I to IV. Fertilizer producers had to mark "Subsidized" on the front of fertilizer bags.

In December 1998 the Ministry of Agriculture announced that fertilizer marketing would no longer be regulated and that fertilizer subsidies were removed.

1999

Decree No. 26/MPP/Kep/1999 declared that PT Pusri would be responsible for the supply, distribution and stocks of urea, TSP/SP-36, AS and KCl for food crop farmers in areas that are remote and difficult of access.

2001

According to decree No. 93/MPP/Kep/3/2001 the distribution of urea for food crops and smallholder plantations would be implemented by PT Pusri. This decree also described requirements as regards distributors.

2003

Decree No. 70/MPP/Fep/2/2003 assigned the areas or provinces where respective fertilizer factories would be responsible for supplying fertilizer. Each fertilizer factory is responsible for the distribution of urea to provinces close to their respective plants. Due to the large amounts of

urea needed in Java three plants share the distribution of urea in Java. The distribution of the other fertilizers (AS, SP-36 and Ponska) throughout the country is the sole responsibility of PT Petrokimia Gresik. Most of the urea, SP-36 and AS is used on food crops.

Fertilizer distribution systems

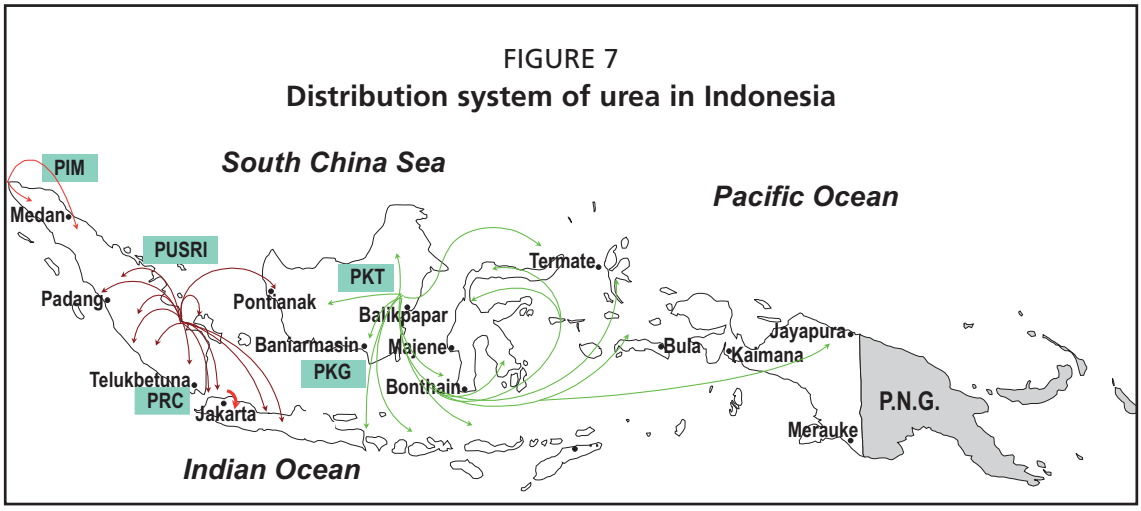
Fertilizer use in Indonesia is largely for food, estate (perennial) and horticultural crops. Provision of appropriate types and amounts of fertilizers at the right time, place and affordable prices are very important for the success of agriculture development, especially food security programmes. The largest fertilizer market is urea, followed by SP-36, AS, KCl and Ponska.

The government organizes fertilizer distribution. Distribution of urea is the responsibility of five state-owned fertilizer plants. Each fertilizer factory is assigned to distribute urea to provinces nearby to the factory site and by considering total amount of urea required by the provinces (Figure 7). Distribution of other fertilizers (AS, SP-36 and Ponska) throughout the country is the sole responsibility of one plant.

FERTILIZER PRICES, SUBSIDIES AND FERTILIZER USE PROFITABILITY

The government regulates not only the supply and distribution of fertilizers but also their prices. The government has attempted to fix fertilizer prices at levels affordable by the farmers, in the form of the *highest retail price* (HRP) at farmers/consumers level, valid for all regions in Indonesia.

FIGURE 7
Distribution system of urea in Indonesia



The fertilizer pricing policy for sales at the producer level during the "subsidy era" can be divided into three periods (IFPA, 2004):

1. Before 1992: The price paid for fertilizer bought by the government (Government purchasing price, GPP) was calculated on a "cost plus fee" basis. For every tonne produced, the industry received a fee of Rp5 000/tonne.
2. 1992-1997: Purchases by the government were based on a border price, whereby the selling prices of urea were standardized for all fertilizer plants and calculated based on an oil price of US$1.00/MMBTU.
3. 1997-December 1998: Following the impact of the monetary crisis in Indonesia, after mid 1997 the calculation of the GPP was based on the foreign currency expenditure needed to purchase the main raw materials, feed stock, plant spare parts and insurance. The GPP was based on a rate of US$1 = Rp6 000. However, in reality the rates moved between Rp10 000 and Rp12 000. Consequently, the Ministry of Finance agreed to subsidize the exchange rate difference.

The period from 1 December 1998 may be described as the "free market era", when subsidies and market regulations were at first abandoned. The fertilizer price was then entirely dependent on the market mechanism and the law of supply and demand (IFPA, 2004). However, decrees issued in 2001 and 2003 again regulated the fertilizer market, as described above.

The development of fertilizer prices is shown in Table 13.

The prices of urea have fluctuated more than those of other fertilizers. This is because the demand for urea by consumers in China, India and Vietnam is very difficult to predict. Besides consuming their own urea production, China and India sometimes export their surplus stock.

TABLE 13
Domestic and international fertilizer prices

Year	Fertilizer price (US$/tonne)					
	Urea		TSP/SP-36		AS	
	Domestic	International	Domestic	International	Domestic	International
1990	111.1	143.8	137.6	180.6	111.1	181.4
1995	143.7	210.0	228.7	172.5	154.6	105.0
1998	58.1	111.0	87.1	177.5	65.3	69.0
2000	126.6	115.5	166.9	141.0	103.6	-
2001	112.7	-	161.7	-	107.8	-

Source: IFPA, 2004.

The government's policy is to give priority to domestic fertilizer requirements rather than to exports. The government limits the quantities of fertilizer that may be exported by the producers in order to safeguard domestic supply. However, if export prices are attractive and port security is not strict, illegal exports of fertilizer reserved for domestic supply may occur. This jeopardizes the allocation of fertilizer to the country's farmers (IFPA, 2004). Such impacts could be seen from the short supply of fertilizer that have frequently occurred during the peaks of the lowland rice planting seasons between 2002 and 2004.

Information on costs in 2001 was assembled and a partial economic analysis for selected crops was prepared with special emphasis on fertilizer use (Table 14).

Among the food crops, the total costs for lowland rice, which uses the highest amount of mineral fertilizer, ranged between Rp110 000 (15.7 percent of total cost) in Kalimantan and Rp503 000 (31.7 percent of total cost) in Java. The higher proportion of the cost of fertilizer in relation to total cost in Java reflects the more intensive rice cultivation in Java. The second crop that used high fertilizer application rates was maize and the crops that used the least fertilizer were groundnut and cassava.

TABLE 14
Partial economic analysis of fertilizer use on food crops

Commodity	Yield, value and production cost			Nutrient application and cost		
	Yield	Produce value	Production cost	Mineral		Manure
	tonnes/ha	'000 Rp	Rp/ha	kg/ha	'000 Rp	'000 Rp
Rice	4.2	5 111	1 317	200	362	4
Maize	2.7	2 098	511	174	185	19.9
Groundnut	1.1	2 526	637	64	79	14.3
Soybean	1.2	2 741	787	104	127	15.3
Cassava	12.3	2 881	509	77	83	28.7
Sweet potato	9.7	4 091	647	93	93	28.4
	Nutrient cost as a percentage of the value			Produce value/ nutrient cost	Nutrient cost/ production cost	
	Total	Mineral	Manure			
Rice	25.8	7.1	0.08	14.0	0.28	
Maize	24.4	8.9	0.95	10.2	0.40	
Groundnut	25.2	3.1	0.57	27.1	0.15	
Soybean	28.7	4.6	0.56	19.3	0.18	
Cassava	17.7	2.9	1	25.8	0.22	
Sweet potato	15.8	2.3	0.69	33.7	0.19	

Source: CBS, 2003.

The supply of appropriate types and amounts of fertilizers at the right times, places and at affordable prices are very important for the success of agricultural development. Farmers can buy fertilizer from the KUD in cash or with a loan to be repaid later after harvesting the crop. For smallholder oil-palm growers, payment after harvest can be arranged by deducting the cost of the fertilizer from the value of the oil-palm products, which is usually paid monthly by KUD to the farmers. Farmers can also buy fertilizer directly in cash from private fertilizer dealers or depots. Farmers' associations such as the KUD village cooperative units or other farmers' organizations and plantation companies can obtain fertilizer from the warehouses through agreed purchasing arrangements.

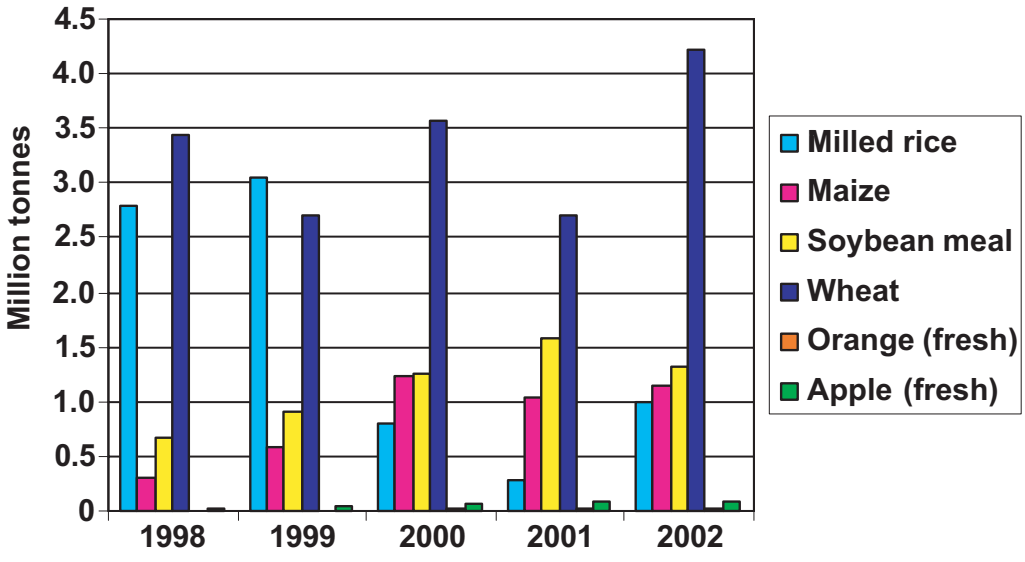
Chapter 5
The crops

Agriculture has played an important role in buffering Indonesia's economy during the recent, lengthy economic crisis. However, the agricultural sector also experienced considerable difficulties that are reflected in fall in the production of many crops presented in this report. Indonesia has to import considerable amounts of several basic food crops, such as rice, maize, soybean, orange and apple (Figure 8). Although there is no record, sugar (cane sugar) was also imported in large amounts, perhaps about 500 to 700 thousand tonnes or more. All wheat is imported since it cannot be grown in the country.

GRAINS, PULSES AND ROOT CROPS

Grains, pulses and root crops, i.e. the food crops, include rice, maize, groundnut, soybean, cassava and sweet potato and a number of other crops. The main staple food crop in Indonesia is rice, which is produced

FIGURE 8
Agricultural crop imports



Source: MOA, 2003.

mainly in irrigated or lowland systems. The other food crops are called *palawija* or secondary crops because they are usually grown after lowland rice, the first crop in the one-year crop rotation system. *Palawija* crops are grown also under non-irrigated or rainfed conditions.

Rice

Rice is grown under intensive cropping with irrigation systems (lowland rice) and rainfed or upland conditions (upland rice). Under dependable irrigation two crops per year are commonly grown by farmers, and occasionally up to five crops can be planted in a 2-year period. Expansion of the lowland rice area in Java is limited due to increasing competition for land with other crops and for non-agricultural uses, such as industry, housing and roads. Agriculture expansion to the outer islands is hindered by the lack of irrigation facilities and swampy, peat or infertile soils.

The production of lowland rice is highly concentrated on Java, followed by Sumatera and Sulawesi (Table 15). The share of harvested area and production of rice in Java from 1998 to 2002 has been nearly constant at around 51 percent. The average yield of brown rice grain was higher on Java (5 tonnes/ha) than in the other regions (4 tonnes/ha), indicating the higher soil fertility or fertilizer use on Java. The total annual harvested area of lowland rice did not change much during the five-year period; it is about 10.5 million ha. Table 16 shows fertilizer use on lowland rice for various provinces.

During the period 1998 to 2002, the harvested area of upland rice fell from 1.3 million ha to 1.1 million ha in 2002 but the average yield

TABLE 15
Lowland rice

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	5 380	5 390	5 263	4.99	5.13	5.25
Sumatera	2 655	2 663	2 675	4.04	4.11	4.05
Bali & N. Tenggara	536	559	528	4.44	4.56	4.61
Kalimantan	742	841	782	2.65	3.02	3.22
Sulawesi	1 126	1 134	1 202	4.03	4.39	4.43
Maluku & Papua	25	32	23	2.81	2.92	3.10
Indonesia	***10 464***	***10 619***	***10 473***	***4.44***	***4.63***	***4.66***
Excluding Java	5 083	5 228	5 209	3.87	4.03	4.07

TABLE 16
Farmers' practice for fertilizer use at farm level for lowland rice

Location	Province	Rate of fertilizer (kg/ha)				
		Urea	AS	SP-36	KCl	NPK (15-15-15)
Karawang	West Java	227		150	50	
Rangkasbitung	Banten	250		100	50	
Sragen	Central Java	280		140	50	70
Solok	West Sumatera	150		50	10	
50 Kota	West Sumatera	150		100	30	
Soppeng	South Sulawesi	250	85	25	25	
Polmas	South Sulawesi	130	10	10	10	
West Lombok	West Nusa Tenggara	400	5	110		
East Lombok	West Nusa Tenggara	310		50	5	

Source: Darwis and Numanaf, 2004.

TABLE 17
Upland rice

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	372	364	345	2.59	2.75	2.88
Sumatera	508	393	297	2.18	2.26	2.31
Bali & Nusa Tenggara	103	113	90	1.98	2.01	2.15
Kalimantan	207	254	291	1.73	1.83	2.18
Sulawesi	49	40	30	1.90	2.21	2.24
Maluku & Papua	15	12	6	1.95	2.06	2.38
Indonesia	***1 253***	***1 176***	***1 059***	***2.20***	***2.29***	***2.44***
Excluding Java	882	812	714	2.03	2.08	2.23

Source: CBS, 1999 – 2002.

remained constant about 2.3 tonnes/ha (Table 17). The area of upland rice was much less and the average yield lower than those of lowland rice. Farmers grow upland rice mainly for subsistence purposes. Many farmers still use old, long growing-period varieties, which have the aroma and taste they prefer. Besides being planted in rotation with food crops such as maize, groundnut and cassava, upland rice is also intercropped with newly replanted rubber trees, especially by smallholders in regions other than Java.

Maize

Maize is the second most important crop after rice. The maize area also is concentrated mostly in Java (Table 18). From 1998 to 2002, this island accounted for about 57 percent of harvested area and about 61 percent of

TABLE 18
Maize

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	2 218	1 957	1 736	2.76	2.96	3.37
Sumatera	739	745	663	2.70	2.82	2.95
Bali & Nusa Tenggara	318	323	307	2.10	2.13	2.78
Kalimantan	55	57	49	1.56	1.61	1.97
Sulawesi	477	408	356	2.54	2.45	2.55
Maluku & Papua	10	9	10	1.40	1.49	1.54
Indonesia	***3 816***	***3 500***	***3 121***	***2.64***	***2.77***	***3.05***
Excluding Java	1 598	1 543	1 385	2.48	2.52	2.65

Source: CBS, 1999 – 2002.

TABLE 19
Farmers' practice for fertilizer use at farm level for maize

		Rate of fertilizer (kg/ha)			
Location	Province	Urea	SP-36	KCl	Manure
Kotabumi	Lampung	250	200	100	
Bogor	West Java	300	200	100	
Sukabumi	West Java	225			3 000
Pelaihari	South Kalimantan	250	25	60	1 300

Source: Darwis and Numanaf, 2004.

the total production. Maize yields in the outer islands were lower (1.56 to 2.95 tonnes/ha) than those in Java (2.76 to 3.37 tonnes/ha). The lower maize yields in the outer islands, also the yields of other *palawija* crops, is caused by lower soil fertility and rates of fertilizer use. The demand for maize continues to increase, mainly for livestock feed, but from 1998 to 2002 the harvested maize areas decreased from 3 816 to 3 121 thousand ha. Unless there is a substantial increase in the maize area, especially in Java, and a substantial improvement in soil fertility in the outer islands, meeting the maize demand will continue to depend on imports. Table 19 shows fertilizer use on maize for various provinces.

Cassava

Cassava is the third most important crop after rice and maize. From 1998 to 2002, the harvested area of cassava increased slightly from 1 198 to 1 269 thousand ha (Table 20). The major growing area is Java, accounting for slightly more than half of the harvested area. The average yield in

TABLE 20
Cassava

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	652	670	662	13.2	13.8	14.6
Sumatera	298	362	389	11.4	11.4	11.7
Bali & Nusa Tenggara	101	106	92	9.6	10.3	10.9
Kalimantan	44	42	40	11.9	11.8	12.7
Sulawesi	76	73	66	10.8	10.8	12.6
Maluku & Papua	28	32	18	11.2	11.1	11.8
Indonesia	***1 198***	***1 287***	***1 269***	***12.2***	***12.5***	***13.2***
Excluding Java	545.8	616	606	11.0	11.1	11.8

Source: CBS, 1999 – 2002.

TABLE 21
Groundnut

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	423	466	446	1.05	1.08	1.12
Sumatera	80	67	62	1.05	1.07	1.08
Bali & Nusa Tenggara	48	53	55	1.11	1.09	1.13
Kalimantan	24	23	20	1.11	1.05	1.16
Sulawesi	65	65	61	1.09	1.09	1.08
Maluku & Papua	6	1	4	0.95	0.92	1.07
Indonesia	***647***	***684***	***648***	***1.06***	***1.08***	***1.11***
Excluding Java	223	218	203	1.08	1.07	1.10

Source: CBS, 1999 – 2002.

Java is about 13–14.5 tonnes/ha, whereas that in other regions is about 11 tonnes/ha. Cassava is mostly not fertilized.

Groundnut

Total harvested area of groundnut is relatively small (Table 21). The area remained stable between 1998 and 2002 with relatively low yields of 1.1 tonnes/ha. About 65 to 70 percent of the groundnut area is concentrated on Java. Groundnut is grown after lowland rice and is commonly not fertilized.

Soybean

Soybean, together with groundnut, is an important source of protein in the traditional diet of the Indonesian people. During the period under

TABLE 22
Soybean

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	669	553	398	1.24	1.29	1.21
Sumatera	207	120	47	1.11	1.11	1.14
Bali & Nusa Tenggara	138	81	64	1.09	1.09	1.15
Kalimantan	16	16	11	1.09	1.10	1.17
Sulawesi	55	45	22	1.22	1.24	1.24
Maluku & Papua	9	9	5	1.08	1.06	1.04
Indonesia	***1 094***	***824***	***547***	***1.19***	***1.23***	***1.20***
Excluding Java	425	271	149	1.12	1.13	1.16

Source: CBS, 1999 – 2002.

consideration, the total harvested area of soybean decreased from 1 094 to 546 thousand ha, especially in Java (Table 22). The average yield remained low at about 1.2 tonnes/ha. The major producing area is Java, which from 1998 to 2002 contributed between 61 and 73 percent of the total harvested area. Smallholder farmers are the main growers but as they plant groundnuts after lowland rice, they rely on the residual fertility of the soil.

Sweet potato

The area devoted to sweet potato is relatively small and from 1998 to 2002, the total harvested area decreased from 199 to 171 thousand ha (Table 23). The main growing area is Java, but during the reported period, the harvested area on this island decreased considerably, from 82 to 62 thousand ha and its share of the total harvested area fell from 41 percent to 36 percent. The second largest growing area is Sumatera Island, but the

TABLE 23
Sweet potato

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	82	67	62	10.8	10.9	11.5
Sumatera	45	38	35	8.9	9.1	9.3
Bali & Nusa Tenggara	19	27	19	8.9	8.7	9.3
Kalimantan	9	9	10	8.0	7.8	8.2
Sulawesi	15	17	17	8.2	8.2	9.1
Maluku & Papua	28	36	28	8.7	8.5	11.2
Indonesia	***199***	***194***	***171***	***9.6***	***9.4***	***10.3***
Excluding Java	117	127	108	8.7	8.6	9.7

Source: CBS, 1999 – 2002.

harvested area also decreased there, although yields tended to increase. Sweet potato is commonly not fertilized in Indonesia.

PLANTATION AND INDUSTRIAL CROPS

The plantation and industrial crop sector comprises more than twenty crops and occupies an area of more than 15 million ha. These crops play an important role in the Indonesian economy, particularly as regards exports. Among the twenty recognized plantation crops in Indonesia, ten are discussed in this section, i.e. rubber, coconut, oil-palm, sugar cane, coffee, tea, cocoa, tobacco, clove and pepper.

The management systems of plantation and industrial crops may be classified into three categories:

1. Smallholder estates (SHE)
2. Private estates (PE)
3. Government-owned estates (GOE).

The PE and GOE categories in this section are aggregated as large estates (LE).

The SHE generally use low levels of input in their production systems with consequently lower yields than those of LE. In addition, the SHE use traditional processing methods and thus its products have lower quality than those of the PE and GOE.

Rubber

In 1998, the total harvested area of rubber was 3.6 million ha with an average yield of 1.03 tonnes/ha (Table 24). However, by 2002 the area had fallen to 3.3 million ha and the average yield to 0.74 tonnes/ha. The major

TABLE 24
Rubber

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	142	133	133	1.07	0.82	0.90
Sumatera	2 598	2 385	2 347	0.71	0.65	0.70
Bali & Nusa Tenggara	0.1	0.1	0.1	1.33	0.77	0.84
Kalimantan	892	833	817	0.79	0.67	0.71
Sulawesi	14	17	17	1.72	0.85	0.91
Maluku & Papua	6	5	5	0.60	0.31	0.38
Indonesia	***3 653***	***3 373***	***3 318***	***1.04***	***0.68***	***0.74***
Excluding Java	3 511	3 240	3 185	1.03	0.65	0.71

Source: MOA, 2003.

TABLE 25
Management systems for rubber

System	Unit	1998	2000	2002	Annual percent change
Smallholder estates					
Area	'000 ha	3 082	2 883	2 829	-10.8
Yield	tonnes/ha	0.4	0.4	0.7	
Production	'000 tonnes	1 243	1 125	1 223	-0.1
Governmental estates					
Area	'000 ha	230	213	213	-1.8
Yield	tonnes/ha	0.8	0.8	0.9	
Production	'000 tonnes	193	170	189	-0.2
Private estates					
Area	'000 ha	341	277	277	-4.9
Yield	tonnes/ha	0.8	0.7	0.8	
Production	'000 tonnes	284	206	219	-5.8
Total area	'000 ha	3 653	3 372	3 318	

Source: DG Estate crops, 2000 and 2002.

growing area is Sumatera Island with a harvested area of 2.5 million ha, accounting for about 70 percent of the total harvested area. The average yields in Sumatera were low but constant at about 0.7 tonnes/ha. The second major rubber areas were provinces in Kalimantan Island but there also the average yields were low. The other rubber growing areas were provinces in Java where the average yields were rather higher at about 1 tonne/ha. Rubber is not fertilized.

In 1998, the rubber area under SHE was the largest at 3.08 million ha (84 percent of the total rubber area). However, the area of SHE rubber had decreased to 2.8 million ha by 2002, a fall of 253 thousand ha in five years or a negative growth rate of about 11 percent per annum (Table 25). This reduction in the area was due, at least in part, to a strong trend towards the replacement of rubber by oil-palm.

Oil-palm

During the 1998 to 2002 period, the total harvested area of oil-palm increased from 2.8 million ha in 1998 to 4.1 million ha in 2002, or an increase of 1.3 million ha during the five-year period (Table 26). The expansion of oil-palm took place mainly in Sumatera and Kalimantan Islands. However, during this period the average yield of CPO decreased from 3.32 to 3.08 tonnes/ha.

TABLE 26
Oil-palm

Island	Harvested area ('000 ha)			Average yield (tonnes CPO/ha)		
	1998	2000	2002	1998	2000	2002
Java	22	21	21	1.56	1.48	1.69
Sumatera	2 140	2 744	2 865	3.08	2.78	2.84
Bali & Nusa Tenggara	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Kalimantan	493	844	1 ¸057	1.99	1.94	1.82
Sulawesi	112	108	116	1.99	2.04	2.15
Maluku & Papua	23	52	57	4.14	3.61	3.15
Indonesia	***2 788***	***3 770***	***4 117***	***3.32***	***3.09***	***3.08***
Excluding Java	2 768	3 749	4 096	2.80	2.59	2.49

CPO = Crude palm oil
Source: MOA, 2003.

The increase in the oil-palm area was due mainly to an expansion of oil-palm estates under the PE system, which rose from 2.1 to 3.9 million ha between 1998 and 2002 (Table 27). The second largest increase was in oil-palm estates under the SHE system. However, yields of oil-palm under the SHE and PE systems were low, ranging between 1.4 to 1.8 tonnes/ha of CPO. The yields of GOE estates ranged between 3.5 and 3.7 tonnes/ha of CPO, or almost twice the yields of the SHE and PE estates.

Sugar cane

The total area of sugar cane in 1998 was 377 thousand ha, of which 245 thousand ha (65 percent) were in Java, the second largest area being in

TABLE 27
Management systems for oil-palm

Systems	Unit	1998	2000	2002	Annual percent change
Smallholder estates					
Area	'000 ha	892	1 190	1 222	8.5
Yield	tonnes/ha	1.4	1.7	1.8	
Production	'000 ha	1 246	1 978	2 227	17.0
Governmental estates					
Area	'000 ha	485	529	545	3.0
Yield	tonnes/ha	3.5	3.7	3.7	
Production	'000 tonnes	1 699	1 971	2 023	4.5
Private estates					
Area	'000 ha	1 403	2 051	2 349	14.5
Yield	tonnes/ha	1.5	1.8	1.7	
Production	'000 tonnes	2 062	3 632	3 907	18.5
Total area	'000 ha	2 780	3 770	4 117	9.6

TABLE 28
Sugar cane

Island	Harvested area ('000 ha)			Average yield (tonnes sugar/ha)		
	1998	2000	2002	1998	2000	2002
Java	245	226	214	3.90	4.96	4.67
Sumatera	114	119	112	4.25	5.34	5.04
Bali & Nusa Tenggara	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Kalimantan	6	3	3	1.62	1.76	1.67
Sulawesi	12	19	18	3.24	4.32	2.75
Maluku & Papua	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Indonesia	***377***	***366***	***347***	***3.94***	***4.96***	***5.45***
Excluding Java	132	140	133	3.04	3.81	3.15

Source: MOA, 2003.

Sumatera (30 percent). During the 1998 to 2002 period, the total area of sugar cane fell by 8 percent (Table 28). The national average yield in 1998 was 3.94 tonnes sugar/ha, which increased to 5.45 tonnes sugar/ha in 2002. The recommended fertilizer rates for sugar cane are similar for all sites (Table 29); instead of urea as source of nitrogen, AS is used. Despite the increase in the yield of sugar cane, total sugar production could not meet the national demand. It is estimated that around 500 to 700 thousand tonnes of sugar were imported annually, although more sugar may have entered the country through illegal imports.

Coffee

The total harvested area of coffee in 1998 was 1.15 million ha and increased to 1.27 million ha in 2002, with average yields of about 0.62 tonnes/ha throughout the period (Table 30). Coffee plantations were located mostly in Sumatera, which in 1998 accounted for 59 percent (0.68 million ha) of the total harvested area. The other major coffee areas were Java, Sulawesi, Bali and Nusa Tenggara Islands. Sumatera had the highest average yield, 0.65 tonnes/ha in 1998, but it decreased to 0.57 tonnes/ha in 2002. The other areas have lower yields particularly Java with average yields of only 0.40 and 0.48 tonnes/ha in 1998 and 2002, respectively. Coffee is mostly grown by smallholders and fertilizer use is not common.

Tea

The total harvested area of tea during the 1998-2002 period was approximately constant, at about 158 thousand ha, with an average yield,

TABLE 29
Recommended rate of fertilizer for sugar cane at various sugar cane plantations on Java and Sumatera

Location	Province	Land typology	Crop	Rate of fertilizer (kg/ha)		
PT Nusantara IX plantation				**AS**	**SP-36**	**KCl**
Jatibarang	West Java	Lowland	Plant cane	700	200	100
			Ratoon	700	200	0
	West Java	Dry land	Plant cane	700	200	0
			Ratoon	700	200	0
Pangka	Central Java	Lowland	Plant cane	700	200	200
			Ratoon	700	200	200
		Dry land	Plant cane	700	200	200
			Ratoon	700	200	200
Sumberharjo	Central Java	Lowland	Plant cane	700	200	200
			Ratoon	800	200	200
		Dry land	Plant cane	700	200	200
			Ratoon 1	700	200	200
			Ratoon 2	800	200	200
Sragi	Central Java	Lowland	Plant cane	700	200	200
			Ratoon	700	200	200
		Dry land	Plant cane	700	200	200
			Ratoon 1	700	200	200
			Ratoon 2	700	200	200
Rendeng	Central Java	Dry land	Plant cane	700	200	100
			Ratoon 1	700	200	100
			Ratoon 2	700	200	100
Mojo	Central Java	Lowland	Plant cane	700	200	200
			Ratoon	700	200	200
		Dry land	Plant cane	700	200	200
			Ratoon	700	200	200
Tasikmadu	Central Java	Lowland	Plant cane	700	200	200
			Ratoon	700	200	200
		Dry land	Plant cane	600	200	200
			Ratoon 1	600	200	200
			Ratoon 2	600	200	200
Gondang Baru	Central Java	Lowland	Plant cane	600	100	100
			Ratoon	600	100	100
		Dry land	Plant cane	700	100	0
			Ratoon 1	700	100	100
			Ratoon 2	700	100	100
PT Nusantara VII				**Rate of fertilizer (kg/ha)**		
				Urea	**TSP**	**KCl**
Bunga Mayang	Lampung	Dry land	Plant cane	400	350	300
			Ratoon	500	400	400
Gunung Madu	Lampung	Dry land	Plant cane	300	200	300
			Ratoon	300	200	300

Source: Sri Adiningsih *et al*., 2003.

TABLE 30
Coffee

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	183	165	166	0.40	0.48	0.48
Sumatera	681	793	803	0.65	0.57	0.57
Bali & Nusa Tenggara	108	109	109	0.52	0.53	0.54
Kalimantan	38	39	39	0.47	0.47	0.47
Sulawesi	131	136	134	0.63	0.51	0.63
Maluku & Papua	13	15	18	0.41	0.38	0.36
Indonesia	***1 153***	***1 258***	***1 269***	***0.61***	***0.63***	***0.62***
Excluding Java	970	1 093	1 103	0.53	0.49	0.51

Source: MOA, 2003.

TABLE 31
Tea

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	133	129	133	1.16	1.03	1.05
Sumatera	25	22	24	1.44	1.36	1.71
Bali & Nusa Tenggara	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Kalimantan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sulawesi	0.1	2	2	1.28	0.16	0.72
Maluku & Papua	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Indonesia	***158***	***153***	***159***	***1.43***	***1.39***	***1.43***
Excluding Java	25	24	26	1.44	1.27	1.22

Source: MOA, 2003.

also constant, of 1.43 tonnes/ha (Table 31). The primary tea-producing island was Java, which accounted for 84 percent of the total harvested area, with West Java Province as the major producer. The second most important tea-producing island was Sumatera, which in 2002 accounted for 15 percent of the total harvested area. The contribution of the other islands to tea production was negligible. Tea is managed by smallholders and on plantations (about 50 percent of the total area each). A general fertilizer recommendation is 150 kg/ha N, 100 kg/ha P_2O_5 and 100 kg/ha K_2O plus 50 kg/ha MgO.

Cocoa

The total harvested area of cocoa during the 1998 to 2002 period increased rapidly from 578 to 777 thousand ha (Table 32). The increase took place mostly in Sulawesi (from 289 to 423 thousand ha) and Sumatera (from 107 to 143 thousand ha). The national average yield was 1.19 tonnes/ha in 1998 but it fell to 0.90 tonnes/ha in 2002. The relatively low yields were

TABLE 32
Cocoa

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	50	56	57	0.50	0.42	0.43
Sumatera	107	137	143	0.71	0.54	0.54
Bali & Nusa Tenggara	22	42	45	0.72	0.56	0.57
Kalimantan	46	45	47	0.44	0.46	0.50
Sulawesi	289	410	423	1.15	0.86	0.93
Maluku & Papua	64	60	63	0.77	0.57	0.60
Indonesia	***578***	***750***	***777***	***1.19***	***0.89***	***0.90***
Excluding Java	528	694	720	0.76	0.60	0.63

Source: MOA, 2003.

due partly to inappropriate fertilization practices. Cocoa is mostly grown by smallholders and fertilizer use is not common.

Coconut

Coconut is grown throughout the country (except in Jakarta province), with a total area of 3.5 million ha (Table 33). The average yields were 0.75 tonnes copra/ha in 1998 and 0.87 tonnes copra/ha in 2002. The major coconut producing islands are Sumatera, Java and Sulawesi, accounting for about 76 percent of the total harvested area. Coconut is mainly managed by smallholders and fertilizer applications are not common. A medium fertilizer application rate is 100 kg/ha N, 50 kg/ha P_2O_5 and 100 kg/ha K_2O.

Tobacco

The total harvested area of tobacco was 222 thousand ha in 1998 and 257 thousand ha in 2002 (Table 34). The average yield increased from

TABLE 33
Coconut

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	874	876	876	0.67	0.74	0.78
Sumatera	1 173	1 121	1 121	0.73	0.92	0.97
Bali & Nusa Tenggara	299	302	302	0.56	0.60	0.63
Kalimantan	247	254	254	0.61	0.64	0.67
Sulawesi	635	659	663	0.98	0.97	1.01
Maluku & Papua	277	269	269	0.85	0.85	0.90
Indonesia	***3 505***	***3 480***	***3 486***	***0.75***	***0.83***	***0.87***
Excluding Java	2 631	2 604	2 610	0.77	0.86	0.90

Source: MOA, 2003.

TABLE 34
Tobacco

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	141	201	225	0.52	0.71	0.73
Sumatera	5	5	5	0.48	0.63	0.63
Bali & Nusa Tenggara	19	32	26	0.77	1.23	1.20
Kalimantan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sulawesi	0.5	1	1	0.83	0.65	0.68
Maluku & Papua	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Indonesia	***222***	***169***	***257***	***0.66***	***0.76***	***0.87***
Excluding Java	24	39	32	0.69	0.83	0.84

Source: MOA, 2003.

0.66 tonnes/ha in 1998 to 0.87 tonnes/ha in 2002. Tobacco was grown primarily in Java (East, Central and West Java Provinces), Bali and Nusa Tenggara and Sumatera (North Sumatera Province). Tobacco is grown by both smallholders and on plantations. General fertilizer application is 100 – 150 kg/ha AS, 100 – 150 kg/ha TSP and 100 – 150 kg/ha K_2SO_4.

Cloves

The total harvested area of cloves amounted to 429 thousand ha in 1998, decreasing slightly to 417 thousand ha in 2002 (Table 35). Cloves are grown throughout the country. The major producing islands are Sulawesi, Java and Sumatera. Clove yields commonly fluctuate with a high yield in one year out of four. The average yield increased substantially between 1998 and 2002.

TABLE 35
Cloves

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	140	134	134	0.17	0.17	0.21
Sumatera	66	59	58	0.14	0.08	0.09
Bali & Nusa Tenggara	37	34	33	0.28	0.17	0.26
Kalimantan	4	3	3	0.08	0.05	0.07
Sulawesi	145	148	149	0.26	0.15	0.15
Maluku & Papua	37	39	39	0.12	0.12	0.13
Indonesia	***429***	***418***	***417***	***0.20***	***0.28***	***0.30***
Excluding Java	289	284	282	0.18	0.13	0.15

Source: MOA, 2003.

TABLE 36
Pepper

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	2	3	3	0.36	0.52	0.51
Sumatera	97	112	113	0.55	0.59	0.58
Bali & Nusa Tenggara	0.2	0.3	0.3	0.32	0.41	0.50
Kalimantan	18	20	20	0.84	0.88	0.85
Sulawesi	14	15	24	0.54	0.71	0.68
Maluku & Papua	0.1	0.1	0.1	0.35	0.32	0.38
Indonesia	***131***	***150***	***161***	***0.81***	***0.80***	***0.76***
Excluding Java	129	147	158	0.52	0.58	0.60

Source: MOA, 2003.

Pepper

Pepper is produced in the South Sumatera and Lampung provinces of Sumatera. During the 1998 to 2002 period, the total harvested area increased from 131 to 161 thousand ha, of which South Sumatera and Lampung accounted for about 70 percent (92 thousand ha) in 1998, the proportion decreasing slightly to 67 percent (108 thousand ha) in 2002 (Table 36). It should be noted that since 2000 the South Sumatera province has been divided into two provinces, South Sumatera and Bangka Belitung. Most of the pepper plantations were in Bangka Belitung and not in South Sumatera. Table 37 shows fertilizer recommendation rates for pepper. Pepper is grown by SHE and on plantations.

VEGETABLE CROPS

Fertilizer use on total vegetable and fruit crop amounts to about 5 percent and 4 percent respectively of total fertilizer use in Indonesia (FAO *et al.*, 2002). The tables for the vegetable and fruit crops considered

TABLE 37
Fertilizer recommendations for pepper

Plant age (year)	Nutrient composition ($N : P_2O_5 : K_2O : MgO$)	Rate of fertilizer (g/plant/year)
1	12 : 12 : 17 : 2	4 x (20 – 25)
2	12 : 12 : 17 : 2	4 x (50 – 100)
3	12 : 12 : 17 : 2	4 x (200 – 400)

Source: Hanson *et al.,* 1994.

are given in Annex 1 and Annex 2 respectively. There are no fertilizer recommendations for vegetable crops, although the use of fertilizers for these crops is very high (intensive). An approximation is 100 - 150 kg/ha N, 100 - 150 kg/ha P_2O_5 and 100 - 200 kg/ha K_2O, lime (1 tonne/ha) might be needed on acid soils.

Potato

The harvested area of potato during the 1998 to 2002 period decreased significantly, by about 15 percent, from 65 to 55 thousand ha. This decrease was due to a considerable reduction in the harvested area in the major producing island of Java, from 40 to 35 thousand ha, combined with a substantial decrease from 21 to 16 thousand ha in the second largest producing island of Sumatera. The third largest potato-producing island is Sulawesi. However, the average yield in Sulawesi, at about 9 tonnes/ha in 1998 falling to 6 tonnes/ha in 2002, was much lower than those in Java and Sumatera, where yields reached about 17 tonnes/ha.

Cabbage

The harvested area of cabbage during the 1998 to 2002 period decreased substantially, falling from 69 to 58 thousand ha. This decrease occurred mainly in the two major cabbage producing regions of Java and Sumatera Islands. The harvested area in the third largest cabbage producing region, Sulawesi Island, fell only slightly but the yield was low at about 12 tonnes/ha in 1998, falling to 7.4 tonnes/ha in 2002. Bali and Nusa Tenggara Islands had the highest cabbage yields in the country. Although these islands had a small harvested area of less than two thousand ha, the yield was more than 30 tonnes/ha.

Tomato

The major tomato producing regions are Java, Sumatera and Sulawesi, in the provinces of North Sumatera, Bengkulu, West Sumatera, West Java, North Sulawesi and South Sulawesi. The total harvested area of tomato decreased from 47 in 1998 to 43 thousand ha in 2001 but increased again to 49 thousand ha in 2002. The average yield remained constant at about 11.5 tonnes/ha. The production areas of tomato were highly concentrated in West Java and North Sumatera.

Carrot

During the period in question, the total harvested area of carrot remained stable at about 20 thousand ha. The major producing area was Java with a harvested area of 13 thousand ha or 65 percent of the national harvested area. The second major carrot producing area was Sumatera Island, particularly in North Sumatera and Bengkulu Provinces. However, yields of carrot vary between the islands, ranging from about 18 tonnes/ha in Java to between 12 and 13 tonnes/ha in Sumatera and the other islands.

Spring onion

The total harvested area of spring onion during the 1998 to 2002 period decreased slightly from 36.5 to 34.1 thousand ha, but the average yield remained at about 8 tonnes/ha. The major producing areas were Java Island, particularly East Java, and Sumatera Island, particularly North Sumatera and Bengkulu Provinces. The highest yield was obtained in Java at about 9 tonnes/ha, whereas in Sumatera it was lower, ranging between 5 and 6 tonnes/ha.

Chili

Chili is grown throughout the country. The major growing areas are all the provinces of Java, with a total harvested area that remained constant at about 83 thousand ha during the 1998-2002 period. However, the average yield in these areas decreased from 6.2 to 4.6 tonnes/ha. The second major producing island was Sumatera, particularly in North Sumatera, West Sumatera, N. A. Darussalam and Bengkulu Provinces, but the total harvested area in Sumatera decreased considerably between 1998 to 2002, falling from 56 to 42 thousand ha, and the average yields at about 3 tonnes/ha was lower than those obtained in Java. Table 38 provides fertilizer use for various provinces for red chili.

TABLE 38
Farmers' practice of fertilizer use for red chili at farm level

Location	Province	Rate of fertilizer (kg/ha)					
		Urea	AS	SP-36	KCl	NPK (15-15-15)	Manure
Garut	West Java	620	295	410	160	40	5 200
Magelang	Central Java		380	355	250	180	8 500
Gresik	East Java	300	100	160	85	80	970

Source: Rahmanto, 2001.

Shallot

During the 1998-2002 period, the total harvested area of shallot increased from 76 to 88 thousand ha. Major provinces producing shallot were North Sumatera, West, Central and East Java, West Nusa Tenggara and South Sulawesi. However, the average yield in South Sulawesi was very low (about 3 tonnes/ha), whereas in other provinces yields were about 8 to 9 tonnes/ha.

Mustard green

The total harvested area of mustard green decreased substantially, from 52 to 35 thousand ha during the 1998 to 2002 period, although the average yield remained at about 9 tonnes/ha. The major producing islands were Java and Sumatera, which accounted for about 80 percent of the total harvested area. Average yields of mustard green in Java, Sumatera, Bali and Nusa Tenggara were about 10 tonnes/ha, but the average yield in other islands was considerably lower, at 3 to 5 tonnes/ha.

FRUIT CROPS

Numerous fruit crops are produced in Indonesia. In this report, only those fruits that have an important economic status nationally are discussed. Generally fruit crops such as mango, rambutan, durian and avocado are not grown as plantation crops on large areas, but are produced from one to five trees grown in the yards of farm houses. Other fruit crops such as banana and pineapple are planted in larger numbers in the border areas of farms. Most fruits are grown by SHE but recently there has been a tendency for fruit crops such as banana, orange, papaya, pineapple and salacia to be grown as commercial enterprises. Common fertilizer applications are 100 - 150 kg/ha of N, 100 – 150 kg/ha of P_2O_5 and 100 – 200 kg/ha of K_2O. Mg and S might be needed for specific sites and crops.

Banana

Many varieties of banana are grown in different areas, depending on the agro-ecological conditions and consumers' preferences. Banana produces fruits all the year round. Between 1998 and 2001, total banana production in Indonesia increased from 3.2 to 4.4 million tonnes. This increase was

due mostly to higher average yields per hectare, which rose from 44.4 to 58.7 tonnes/ha. Java is the largest banana producing area with about a 65 to 70 percent share of the national market. The major areas of production are West Java, East Java and Central Java provinces. Other major producing provinces are North Sumatera, West Sumatera, South Sumatera, Lampung and West Nusa Tenggara.

Orange

Unlike most of the other crops, the major orange production area is not Java but Sumatera Island, followed by Java, Bali and Nusa Tenggara and Sulawesi Islands. During the 1998 to 2002 period orange production increased from 491 to 691 thousand tonnes, but fell back slightly to 664 thousand tonnes in 2002. This increase was due mostly to a higher harvested area, which rose from 23.7 to 47.3 thousand ha. Sumatera had the largest market share, contributing about 36 to 53 percent of total orange production, while Java accounted for 18 to 22 percent. The major provinces for orange production are North Sumatera, Bali, East Java, West Sumatera, West Java and Central Java. During the past five years, the orange area has increased considerably in Central Java (from 0.5 to 1.5 thousand ha) and North Sumatera (from 5.5 to 10.4 thousand ha). However, a large proportion of these changes took place on lowland rice areas, which are among the most productive land areas in the country. This change in land use has some negative impact on national food (rice) security but it has improved farmers' incomes.

Papaya

Papaya is planted throughout the country and is produced all the year round. During the 1998 to 2002 period, except in 2000, national production remained relatively constant at about 500 thousand tonnes per annum. The total harvested area increased from 9.8 to 10.4 thousand ha and the average yield rose from 50 to 59 tonnes/ha. Java had about six thousand ha of papaya, a 75 percent of market share, which decreased to 66 percent in 2002. Other major producing islands were Sumatera and Bali and Nusa Tenggara, which together accounted for 18 to 26 percent of total papaya production. The major papaya production provinces were East Java, Central Java, West Java and East Nusa Tenggara. In 1998, East

Java produced 262 thousand tonnes papaya; accounting for 54 percent of national production but in 2002 it produced only 181 thousand tonnes (37 percent). However, papaya production in West Java increased from 44 to 71 thousand tonnes and in East Nusa Tenggara from 21 to 51 thousand tonnes.

Pineapple

Pineapple production increased from 327 to 463 thousand tonnes during the 1998-2002 period. The increase was the result of higher harvested areas (from five to nine thousand ha) and in average yields (from 67 to 75 tonnes/ha). Production on Java during this period declined slightly from 167 to 146 thousand tonnes. Pineapple production in Sumatera increased more than two-fold, from 144 to 301 thousand tonnes. Initially North Sumatera was the major pineapple province in Sumatera but a major increase of pineapple production has occurred in South Sumatera, Riau and Lampung Provinces. This development suggests that pineapple has become a commercial commodity in these three provinces.

Mango

Mango is a seasonal fruit and the major producing areas are in areas with a distinct dry season i.e. East Java, West Java, South Sulawesi and East Kalimantan Provinces. During the 1998 to 2002 period mango production increased from about 600 to 900 thousand tonnes per annum. East Java accounted for 40 to 45 percent of the total 1998 to 2002 mango production, followed by West Java and South Sulawesi, which accounted respectively for 12 to 18 percent and 4 to 8 percent of the total mango production. The increase in production resulted from higher harvested areas and higher average yields.

Rambutan

The production of rambutan increased from 279 to 477 thousand tonnes during the 1998 to 2002 period. The harvested area increased from 46 to 69 thousand ha and the yield from 4.5 to 6.1 tonnes/ha. The major production areas are Java and Sumatera Islands. During this period, the production of rambutan on Java increased from 164 to 199 thousand tonnes. The major producing areas are West Java, East Java and Central Java. During peak

seasons, rambutan fruit generally overloads local markets, suggesting that fruit processing industries are needed to conserve the fruits.

Durian

Durian has a high cash value. It is produced seasonally, around November to January. During the 1998 to 2002 period, national production increased from 210 to 347 thousand tonnes. During this period, the total harvested area increased from 26 to 41 thousand ha and yields increased from 8 to 12.8 tonnes/ha). The major areas of production are Java and Sumatera. In 1998, Java accounted for 43 percent of national production (91 thousand tonnes) but the proportion declined to 32 percent (65 thousand tonnes) in 2002.

Avocado

The national production of avocado reached more than 130 thousand tonnes in 1998 and increased to 151 thousand tonnes in 2002. The major areas of production were Java and Sumatera, which together accounted for 80 percent of national production. Their market share rose to 82 percent in 2002. The increases were due to increases in harvested areas and yields. The major production areas were West Java and East Java Provinces.

Salacia

During the 1998 to 2002 period, production of salacia increased from 353 to 467 thousand tonnes, with a peak in 2001 of 681 thousand tonnes. The major producing areas are Java, Sumatera and Bali-Nusa Tenggara, these three regions together accounting for 97 percent of national production.

Chapter 6
Fertilizer policy and future fertilizer needs

Since the green revolution in the early 1960s, mineral fertilizers have been officially recognized in Indonesia as essential inputs for the improvement of agriculture production. The first fertilizer plant came into production in 1963. This marked the beginning of the fertilizer industry in the country and other fertilizer plants were constructed subsequently. The Government of Indonesia used the fertilizer subsidy as an important instrument for managing fertilizer marketing and distribution, with a major focus on the increased production of rice, the staple food in Indonesia. Rice production more than doubled, from about 20 million tonnes in early 1970s to 51 million tonnes in 2002. This achievement was made possible by a remarkable increase in fertilizer use. During the last 30 years (1970-2000), annual fertilizer use has increased from 635 to 5 931 thousand tonnes (Figure 2), over half of which was used to increase rice production.

Because of the subsidy, the domestic prices of fertilizer were lower than the world prices of the corresponding products. However, the past policy of subsidizing domestic fertilizer prices had two undesirable outcomes. Firstly, the cost became a heavy budgetary burden and secondly it created inefficiency on fertilizer use at the farm level. A study in West Java reported that rice farmers were applying levels of fertilizers that were higher than the recommended rates, by 12 percent in the case of urea, 16 percent in the case of TSP and 50 percent in the case of KCl. Another study found that TSP and KCl were often still applied when soil tests showed that the soil reserves had built up to high levels. Relatively low domestic fertilizer prices also resulted in fertilizer smuggling (Hanson *et al.*, 1994).

To reduce the budgetary burden and to improve the efficiency of fertilizer use, the government had to increase the retail price. The

subsidy on potassium chloride was removed in October 1991, those on AS and TSP/SP-36 in October 1994 and the urea subsidy was removed in December 1998. To maintain a relatively constant fertilizer to paddy price ratio, the floor purchase price of paddy was also increased annually. The ratio fluctuated around 0.78 in 1970/71, 1.75 in 1985/86 and 1.14 in 1992/93.

The fertilizer policy had the most impact on the yields of rice. Between 1960 and 1975 the yield increased from 2.18 to 2.75 tonnes/ha or an average increase of 1.64 percent per year, while from 1975 to 1985 it increased from 2.75 to 4.00 tonnes/ha or an increase of 4.1 percent per year. During these two periods, total rice production increased from 14.3 million tonnes in 1960 to 23.4 million tonnes in 1975 and to 39.7 million tonnes in 1985. However, from 1985 onwards yields tended to stagnate, with an increase from 4 to 4.4 tonnes/ha or an average of 0.68 percent per year. During this latter period fertilizer use increased only slightly, from 4.4 to 5.5 million tonnes or a rate of increase of 1.7 percent per year.

The high increase of average rice yields in the 1975-1985 period was achieved by a special governmental intensification program which involved the dissemination of technology, the provision of capital and a guaranteed floor price for rice. The low increase of rice yields during the period between 1985 and 2000 was due to decreased government support, involving a reduction in advisory services, reduction in the subsidy on pesticides and fertilizers and uncertainty concerning the floor price of rice.

Aware of the negative impact of this development, since 1998 the government has taken some measures to reinstate certain subsidies. However, the re-implementation of subsidies has been inconsistent, largely due to the government's limited financial capacities. In April 1998 a subsidy for AS and SP-36 fertilizer for the agriculture sector was reinstated. This decision was soon followed by an announcement by the Ministry of Agriculture on 1 December 1998 that the government would no longer be involved in the marketing of fertilizers and that subsidies on fertilizers were to be terminated. However, in January 1999 the government regulated the supply and distribution of urea, TSP/SP-36, AS and KCl for farmers in remote areas that are difficult of access. In March 2001 the marketing of urea for the agricultural sector reverted to government

control. In February 2003 the government applied regulations allocating the areas for the distribution of fertilizers to the different companies. The government has reinstated fertilizer subsidies for the years from 2003 until 2005 for urea, SP-36, AS and NPK fertilizers, but only for use on food crops and smallholder plantations.

These sometimes conflicting decisions were made in recognition of the importance of food security for stabilizing the country's economy, a country with a population of 215 million people and an economy heavily dependent on agriculture.

After two years experience, however, it is apparent that the dual pricing system leads to inefficiency and a distortion of marketing systems. Subsidized fertilizers are frequently not reaching the intended beneficiaries; they can easily be used for the unsubsidized non-food crop subsector and some subsidized fertilizers have been exported.

A serious problem is the frequent occurrence of non-availability or lack of appropriate types of fertilizer at the village level. Sometimes shortages occur when the fertilizers are needed for the basal fertilization of food crops during the planting season. Furthermore, despite the subsidy, farmers cannot afford to buy the full amounts they require due to their low purchasing power, this being a direct and indirect result of the economic crisis. However, these are not the only significant constraints. Other constraints include problems of low fertilizer quality, an inadequate choice of fertilizer types and inadequate access to credit, especially for smallholders. During the economic crisis, there was a deterioration also in other farming practices.

For efficient fertilization, the supply of fertilizers should be:

- Of the required type.
- In adequate amounts.
- Of guaranteed quality.
- Available at the place required, village or farm level.
- Available at the time required, well before the peak planting season.
- At an affordable price.

Crop yields could be increased and food security thus improved by the application of improved fertilization technologies. Research has developed integrated plant nutrient management (IPNM) systems based on soil and plant analyses for both annual and perennial crops. Combining

TABLE 39
National fertilizer supply and demand

Year	Urea ('000 tonnes)		TSP/SP-36 ('000 tonnes)	
	Capacity	Demand	Capacity	Demand
2003	7 440	4 933	1 000	658
2004	7 440	5 028	1 000	665
2005	8 010	5 125	1 000	671

Source: IFPA, 2004.

inorganic fertilizers with locally available soil amendments, such as farmyard manure and crop residues, can make inorganic fertilizer use more attractive economically.

The most important factor for increasing fertilizer demand is an improvement in the profitability of its use.

Based on data of fertilizer production and consumption in the period from 1998 to 2002, it is estimated that national fertilizer requirements until 2006, the end year of the assessment, can be supplied by the domestic fertilizer producers (Table 39).

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Annex 1
Areas and average yields of vegetable crops

TABLE A1.1
Potato

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	40	43	35	16.3	14.8	15.2
Sumatera	21	20	16	14.8	14.2	16.9
Bali & Nusa Tenggara	0.8	0.7	0.7	8.3	7.3	9.3
Kalimantan	<0.1	<0.1	n.a.	2.0	2.0	n.a.
Sulawesi	3	9	4	8.9	5.4	5.8
Maluku & Papua	0.1	n.a.	0.1	1.9	n.a.	9.5
Indonesia	***65***	***73***	***55***	***15.3***	***13.4***	***14.9***
Excluding Java	25	31	20	13.8	11.3	14.4

n.a. = not available
Source: CBS, 1999 – 2002.

TABLE A1.2
Cabbage

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	43	44	40	21.4	19.1	20.2
Sumatera	20	18	13	21.7	21.8	25.7
Bali & Nusa Tenggara	2	2	2	33.0	32.3	31.0
Kalimantan	<0.1	<0.1	<0.1	5.3	5.6	7.6
Sulawesi	3	3	3	11.9	16.0	7.4
Maluku & Papua	1	<0.1	0.4	3.6	8.7	5.9
Indonesia	***69***	***67***	***58***	***21.1***	***20.0***	***20.9***
Excluding Java	26	23	18	20.6	21.6	22.5

Source: CBS, 1999 – 2002.

TABLE A1.3
Tomato

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	17	20	18	9.9	9.5	11.2
Sumatera	18	15	17	7.8	7.4	5.2
Bali & Nusa Tenggara	2	2	2	10.4	7.8	14.2
Kalimantan	2	2	2	4.1	4.8	3.6
Sulawesi	6	7	10	4.8	5.3	6.5
Maluku & Papua	1	<0.1	1	4.9	6.1	7.5
Indonesia	***47***	***45***	***49***	***11.7***	***13.1***	***11.5***
Excluding Java	30	25	31	6.4	6.3	7.4

Source: CBS, 1999 – 2002.

TABLE A1.4
Carrot

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	13	14	13	18.7	17.4	16.8
Sumatera	6	4	4	12.3	16.9	13.3
Bali & Nusa Tenggara	0.3	0.5	0.5	14.6	9.7	11.8
Kalimantan	n.a.	<0.1	<0.1	n.a.	2.5	1.9
Sulawesi	1	1	2	4.0	6.1	12.6
Maluku & Papua	<0.1	n.a.	<0.1	4.6	n.a.	4.1
Indonesia	***21***	***20***	***19***	***15.9***	***16.4***	***15.5***
Excluding Java	8	6	6	11.2	14.1	12.9

Source: CBS, 1999 – 2002.

TABLE A1.5
Spring onion

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	25	26	25	9.3	9.2	9.1
Sumatera	7	5	5	5.0	5.3	6.2
Bali & Nusa Tenggara	0.1	0.2	0.2	11.8	9.4	11.2
Kalimantan	1	0.6	0.6	1.9	1.7	2.3
Sulawesi	3	4	4	4.8	10.2	6.0
Maluku & Papua	0.6	<0.1	0.2	1.0	4.4	1.3
Indonesia	***36***	***36***	***34***	***7.9***	***8.6***	***8.2***
Excluding Java	11	10	9	4.6	7.1	5.8

Source: CBS, 1999 – 2002.

TABLE A1.6
Chili

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	84	99	83	6.2	5.2	4.6
Sumatera	56	48	42	2.9	3.1	3.3
Bali & Nusa Tenggara	11	12	11	4.6	4.3	4.1
Kalimantan	5	5	4	2.9	3.2	3.0
Sulawesi	8	12	10	3.9	2.9	3.5
Maluku & Papua	1	<0.1	1	4.1	8.6	3.9
Indonesia	***165***	***175***	***151***	***4.1***	***4.6***	***3.7***
Excluding Java	81	76	68	3.9	4.4	3.6

Source: CBS, 1999 – 2002.

TABLE A1.7
Shallot

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	52	64	67	8.7	9.3	8.9
Sumatera	9	7	6	8.9	9.9	6.7
Bali & Nusa Tenggara	9	5	9	6.3	6.2	12.4
Kalimantan	<0.1	<0.1	<0.1	1.9	7.8	3.7
Sulawesi	7	8	6	2.3	9.6	3.0
Maluku & Papua	0.3	0.1	0.4	6.1	27.3	4.3
Indonesia	***76***	***84***	***88***	***7.8***	***9.2***	***8.7***
Excluding Java	25	20	21	6.1	8.9	8.3

Source: CBS, 1999 – 2002.

TABLE A1.8
Mustard green

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	27	28	20	10.1	10.4	10.5
Sumatera	15	11	7	9.4	10.0	10.3
Bali & Nusa Tenggara	2	2	2	11.2	10.6	10.8
Kalimantan	5	3	3	3.4	4.3	3.4
Sulawesi	3	4	3	5.2	6.4	4.6
Maluku & Papua	1	0.1	0.4	1.0	4.6	2.9
Indonesia	***52***	***47***	***35***	***8.9***	***9.6***	***9.4***
Excluding Java	25	19	15	7.6	8.5	7.8

Source: CBS, 1999 – 2002.

Annex 2
Areas and average yields of fruit crops

TABLE A2.1
Banana

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	41	45	40	48.1	53.6	60.7
Sumatera	13	13	14	39.3	34.6	39.5
Bali & Nusa Tenggara	10	7	9	27.4	40.8	53.2
Kalimantan	3	3	4	35.3	37.9	47.4
Sulawesi	5	6	6	43.4	49.4	49.1
Maluku & Papua	0.2	0.3	1	43.6	23.6	38.3
Indonesia	***72***	***74***	***74***	***44.4***	***50.9***	***58.7***
Excluding Java	30	29	34	37.8	37.1	45.5

Source: MOA, 2003.

TABLE A2.2
Orange

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002*	1998	2000	2002
Java	3	5	4	29.4	26.3	34.3
Sumatera	10	16	17	20.0	17.9	20.0
Bali & Nusa Tenggara	4	4	3	17.2	17.8	24.3
Kalimantan	2	1	1	19.9	15.6	20.3
Sulawesi	4	11	7	16.3	11.9	21.9
Maluku & Papua	0.3	0.2	0.2	12.8	4.6	19.0
Indonesia	***24***	***37***	***32***	***20.7***	***17.4***	***20.2***
Excluding Java	21	32	28	17.2	13.6	21.1

*Data were recalculated
Source: MOA, 2003.

TABLE A2.3
Papaya

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	6	6	6	54.5	56.6	57.8
Sumatera	1	1	2	38.0	41.3	52.1
Bali & Nusa Tenggara	1	1	1	34.8	37.2	54.0
Kalimantan	0.4	0.4	0.4	30.7	33.0	49.6
Sulawesi	1	0.6	0.6	30.3	15.5	26.0
Maluku & Papua	<0.1	<0.1	0.1	20.3	15.5	26.0
Indonesia	***10***	***9***	***10***	***49.6***	***48.3***	***58.9***
Excluding Java	4	3	4	30.8	32.2	45.9

Source: MOA, 2003.

TABLE A2.4
Pineapple

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	3	2	4	75.8	74.4	73.8
Sumatera	2	5	4	61.6	52.7	69.9
Bali & Nusa Tenggara	0.1	0.2	1	35.9	50.8	64.6
Kalimantan	0.1	0.1	0.1	96.5	70.4	95.8
Sulawesi	<0.1	<0.1	<0.1	66.3	72.8	70.4
Maluku & Papua	<0.1	<0.1	<0.1	34.0	8.0	80.7
Indonesia	***5***	***7***	***9***	***67.3***	***62.7***	***75.1***
Excluding Java	2	5	5	58.9	50.9	76.3

Source: MOA, 2003.

TABLE A2.5
Mango

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	25	31	142	20.6	22.3	8.2
Sumatera	1	2	8.0	22.5	22.5	9.0
Bali & Nusa Tenggara	3	5	14.6	17.4	22.7	8.2
Kalimantan	0.1	0.3	1.6	26	23.6	7.5
Sulawesi	4	7	16.2	13.9	18	8.7
Maluku & Papua	<0.1	<0.1	0.1	17.2	11.6	6.8
Indonesia	***33***	***44***	***182.2***	***17.9***	***19.8***	***7.6***
Excluding Java	8	13	40.4	19.4	19.7	8.3

Source: Source: MOA, 2003.

TABLE A2.6
Rambutan

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	21	24	33	7.7	7.1	5.5
Sumatera	15	14	20	5.4	4.9	7.5
Bali & Nusa Tenggara	4	2	3	2.8	8.6	8.0
Kalimantan	3	6	8	6.5	5.3	7.1
Sulawesi	3	3	4	2.9	5.1	6.9
Maluku & Papua	0.3	<0.1	0.6	1.7	2.9	1.5
Indonesia	***46***	***48***	***69***	***4.5***	***5.7***	***6.1***
Excluding Java	25	24	36	3.9	5.4	6.2

Source: MOA, 2003.

TABLE A2.7
Durian

Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	10.2	8.6	10.4	8.4	10.5	10.7
Sumatera	10.5	8.9	19.6	8.5	9.4	12.8
Bali & Nusa Tenggara	0.6	0.4	0.5	6.3	10	8.5
Kalimantan	2.2	2.7	6.8	4.6	11.7	9.8
Sulawesi	1.8	1.8	3.6	7.2	11.6	12.7
Maluku & Papua	0.8	0.6	0.2	8.3	6.7	19.9
Indonesia	***26.1***	***23***	***41.1***	***8.0***	***10.3***	***12.8***
Excluding Java	15.9	14.4	30.7	7.0	9.9	12.7

Source: MOA, 2003.

TABLE A2.8
Avocado

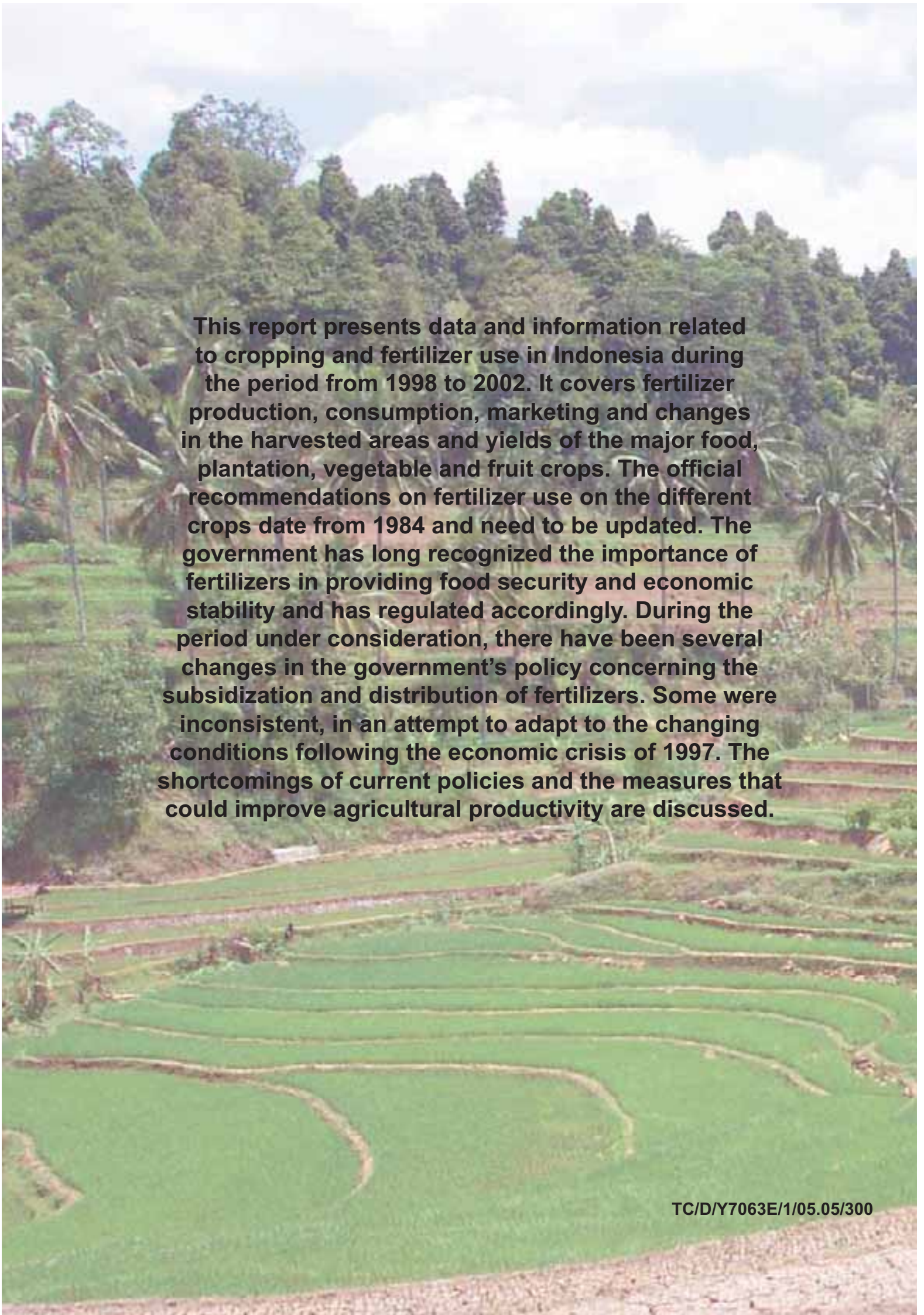
Island	Harvested area ('000 ha)			Average yield (tonnes/ha)		
	1998	2000	2002	1998	2000	2002
Java	8	8	11	8.4	10.0	10.1
Sumatera	1	1	3	10.3	10.1	10.4
Bali & Nusa Tenggara	1	2	3	8.6	7.7	8.6
Kalimantan	<0.1	<0.1	<0.1	5.5	3.7	8.3
Sulawesi	0.3	2	2	7.3	7.9	7.5
Maluku & Papua	<0.1	<0.1	<0.1	6.4	6.2	7.5
Indonesia	***10***	***13***	***18***	***10.7***	***11.0***	***12.8***
Excluding Java	2	5	7	7.6	7.1	8.5

Source: MOA, 2003.

TABLE A2.9
Salacia

Island	Production (tonnes)		
	1998	2000	2002
Java	171	222	472
Sumatera	128	128	222
Bali & Nusa Tenggara	44	60	49
Kalimantan	4	5	15
Sulawesi	7	9	11
Maluku & Papua	0.1	0.1	0.5
Indonesia	***353***	***424***	***768***
Excluding Java	182	202	296

Source: MOA, 2003.



This report presents data and information related to cropping and fertilizer use in Indonesia during the period from 1998 to 2002. It covers fertilizer production, consumption, marketing and changes in the harvested areas and yields of the major food, plantation, vegetable and fruit crops. The official recommendations on fertilizer use on the different crops date from 1984 and need to be updated. The government has long recognized the importance of fertilizers in providing food security and economic stability and has regulated accordingly. During the period under consideration, there have been several changes in the government's policy concerning the subsidization and distribution of fertilizers. Some were inconsistent, in an attempt to adapt to the changing conditions following the economic crisis of 1997. The shortcomings of current policies and the measures that could improve agricultural productivity are discussed.

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