

Chapter 4

Cassava in Asia and the Pacific

I.C. Onwueme

*Fulton Center for Sustainable Living, Wilson College, Chambersburg,
PA 17201, USA*

Origin and Distribution of Cassava in Asia

Cassava was introduced to most parts of Asia in the late 18th and early 19th centuries. Some of the locations for the early arrival of cassava were in India, Java and the Philippines. Most of these introductions were done by European explorers, who in turn had obtained cassava from South America. By the time cassava was introduced to various parts of Asia, it had already been a major commodity of trade between South America and Europe for over a century. After its introduction, cassava was initially used primarily as a food for local consumption. It was cultivated mainly on marginal lands, by poor farmers who often used it as an emergency crop. By the second half of the 19th century, domestic use of cassava was firmly established in various part of Asia. From domestic use, cassava progressed to become a cash crop for export, and by the first half of the 20th century, cassava products from Asia had already begun to compete on world markets with similar products from Latin America.

Today, cassava is grown to some extent in all the tropical and subtropical countries of Asia. However, the countries of major cassava production in Asia are Indonesia, Thailand, India, China, Philippines and Vietnam. In Indonesia, most of the production is in East Java and Lampung Province. In Thailand, the northeast

of the country and the central plain account for most of the cassava production. In China, production is mostly in the southeastern provinces of Guangdong and Guanxi, which account for over four-fifths of China's cassava production. In India, Kerala and Tamil Nadu states are the main cassava producers, with some additional production in the northeastern part of the country. In both the Philippines and Vietnam, production is concentrated in the central and southern parts of each country.

Generally speaking, the most fertile lands, which are usually the lowlands, are reserved for rice, so that cassava cultivation occurs on the less fertile hillsides. The most common soil types in the cassava areas are Ultisols (Howeler, 1988). This is true in Thailand, Indonesia, China and Philippines. Inceptisols, Entisols and Alfisols are also used in parts of Java and southeast Thailand. As implied above, the soils used for cassava are usually low in fertility, and there is a frequent need to apply fertilizers and organic manures. In most of the countries, the soils used for cassava have a high clay content, although in Thailand they are sandy loam in texture. Most of these soils are acidic, with pH ranging from 4.5 to 6.5, but their organic matter content is usually low.

With the intensification of production, low organic matter and undulating topography, it is not surprising that most of the Asian cassava soils have a high potential for erosion. This potential has indeed become a reality in

Thailand, especially because of the light sandy-loam texture of its cassava soils. Soil erosion is also a serious problem in cassava soils in Philippines, China, Java and Kerala.

The Asian cassava regions are nearly all tropical, with monsoon climates. Except for China and northeast India, temperatures are usually in the range of 26–27°C throughout the year. Rainfall is generally high (1500–3000 mm year⁻¹). However, the high-intensity cassava regions of Thailand, east Java and Tamil Nadu are much drier (900–2000 mm), a situation that gives cassava an ecological comparative advantage over other crops.

Agronomy and Utilization of Cassava in Asia

Cropping systems for cassava vary widely from one part of Asia to another. In commercialized production, sole cropping predominates, especially in Thailand, Malaysia and Sumatra. Where cassava is intercropped, the intercrop combinations usually include groundnut, rice, maize and vegetables. Cassava is also grown under plantations of coconut or rubber in parts of Kerala, Philippines, Thailand, Java and Malaysia. In such situations, yields are usually relatively low. Except for Tamil Nadu where cassava irrigation is practised, virtually all Asian cassava is grown under rain-fed conditions.

There is virtually no commercial trade in cassava planting materials in Asia. Cassava planting material is usually obtained from the farmers' own fields (or from neighbours' fields) at or before the previous harvest. Stems destined for planting are usually cut into long lengths, tied in bundles and stored in shady conditions. Just before planting, they are cut to the normal planting lengths of 15–20 cm.

Planting is done on the flat or on ridges, although mounds are sometimes used in India. Each stem cutting is usually placed vertically or slanted, with some of it sticking out of the soil. Horizontal placement, with the cutting entirely buried, is common in China, Malaysia and the Philippines. Plant spacing in the field is usually about 90 × 90 cm, but where intercropping is practised, the spacing between cassava plants is wider.

Because of its requirement for a long growing season, cassava in Asia is nearly always planted at the start of the major rainy season. The exact month that this corresponds to varies from place to place. In areas where rain occurs throughout the year as in Sri Lanka, Sumatra and parts of Malaysia, cassava planting occurs all year round.

Weed control is most commonly accomplished with hand-held hoes or bullock-drawn ploughs. Weeding twice or three times early in the season, is usually sufficient, since little or no weeding is needed once effective canopy closure has occurred. Weed control with herbicides is practised in Malaysia and parts of Thailand. Harvesting occurs 9–12 months after planting. The most common practice is hand-pulling, aided by hand tools.

In Indonesia, Philippines, Sri Lanka and Kerala (India), fresh cassava roots are utilized for direct human consumption. In Thailand and Indonesia, much of the production is processed into chips and pellets which are exported for animal feeding. Cassava processed into starch or starch-based products is important in most of the countries, especially Malaysia, Thailand, Indonesia, India (Tamil Nadu), China and Vietnam.

Area, Production and Yield

Table 4.1 shows that in 1999, about 3.3 million ha of cassava were harvested in Asia. Thus, Asia accounted for 20% of the area of cassava harvested in the world. This was more than the area harvested in South America where cassava originated. The area of cassava harvested in Asia declined by around 13%, over the 4 years from 1996 to 1999.

About 46 million t of cassava were produced in Asia in 1999. This was 27% of world production. This was less than the production from Africa (51%), but more than the production from South America (17%). Despite minor fluctuations, Asian cassava production has remained relatively steady from 1996 to 1999. Average cassava yields in Asia were approximately 14 t ha⁻¹ in 1999. This is higher than the average yields in Africa, South America or Oceania.

Within Asia, the largest areas devoted to cassava cultivation are in Indonesia and

Table 4.1. World production, area and yield of cassava from 1996–1999.

	1996	1997	1998	1999
Production				
World	165,324,042	164,303,125	164,004,441	168,054,531
Central America and Caribbean	1,040,749	999,869	1,017,149	931,876
Africa	84,568,300	84,405,250	85,959,190	92,119,233
Asia	48,837,430	47,547,650	46,445,280	46,057,280
Oceania	198,683	168,092	168,592	183,292
South America	30,678,879	31,182,262	27,414,220	28,763,123
Area (ha)				
World	16,753,288	16,283,307	16,244,075	16,579,480
Central America and Caribbean	202,109	194,521	197,600	196,729
Africa	10,290,280	10,097,360	10,331,450	10,823,616
Asia	3,757,735	3,477,549	3,482,549	3,276,649
Oceania	16,920	15,920	15,920	15,848
South America	2,486,247	2,497,953	2,216,553	2,266,638
Yield (t ha⁻¹)				
World	9.87	10.09	9.91	10.14
Central America and Caribbean	5.15	5.14	5.15	4.74
Africa	8.22	8.36	8.32	8.51
Asia	13.00	13.67	13.34	14.06
Oceania	11.74	10.56	10.59	11.57
South America	12.34	12.48	12.37	12.69

Source: FAO database (2000).

Thailand, with each country having about 1.2 million ha of cassava (Table 4.2). India, Philippines, Vietnam and China follow in that order, each harvesting about a quarter of a million ha of cassava in 1999.

Thailand produced 16.5 million t and Indonesia produced 15.5 million t of cassava in 1999. India, China, Philippines and Vietnam are the next highest producers in that order, although as a group, their production is far below those of Indonesia and Thailand.

Yield levels vary considerably within Asia, depending on the cropping systems used and the general production conditions. Among the major producers, India stands out as having the highest yield levels of about 24 t ha⁻¹. China, Thailand and Indonesia also have relatively high average yields of 15.9, 15.5 and 12.8 t ha⁻¹, respectively. Yields in Vietnam, Philippines and Sri Lanka are relatively low at 8–8.5 t ha⁻¹.

Cassava Trade in Asia

Table 4.3 shows that Asia is by far the world leader in the export of cassava products. The

main commodities exported are dried cassava (mainly in the form of chips and pellets for animal feeding), cassava starch and cassava tapioca. In 1998, the various countries of Asia exported about 4 million t of dried cassava, 0.5 million t of cassava starch and 58,000 t of cassava tapioca.

For dried cassava, Thailand is by far the greatest exporter, followed distantly by Indonesia and Vietnam (Table 4.4). Thailand again is the outstanding leader in cassava starch exportation, followed by China, Malaysia and Indonesia. The largest exporters of tapioca are Indonesia, Thailand, China and India in that order.

Most of Asia's cassava exports go to countries of the European Union. The tariff situation changed dramatically in the late 1990s, and has made cassava less competitive. This casts doubt on the long-term sustainability of this cassava trade. The various exporting countries are now exploring diverse strategies for tackling the problem.

While most cassava exports from Asian countries go to other continents (especially Europe), there are countries within Asia that

Table 4.2. Asian production, area and yield of cassava from 1996–1999.

	1996	1997	1998	1999
Production				
Asia	48,837,430	47,547,650	46,445,280	46,057,280
Cambodia	69,656	69,656	69,656	67,500
China	3,600,744	3,600,744	3,600,744	3,650,658
India	5,979,000	5,979,005	5,979,000	6,000,000
Indonesia	17,002,460	15,072,050	16,052,830	15,421,885
Laos	70,000	70,000	70,000	70,000
Malaysia	400,000	400,000	400,000	400,000
Myanmar	77,148	80,000	80,000	88,144
Philippines	1,910,780	1,958,050	2,000,000	1,786,710
Sri Lanka	271,000	250,000	250,000	257,153
Thailand	17,387,800	18,083,600	15,958,500	16,506,625
Vietnam	2,067,300	1,983,000	1,983,000	1,983,000
Area (ha)				
Asia	3,757,735	3,477,549	3,482,549	3,276,649
Cambodia	13,000	13,000	13,000	7,000
China	230,060	230,060	230,060	230,045
India	244,000	244,000	244,000	250,000
Indonesia	1,415,100	1,233,550	1,233,550	1,205,330
Laos	5,100	5,100	5,100	5,100
Malaysia	39,000	39,000	39,000	39,000
Myanmar	6,785	7,000	7,000	7,736
Philippines	231,855	235,000	240,000	210,000
Sri Lanka	32,000	32,000	32,000	30,064
Thailand	1,265,096	1,200,000	1,200,000	1,065,435
Vietnam	275,600	238,700	238,700	226,800
Yield (t ha⁻¹)				
Asia	13.00	13.67	13.34	14.06
Cambodia	5.36	5.36	5.36	9.64
China	15.65	15.65	15.65	15.87
India	24.50	24.50	24.50	24.00
Indonesia	12.01	12.22	13.01	12.79
Laos	13.72	13.72	13.72	13.76
Malaysia	10.26	10.26	10.26	10.26
Myanmar	11.37	11.43	11.43	11.39
Philippines	8.24	8.33	8.33	8.59
Sri Lanka	8.47	7.81	7.81	8.55
Thailand	13.74	15.07	13.30	15.49
Vietnam	7.50	8.31	8.31	7.97

Source: FAO database (2000).

import significant quantities of cassava products, mainly from other Asian countries. Korea (South), Turkey and China import substantial quantities of dried cassava, while China, Indonesia and Japan are notable importers of cassava starch. Importers of cassava tapioca within Asia include Philippines, Malaysia, Bangladesh and Singapore in that order.

Cassava Industry in the Asia-Pacific Region

Cassava in Thailand

Cassava was introduced into Thailand about 1850, and during its first century, became established as a food crop in the eastern

Table 4.3. World cassava exports by continents, from 1995–1998.

	1995	1996	1997	1998
Dried cassava (t)				
World	4,090,063	4,487,984	3,327,385	4,716,407
Central America and Caribbean	47,813	55,129	42,158	42,136
Africa	27,925	31,321	43,041	43,034
Asia	3,737,849	4,149,940	3,001,917	4,282,297
Oceania	945	945	965	511
South America	3,490	1,211	4,841	3,514
Cassava starch (t)				
World	525,195	539,298	454,355	510,450
Central America and Caribbean	16	4	30	67
Africa	4	47	41	80
Asia	501,736	512,952	439,802	495,193
Oceania	1	0	0	0
South America	19,552	15,738	13,259	13,391
Cassava tapioca (t)				
World	63,085	40,320	46,005	59,720
Central America and Caribbean	0	0	0	4
Africa	431	422	427	409
Asia	61,909	38,956	44,562	58,412
Oceania	0	0	0	0
South America	592	649	765	730

Source: FAO database (2000).

seaboard province (Titapiwatanakun, 1990). Since about 1956, the crop has spread to other parts of the country, especially the northeast which is now the major producing area. The dramatic increase in cassava hectareage in the northeast was achieved through partial replacement of *kenaf* fields, and by opening up new previously forested land. Today, most of Thailand's cassava production occurs in the northeast and in the central plains. Very little production takes place in the north and the south regions.

The topography in the cassava producing areas is generally undulating and the soils are mostly Ultisols of loamy sand or sandy loam texture, and pH 5–6.5. Some of these soils are erosion-prone, and most of them have been degraded due to erosion and long-term intensive cropping. Mean temperature in the cassava regions is about 27°C and the annual rainfall is 1100–1500 mm in the central plain and 900–1400 mm in the northeast. The rainy season commences in April.

In Thailand, most of the cassava is grown as a sole crop (Howeler, 1988). Occasionally, it is intercropped with maize, groundnut, rubber or coconuts. Normal spacing in sole cropped

cassava is about 1 × 1 m. Planting occurs from May to November, with most of the planting being done in May to June. Land preparation is with tractors or by bullocks. Planting is done on the flat or on ridges, with the cutting placed in a vertical position. Harvesting occurs January–March or in October and most is harvested before it is 1 year old. Very little harvesting is done in the rainy months from May to September. The problems of harvesting in the rainy months include the low starch content of the tubers at that time, low prices, reduced demand from buyers and increased difficulty of sun drying, which is the main method for producing the chips (Tongglum *et al.*, 1988). Chips for export must be below 14% moisture.

The first major industrial use of cassava was for processing into starch which started in the mid-1940s. The starch was used domestically as well as for export. However, in the 1960s, the processing of cassava into chips and pellets for animal feeding gained momentum, stimulated by the emerging market for these products in Europe. For the next two decades, the cassava industry witnessed a very rapid and successful expansion. By the 1980s, there were over 2500

Table 4.4. Quantities of cassava exported from various Asian countries from 1995–1998.

	1995	1996	1997	1998
Dried cassava (t)				
Asia	3,737,849	4,149,940	3,001,917	4,282,297
China	163	87	78	18
Indonesia	481,483	388,591	247,001	–
Malaysia	33	21	21	52
Philippines	267	587	328	221,404
Singapore	0	222	673	–
Sri Lanka	1,180	1,010	1,166	1,166
Thailand	3,224,191	3,728,747	2,722,114	3,981,000
Vietnam	30,500	30,500	30,500	78,000
Cassava starch (t)				
Asia	501,736	512,952	439,802	495,193
China	2,650	1,469	2,772	831
China, Hong Kong	15,197	26,943	32,116	27,482
India	1,954	65	65	65
Indonesia	30,870	17,924	7,338	82,803
Malaysia	202	14,292	14,292	18
Pakistan	0	0	102	22
Singapore	3,231	1,040	856	1,718
Thailand	447,625	451,126	328,246	382,246
Cassava tapioca (t)				
Asia	61,909	38,956	44,562	58,412
China	4,953	6,278	6,682	7,719
China, Hong Kong	4,901	1,185	1,717	1,645
India	28,238	5,311	5,311	5,311
Indonesia	1,510	9,810	18,863	31,617
Malaysia	1,448	1,930	1,100	1,215
Philippines	7,721	30	18	43
Singapore	823	927	689	670
Thailand	12,313	13,448	10,181	10,181

Source: FAO database (2000).

chip factories, 600 pellet factories and 125 cassava starch factories in Thailand.

About 50% of the country's cassava now goes to starch production. Of the total starch production, nearly half is exported to Taiwan and Japan. Domestic cassava consumption in Thailand is negligible, and over 90% of cassava production is destined for export.

For over two decades, the cassava industry was sustained by favourable price and quota policies of the European Community (EC). Starting in the 1980s, EC policy changes started to work towards reducing the imports of cassava pellets from Thailand. In 1993, EC grain prices fell, thereby putting further competitive pressure on cassava. In response to the increasingly unfavourable European market for cassava, the Thai authorities have developed a policy aimed

at: (i) reducing the total land area devoted to cassava; (ii) diversifying cassava products and markets; and (iii) reducing the cost of cassava production through improved varieties and agronomic packages (Henry *et al.*, 1994).

Active cassava research in Thailand is conducted at the Rayong Field Crops Research Center of the Department of Agriculture, and at the Sriracha Research Station of Kasetsart University. The Centro Internacional de Agricultura Tropical (CIAT, with headquarters in Cali, Colombia) is collaborating in much of the research, and has been instrumental in the dissemination of improved cassava cultivars and technological packages, not only in Thailand, but in neighbouring countries also. The cassava industry in Thailand, and indeed in all of South-East Asia, has benefited tremendously from the

research and extension activities of CIAT. The Rayong series of cultivars which they have released have contributed to the boosting of yields among commercial producers. Most of these cultivars are high glucoside types.

Cassava in Indonesia

Cassava is the fourth most important food crop in Indonesia after rice, maize and soybeans. In 1999, Indonesia produced approximately 15.4 million t of cassava, harvested from 1.2 million ha. These figures are similar to those for Thailand. However, a larger percentage of Indonesia's cassava production is used domestically for human consumption. Indeed, about 70% of Indonesia cassava production is used for human food, in both the fresh form and in a dried chip form called *gaplek* (Wargiono *et al.*, 1995). Consequently, a smaller percentage is exported.

Within Indonesia, the most important cassava-producing areas are Java, south Sumatra and Kalimantan. Unlike in Thailand, the soils are mostly clay textured and the rainfall is relatively heavy (1500–3000 mm year⁻¹). The rainy season commences in September/October. Planting occurs all year round, but with October–November being favoured. Similarly, harvesting occurs all year round, but over 60% of the crop is harvested during June–October. Land preparation is done with hand tools, bullocks or occasionally with tractors. Planting is done on the flat or on levies. The cuttings are placed vertically. Intercropping with maize, groundnut, rice or soybean is the most common practice, but in the larger plantations, sole cropping is practised.

Indonesia exported about 247,000 t of dried cassava and 7300 t of cassava starch in 1997. Although Indonesia still ranks second in the world in terms of cassava exports, these quantities are much lower than those of Thailand, and the general trend from 1993 to 1997 has been a decline in the cassava export trade.

The Indonesian government has instituted a policy of food diversification and increasing the productivity of the uplands (Poespodarsono and Widodo, 1995). This policy has favoured the intensification of cassava cultivation. Much cassava and extension work in Indonesia is carried out by the Bogor and Malang Research Institutes

for Food Crops and by Brawijaya University in Malang. CIAT has also collaborated in some of the research, and has been instrumental in the release of some promising cultivars.

Cassava in India

India is the third largest producer of cassava in Asia. In 1999, about 6 million t were produced from 250,000 ha. India has also consistently recorded the highest yields per hectare (24.5 t ha⁻¹) for cassava among the Asian countries.

Cassava production in India is concentrated in the states of Kerala and Tamil Nadu, with some production in the northeast of the country. In Kerala, rainfall is sufficient (1800–2000 mm year⁻¹), but in Tamil Nadu it is 900 mm year⁻¹, and supplemental irrigation is practised. In Tamil Nadu, the rain-fed crop is planted in October/November, while the irrigated crop is planted in January–April. In Kerala, planting is done in April/May or in September/October. In Kerala, planting is done on raised mounds or levies, but in Tamil Nadu, flats or ridges are used. Vertical placement of the cutting is the most common practice. Sole cropping of cassava is common, as well as intercropping with groundnut, vegetables or coconuts. Harvesting occurs 10–11 months after planting.

Most of the cassava produced in India is used for human consumption. In Kerala, for example, about 70% of the cassava goes for human consumption (Padmaja *et al.*, 1992).

Cassava research in India is done mostly by the Central Tuber Crops Research Institute in Trivandrum, as well as in various State Agricultural Universities. There is a Cassava Technology Transfer Program (CTTP) with emphasis on both production and processing technologies.

Cassava in China

In Asia, China ranks fourth after Thailand, Indonesia and India in cassava production. In 1999, about 230,000 ha were harvested, producing 3.6 million t (Table 4.2). Cassava production in China is concentrated in the tropical/subtropical extreme southeast corner of the country, south of the Yangze river. This is in the provinces of Guangxi, Guangdong and Hainan Island. The

Chinese cassava zone is cooler (mean temperature 20–24°C) than any of the other cassava-producing regions in Asia, and occasional frosts occur. In Guangxi, the slopes are steep and terraces are used. Soils in China, used for cassava production are clay Oxisols, or Alfisols with low fertility, and pH 4.5–6.5. Annual rainfall is 1800–2500 mm in Hainan Island, but slightly less (1200–1800 mm) in Guangxi. The rainy season starts in March, and planting occurs in March/April. The crop is grown on the flat or on ridges. It is usually intercropped with groundnut or rubber. The stem cuttings are usually planted horizontally. Harvesting is carried out in December/January.

In China, cassava is used mostly for animal feeding (as chips) and for industrial purposes such as the manufacture of starch, fructose and monosodium glutamate. Cassava research in China is conducted by the Guangxi Subtropical Crops Research Institute, the South China Academy of Tropical Crops, and the Upland Crops Research Institute, in collaboration with CIAT (Yinong *et al.*, 1995). Research emphasis is on soil fertility maintenance, erosion control, planting methods, planting time and harvesting time. A Cassava Cooperation Network has recently been established.

Cassava in the Philippines

In the Philippines, cassava ranks third among the food crops after rice and maize. The country produces 1.8–2.0 million t year⁻¹ of cassava on a harvested area of 210,000–240,000 ha. Production and area under cassava declined between 1998 and 1999 but average yield increased (Table 4.2). Average yields are only about 8.4 t ha⁻¹, one of the lowest in Asia. Most of the production is in the southern (Mindanao) and central (Visayas) parts of the country. The soils are clay Ultisols with pH 5–7. Rainfall is heavy (2000–3000 mm year⁻¹).

Land is often prepared using bullocks, and planting is done on the flat or on ridges. Sole cropping is most common, although cropping in coconut plantations is also done. Planting takes place in June or November, and harvesting occurs in January/February or in July/August. The stem cuttings are usually planted horizontally.

Of the total cassava production in the Philippines, about a third is used for human food, another third for animal feed and a third for industrial purposes (Den *et al.*, 1992). The animal feed is mainly in the form of dried chips, some of which is exported. Industrial products made from cassava include starch and glucose.

Active cassava research and promotion work is carried out by the Philippines Root Crops Research and Training Center in Baybay, and at the University of the Philippines, with collaboration from CIAT. Extension work on cassava is part of the Integrated Root Crop Extension Program.

Cassava in Vietnam

Vietnam produces about 2 million t year⁻¹ of cassava each year, harvested from an area of about 230,000 ha. Yields are low, averaging about 8 t ha⁻¹, but with the recent introduction of improved cultivars, these yields are expected to improve. Cassava production occurs in all parts of the country, but with a greater concentration in the northern, mountainous region and the central parts of the country.

Vietnam's cassava soils are mostly Ultisols of pH 5–6 (Bien and Kim, 1992). The soils are low in fertility and the terrain is undulating. The richer soils are reserved for rice cultivation. Rainfall is 1500–2500 mm year⁻¹. Planting occurs in February–May, and harvesting takes place 10–12 months later. In most areas, the stems are planted vertically, but in the sandier soils, horizontal planting is practised. Field spacing is about 1 × 1 m. Because of the high price of fertilizer compared with the low market return for cassava, most producers find it uneconomical to apply fertilizers. Cassava is usually grown as a sole crop, but occasionally it is intercropped with groundnut, mungbean, maize or winged bean.

For decades, cassava was a crop of last resort in Vietnam. Recently it has become increasingly used as a raw material for industry. Starch processing occurs in rural households as well as in large factories. While most of the starch is used for domestic food processing, some of it is used in the textiles and paper industries. In general, 30–40% of Vietnam's cassava is used for industrial purposes, 30% for animal feed and 10–20% for human consumption (Ngoan *et al.*, 1995).

Cassava research in Vietnam has been supported by the Vietnam Root and Tuber Crops Research Program which was initiated in 1989. This program has been working in collaboration with CIAT. Some cassava research is done at the Hung Loc Agricultural Research Center.

Cassava in Malaysia

Malaysia harvests about 400,000 t year⁻¹ of cassava from an area of about 39,000 ha. In Peninsula Malaysia, production is concentrated in the state of Perak, with Ultisol soils. There is also potential for cassava production in the peat soils (Histosols) of Malaysia.

Rainfall is heavy, averaging 2000–3000 mm year⁻¹. The rainy season commences in October, but planting and harvesting occur all year round. Planting is done on tractor-made ridges. The stem cuttings are usually laid horizontally and entirely buried, at a spacing of 1 × 1 m, but vertical planting is done on the peat soils. Sole cropping is the common practice, but cassava is sometimes intercropped with groundnut or maize.

Most of the cassava is for starch production, while a small quantity is processed into chips for animal feed. The use of cassava for direct human consumption is negligible. Malaysia also imports some cassava starch and dried cassava from Thailand. Cassava research is done at the Malaysian Agricultural Research and Development Institute (MARDI), but a relatively low priority is given to the crop.

Cassava in Sri Lanka

Cassava was first introduced to Sri Lanka from Mauritius in 1796. Peak production of 0.85 million t was achieved in 1974. Since then, production has declined steadily (Bandara and Sikurajapathy, 1992). In 1999, Sri Lanka harvested 257,000 t of cassava on an area of 30,000 ha. Average yields are 7.8–8.6 t ha⁻¹, one of the lowest in Asia.

Production occurs in all parts of the country, but it is more concentrated in the south-western part. The land is generally sloping, and the soils are Ultisols with low fertility and pH 5–6. Rainfall is heavy and monsoonal, averaging

2000–3000 mm year⁻¹. Planting and harvesting occur year round. Planting is done on mounds prepared with hand tools, and the cuttings are planted vertically or slanted.

Virtually all the Sri Lanka cassava production is used for human consumption, with a small quantity being used as feed. Some cassava research is done at the Central Agricultural Research Institute (CARI) in Peradeniya.

Cassava in Oceania

Cassava is not a particularly important crop in Oceania. Even though the Pacific Islands constitute one of the most intensive users of root crops in the world, other root crops such as sweet potato, taro, tannia and yam usually come ahead of cassava in terms of culinary preference or cultural attachment. However, cassava remains an important dietary staple and is often produced in greater quantities than the preferred root crops.

In 1999, all of Oceania harvested only 16,000 ha of cassava, producing 183,000 t (see Table 4.5). The average yield was 11.6 t ha⁻¹. The total cassava production from Oceania is only about 1% of the production of Indonesia alone or Thailand alone.

Within Oceania, the largest areas devoted to cassava are in Papua New Guinea (10,000 ha), Fiji (2610 ha) and Tonga (2100 ha). The largest annual production of cassava is from Papua New Guinea (75,000 t) and Fiji (50,336 t).

Papua New Guinea

Cassava production in Papua New Guinea is an extremely casual affair. Even though cassava is usually the cheapest root crop in markets (on a fresh or dry weight basis), its popularity lags far behind that of sweet potato, yam, taro or even sago. There are no large scale plantations or processing plants, and what is produced is offered in local markets as fresh tuberous roots for human consumption. With virtually all the grain for animal feeding being imported, there is potential for expansion of the cassava industry in the country. Cassava research and extension is carried out by the Department of Agriculture and Livestock, and at the University of Technology in Lae.

Table 4.5. Oceania production, area and yield of cassava from 1996–1999.

	1996	1997	1998	1999
Production (t)				
Oceania	198,683	168,092	168,592	183,292
Cook Islands	3,000	2,500	3,000	3,000
Fiji	40,427	50,336	50,336	27,136
French Polynesia	5,500	5,500	5,500	5,500
Micronesia	11,800	11,800	11,800	11,800
New Caledonia	2,800	2,800	2,800	2,800
Papua New Guinea	115,000	75,000	75,000	112,000
Samoa	400	400	400	400
Solomon Islands	1,100	1,100	1,100	2,000
Tonga	28,000	28,000	28,000	28,000
Wallis and Futuna Islands	2,400	2,400	2,400	2,400
Area (ha)				
Oceania	16,920	15,920	15,920	15,848
Cook Islands	170	170	170	170
Fiji	1,856	2,610	2,610	1,938
French Polynesia	300	300	300	300
Micronesia	1,100	1,100	1,100	1,100
New Caledonia	400	400	400	400
Papua New Guinea	11,000	10,000	10,000	10,500
Samoa	30	30	30	30
Solomon Islands	70	70	70	70
Tonga	2,100	2,100	2,100	2,100
Wallis and Futuna Islands	230	230	230	230
Yield (t ha⁻¹)				
Oceania	11.74	10.56	10.59	11.57
Cook Islands	17.65	14.71	17.65	17.65
Fiji	15.49	19.29	19.29	13.68
French Polynesia	18.33	18.33	18.33	18.33
Micronesia	10.73	10.73	10.73	10.73
New Caledonia	7.00	7.00	7.00	7.00
Papua New Guinea	10.45	7.50	7.50	10.67
Samoa	13.33	13.33	13.33	13.33
Solomon Islands	15.71	15.71	15.71	16.00
Tonga	13.33	13.33	13.33	13.33
Wallis and Futuna Islands	10.43	10.43	10.43	10.43

Source: FAO database (2000).

Fiji

In Fiji, cassava is the predominant root crop in terms of quantity produced and consumed, although not in terms of culinary preference. It is grown mostly as the last crop in the ginger–taro–cassava–fallow rotation, usually on sloping hillsides.

In 1994, cassava accounted for about half of the total root crop production in Fiji, with taro being a distant second with about a quarter of the total (Onwueme, 1996). In the same year, 166 t of cassava was exported to Australia and New

Zealand, mostly as frozen tubers. This represented less than 1% of the total production. The rest (99%) was used domestically for human consumption, mostly marketed in the form of fresh tubers. There is virtually no cassava processing into dried forms for human or animal use. However, given the vigorous domestic livestock industry which imports large quantities of feed, there is potential for cassava to be used for animal feed. Cassava research and extension work are carried out at the Koronivia Research Station, and at various stations of the Ministry of Agriculture, Fisheries and Forests.

Tonga

In Tonga, cassava is produced in greater quantity than all the other root crops combined. It is usually grown as the last crop in the rotation before the land is allowed to revert to fallow. Many farmers grow cassava between coconut stands, but sole cropping is practised by the more commercially oriented producers. There is a small export trade in frozen cassava (1508 t in 1993), but the overwhelming proportion of the cassava produced is traded locally as fresh tubers for human consumption. There is virtually no processing of cassava into dried products. Its greater quantity notwithstanding, culinary and social preference for cassava in Tonga is very low. In this respect, it falls far behind yam, taro and, of course, kava. Cassava research and extension work is carried out at the Vaini Research Station.

Australia

There is some latent interest in cassava in the northern tropical parts of Australia, but the economics of production have not permitted this interest to be realized. However, cassava continues to attract research interest at the University of Queensland and a few other institutions in the country.

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