CASSAVA PRODUCTION AND UTILIZATION IN CAMBODIA

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ABSTRACT

This paper reviews Cambodian cassava production from 1980 to 2001. Cassava is mainly grown in Kampong Cham province, while some cassava is also grown in areas bordering the Mekong river. The harvested area, yield and production in each year varied according to market conditions: in 1999, the harvested area, yield and production were 14,000 ha, 16.3 t/ha and 228,512 tonnes fresh cassava roots, but in 2001 these were only 13,600 ha, 10.5 t/ha and 142,262 tonnes cassava roots, respectively.

Most cassava is used for human food, while little is used for animal feed or for industrial purposes. Some farmers like to produce starch to make bread etc. in their small processing units, or they make dry chips for sale.

Farmers in Cambodia are planting only two important local varieties, namely Damlong Me (bitter) and Damlong Chheu (sweet). There are very few areas planted to new varieties and farmers do little land preparation, weeding, fertilization etc. Mong Reththy Plantation introduced Rayong 60 and Kasetsart 50 varieties from Thailand, and they also cultivate by tractor, but the yields are still low because of lack of proper management.

There are only three important cassava factories. The designed capacity of Mong Reththy Tapioca Flour Factory and T.T.Y. Tapioca Flour Factory are 50 tonnes starch per day, and the capacity of Lay Alcohol Factory is about 10 million liters of cassava alcohol per year. Because of low prices, difficulties in transportation, the existence of few organizations, such as extension services, that can give technical support for cassava production, the factories have a serious lack of cassava raw material.

If in Cambodia the role of cassava can change from a traditional fresh human food to an efficient crop for animal feed and starch production, cassava could become an important source of cash income for poor farmers. It is hoped that cassava can receive more support from the government and other organizations and companies, who should work together to create good market conditions and to improve cassava research and extension in Cambodia.

INTRODUCTION

Cambodia occupies 181,035 km^2, and is located between 102-108°E and 10-15°N. The population of Cambodia is 13.4 million. Cambodia has a tropical climate with two distinct monsoon seasons; the rainy season starts in mid-April and continues to October. Average annual rainfall is 1250-1750 mm. Sihanouk Ville has the highest average annual rainfall of 2996 mm. The mean temperature is about 23-32°C.

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Agriculture is the fundamental sector of the Cambodian economy. Small farmers dominate the agricultural sector of the country. Most farmers are still poor and face many constraints, both in their production activities and in marketing.

Normally, when farmers plant cassava, they use about 100 m-days/ha, equivalent to about 50 US$/ha. Some farmers can get 300-400 US$/ha income from fresh roots in Kandal province, and some farmers can get 500-600 US$/ha income from dry chips in Kampong Cham province. So, cassava is an important economic crop for some poor farmers in Cambodia.

Most cassava is used for human food, while little is used for animal feed or for industrial purposes in Cambodia. Farmers like to plant sweet cassava for earning money at the local market; the leaves can be used to feed sheep and cattle. Some fresh roots and dry chips may be sold to factories and small processing units, for production of starch and some favorite tapioca foods.

AGRICULTURE

1. Agricultural Production in Cambodia

Rice dominates crop production in Cambodia (**Table 1**). Nearly 90% of the cultivated area is planted to rice, 3% is planted on maize, and nearly 1% is planted to cassava.

Table 1. Agricultural production in Cambodia in 2001.

	Harvested area (ha)	Yield (t/ha)	Production (t)
Rice	1,980,295	2.07	4,099,016
Maize	67,213	2.76	185,589
Soybean	28,687	0.86	24,658
Mungbean	27,108	0.63	17,153
Sesame	17,444	0.51	8,957
Cassava	**13,590**	**10.47**	**142,262**
Peanut	11,271	0.29	8,913
Sweet potato	7,055	3.72	26,252
Sugarcane	7,727	21.91	169,302
Tobacco	8,540	0.55	4,662
Vegetables	34,569	5.34	184,640

Source: *MAFF, 2001*

2. Cassava Production in Cambodia and Other Asian Countries

Cassava production in Cambodian is characterized by low production, low yield and low harvested areas as compared to other countries in Asia (**Table 2**); it only produces about 0.3% of cassava in Asia.

Table 2. Cassava harvested area, yield and production in Cambodia and other countries in Asia in 2001.

	Harvested area ('000 ha)	Yield (t/ha)	Production ('000 tonnes)
World	***16,466***	***10.67***	***175,617***
Asia	**3,536**	**13.66**	**48,309**
-Cambodia	15	9.61	148
-China	235	15.96	3,751
-India	250	23.20	5,800
-Indonesia	1,360	11.62	15,800
-Laos	5	13.65	71
-Malaysia	38	9.74	370
-Myanmar	8	11.39	88
-Phllippines	210	8.09	1,700
-Sri lanka	29	8.82	260
-Thailand	1,150	15.90	18,283
-Vietnam	235	8.67	2,036

***Source**: FAO, 2001*

3. Cassava Production in Cambodia

The Cambodian cassava harvested area, yield and production in each year varied according to market conditions (**Table 3**). The harvested area, yield and production were higher in years of favorable market conditions in 1980, 1981, 1988, 1992 and 1999. The harvested area, yield and production were 14,000 ha, 16.3 t/ha and 228,512 tonnes fresh cassava roots, respectively, in 1999. But when the market was not so good production was markedly reduced, such as in 2001 when the harvested area was only 13,600 ha, the yield was 10.5 t/ha and production was 142,262 tonnes.

a. Distribution of cassava production

Cambodian cassava is mainly grown in the central and southeastern parts of the country, especially in Kampong Cham and Kampong Thom provinces, while some is also grown along the Mekong river (**Figure 1**).

b. Cassava varieties

There are two main local varieties in Cambodia, one is sweet, the other is bitter. Mong Reththy Tapioca (MRT) plantation, located in Sihanouk ville, in southwest Cambodia, introduced Rayong 60 and Kasetsart 50 in 2000. In areas near the border, the farmers introduced some Vietnamese varieties (bitter) in Kampong Cham province, and a Thai company introduced some Thai varieties (bitter) in Battambang province. Because of a lack of extension, and farmers in many provinces having difficulty finding cassava markets for animal feed and industrial raw material, they generally don't like planting the new bitter varieties; they just want to sell in the local market sweet roots for fresh human consumption. The new varieties are not widely grown yet.

Table 3. Cassava area, yield and production in Cambodia from 1980 to 2001.

Year	Harvested area (ha)	Yield (t/ha)	Production (t)
1980	19,000	8.00	152,000
1981	25,000	7.28	182,000
1982	12,000	6.33	76,000
1983	11,000	3.82	42,000
1984	5,000	6.20	31,000
1985	8,000	2.13	17,000
1986	12,000	5.17	62,000
1987	10,000	4.60	46,000
1988	27,000	9.85	266,000
1989	10,000	6.30	63,000
1990	11,000	5.45	60,000
1991	11,000	5.09	56,000
1992	16,000	9.38	150,000
1993	9,800	5.23	51,292
1994	10,000	6.50	65,000
1995	12,410	6.60	81,950
1996	13,000	5.36	69,656
1997	10,056	7.68	77,266
1998	8,208	8.11	66,534
1999	14,003	16.32	228,512
2000	15,380	9.61	147,763
2001	13,590	10.47	142,262

Source: *MAFF, 2001.*

c. Cassava cultivation practices

The main adopted cultural practices for cassava in Cambodia are shown in **Table 4**. In the flood plain cassava is harvested just 6-8 months after planting; normally, when the flood waters recede, farmers stick the cassava stakes into the soft soil around November, and harvest before flooding occurs again in June. In the uplands, cassava is planted in the wet season and harvested after 9-12 months according to market requirements.

In Kampong Cham province farmers can earn money from selling cassava for processing, so most farmers like to apply intensive cultivation, resulting in the highest average yield and production in Cambodia. Kampong Cham farmers rotate with soybean for improving soil fertility after 2-3 years of planting cassava, and they also intercrop some cassava in young rubber plantations. But in most provinces, cassava is mainly for human consumption providing little income, so cassava cultivation practices are limited to minimum land preparation, weeding and fertilization.

MRT and T.T.Y. plantations plant cassava for their own tapioca factory. They did not apply fertilizers because the land is new, but MRT plantation harvested very low yields after three years planting in 2002. It means that cassava fertilization is also necessary in Cambodia. Because the MRT plantation is located in an area of heavy rainfall, it is difficult to use tractors for plowing and cultivation. For example, it is difficult to harvest by tractor

because of heavy rain; also, some roots rot in the poorly drained lowland; and some plants are washed out by severe erosion in the uplands. So, in the future the company has to try to build a new cassava production base far from the factory.

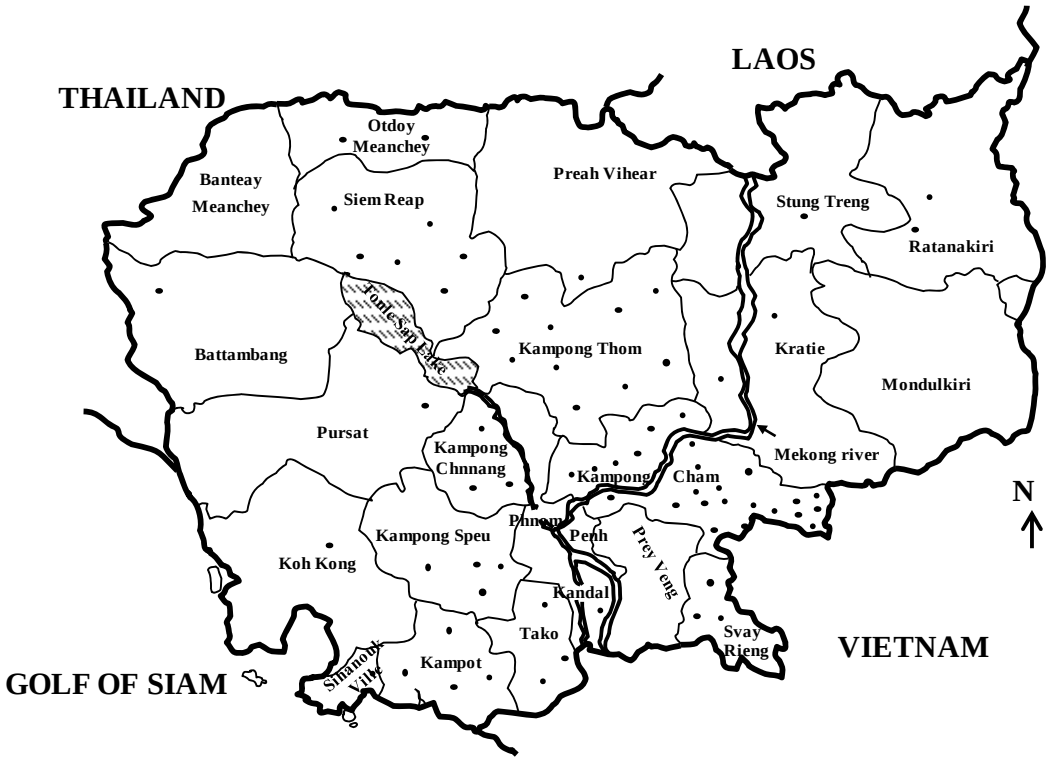

Figure 1. Distribution of cassava growing areas in Cambodia in 2001. Each dot represents 200 ha.

Table 4. The main cultural practices adopted for cassava in Cambodia in 2001, and by M.R.T. and T.T.Y. plantations in 2002.

	Farmers fields	Farmers fields	MRT plantation	TTY plantation
Cultivated soil	upland	flood plain	upland	upland
Main variety	local varieties	local varieties	Rayong 60 and Kasetsart 50	local varieties
Harvested area (ha)	12,457	1,782	1,800	2,500
Planting time	Mar-July	Nov-Dec	Apr-July	May-June
Land preparation	plow by oxen and tractor	plow by oxen	plow and ridge by tractor	plow by tractor
Planting distance (m)	0.5-1.0 x 0.5-1.0	0.5-1.0 x 0.5-1.0	1.2 x 1.2	1.2x1.5
Planting method	mainly inclined	mainly inclined	inclined	inclined
Weeding	hoe and shovel 1-2x	hoe and shovel 1-2x	hoe or knife 1-2x	hoe 2x
Harvesting time	Nov-July	June-Aug	Nov-July	Nov-Feb
Yield (t/ha)	average 10.07	average 13.75	12-20	20-25

Note: The MRT harvested area is not included in MAFF Statistics.

d. Characteristics of major cassava production provinces

Table 5 shows the cassava production and soil characteristics in six major producing provinces. Cassava plants had symptoms of aluminium toxicity in Sway Rieng and Prey Veng provinces.

Table 5. Characteristics of six major cassava producting provinces in Cambodia in 2001.

Parameters	Kampong Cham	Kampong Thom	Kampong Speu	Siem Reap	Kampong Chnnang	Kampot
Harvested area (ha)	4,740	1,880	870	865	613	770
Yield (t/ha)	14.15	10.46	8.00	11.84	7.23	5.18
Production (t)	67,051	19,660	6,960	10,243	4,435	3,990
Rainfall (mm)	1,310	1,631	1,623	1,557	1,184	2,295
Main crops	cassava, fruit, rubber	cassava fruit, rice	cassava, tea, fruit	cassava, rice	cassava, vegetables	cassava, vegetables
Soil	Regur and red soil	Grey-hydromorphic	Podzol	Old-alluvial	Sandstone	Coastal complex
Clay (%)	74	49	20	43	30	20
Sand (%)	11	27	69	21	42	50
Silt (%)	15	24	11	36	28	30
pH	4.0-5.0	5.6	5.4 - 5.7	5.2 - 5.9	5.1	5.3 - 5.7
OM (%)	1.72	0.78 - 1.2	2.00	1.60	0.68	0.93 - 1.30
P (ppm)	5.0	45.0	12.0	38.0	5.0	15.0
K (me/100g)	0.15	0.28	0.06	0.09	0.13	0.22
Ca (me/100g)	0.96	0.27	0.08	0.15	0.25	0.89
Mg (me/100g)	1.68	0.08	0.03	0.05	0.07	0.61

Source: *Soil analysis from Kang Ann in RUA, others from Statistics Office, MAFF in Cambodia.*

e. Cassava pests and diseases

Some pests and diseases can be found in Cambodia. For example, whiteflies, mealybugs, bacterial stem rot, bacterial angular leaf spot, brown leaf spot, blight leaf spot and white leaf spot. But cassava production is not seriously affected. Particularly, there is very light damage along the Mekong River because of the short growing period.

INDUSTRY

Cambodian cassava is little used for animal feed or for industrial raw material. Most farmers just plant sweet cassava on small fields nearby the house for fresh human consumption; and some farmers like to produce various tapioca products, such as bread, cake, dessert, tapioca pearl etc in small processing units in Kampong Cham province. Some farmers also produce dry chips, as it earns more money in the local market or for export to Vietnam and Thailand.

According to information from the Cambodian Investment Board and the Ministry of Industry, the Cambodian government has approved a number of cassava plantations and

tapioca factories from 1994 through 2001, but most companies have now disappeared, due to difficulties in planting and processing cassava in Cambodia.

Presently, there are three rather big factories processing cassava, but all factories are operating below capacity; this is generally due to high costs and low production, so the factories find it difficult to make profits (**Table 6**). The main problems of factories are:

Table 6. The main cassava factories in Cambodia in 2001.

	MRT Tapioca Factory	T.T.Y. Tapioca Factory	Lay Wine Factory	Cassava starch and food processing units
Location	Sihanouk Ville	Kampong Cham	Phnom Penh	Kampong Cham
Start operation	2000	2001	2001	Some time ago
Equipment and technology	Thai equipment	Thai equipment and technology	France yeast and technology	Manual or partially mechanized
Material (t/day)	250 t fresh roots	250 t fresh roots	55 t dry chips	Fresh roots
Price of materials	20 US$/t fresh cassava roots	22-25 US$/t fresh cassava roots	60-65 US$/t dry chips	22-25 US$/t fresh cassava roots
Starch content	24-25% in fresh roots	25-28% in fresh roots	64% in dry chips	25-28% in fresh roots
Production capacity	50 t starch per day	50 t starch per day	27,400 liters cassava alcohol (95^{o}) per day	
Actual production in 2001	500 t starch	2000 t starch	1.6 million liters cassava alcohol	Tapioca pearls, noodles, cake, dessert etc.
Price of product	150-160 US$/t starch	150-160 US$/t starch	0.3 US$/liter cassava alcohol	
Marketing	Local market and export	Local market and export	Local market	Local market

1) **Mong Reththy Tapioca Flour Factory:** Because of the low cassava price and difficulties in transportation, the local farmers do not like to plant cassava. So 90-95% of the raw material has to come from their own plantation. The factory usually operates only 2-3 days per month; the actual production has been only 500 t starch per year in 2000 and 2001. The factory also lacked good management and technology, with too high costs in salaries and fuel. This has resulted in low efficiency and low income. Another big problem is that the company will have to build a new cassava production base far from the factory in the future, which will increase transport costs. Because MRT plantation had low cassava yields in 2002, it is in serious difficulty with respect to raw materials and processing.
2) **T.T.Y Tapioca Flour Factory:** All fresh roots were bought from farmers, and the actual production was 2000 t starch in 2001. The company plans to get 50% of the raw material from their own plantation and the rest from farmers in the future. Because the factory and their most important cassava production area are located

near the Vietnam border, the biggest problem is the highly competitive purchase price in Vietnam.

3) **Lay Cassava Alcohol Factory:** This company mainly buys cassava dry chips from traders in Kampong Cham province. Because this is about 200 km from the Lay factory, the factory gate, price includes 30% transportation cost. The factory was actually operating at 16% capacity in 2001. It also encountered strong competition from Vietnam in terms of purchase price near the border. It mainly sold the cassava alcohol mixed with rice wine in the local market. The main competition is sugar molasses alcohol which is imported from Vietnam. The main difficulties are raw material supply and marketing.

RESEARCH AND TEACHING

Little attention is paid to cassava production in Cambodia. The Ministry of Agriculture, Forestry and Fisheries has not yet drawn up a cassava research program and extension plan. MRT company and T.T.Y company also paid little attention to planting cassava, and the Lay factory just bought dry chips. Most research and teaching involves collaboration with international agencies and donors, and most research is supported by those agencies.

The main cassava research institute is the University of Tropical Agriculture (UTA), which has conducted research mainly on utilization of cassava leaves. Other agricultural units are mainly involved in teaching and practice about cassava (**Table 7**).

Table 7. The main cassava research and teaching institutions in Cambodia.

University of Tropical Agriculture	Mainly research on utilization of cassava leaves: 1)cassava leaf silage and fresh leaves for animal feed 2)intercrop *Gliricidia* sp, *Desmanthus* and water spinach with cassava, all kinds of leaves for animal feed. It has harvested on average 15-17 t/ha fresh cassava leaves at 2 months intervals
Royal University of Agriculture	Mainly teaching and student practices on cassava: 1)cassava agronomy 2)cassava leaf silage and fresh leaves for animal feed 3)cooked cassava roots and leaves for animals
National School of Agriculture Prek Leap	Mainly teaching and student practices of cassava planting and leaf silage for animal feed
National School of Agriculture Kampong Cham	Mainly teaching and student practices on cassava
Cambodian Center for Study and Development in Agriculture	Planting cassava in farming systems project; cassava roots and leaves for human food and animal feed

CONSTRAINTS FOR CASSAVA PRODUCTION

All interviewed people agree that the biggest problem is marketing due to many difficult conditions in Cambodia. Farmers think that cassava production has high costs and low prices, difficulties in transportation and selling. But the factories think cassava raw material has a high price. They also have difficulties in transportation and purchase. The factories have a serious lack of cassava raw material.

There are still many constraints for cassava production in Cambodia. For example: lack of support and organization from the government and factories; lack of research and extension services; lack of new varieties and technologies. There is poor coordination between international organizations and national agencies. All those areas need to be strengthened.

FUTURE POTENTIAL

Because there is a lot of waste land and cassava is a convenient crop for farmers, cassava production has a great potential in Cambodia. If we can create a good marketing system and achieve better coordination between farmers and factories, it will greatly improve cassava production.

If in Cambodia the role of cassava can change from a traditional fresh human food to an efficient crop for animal feed and starch production, cassava could become an important source of cash income for poor farmers.

It is hoped that cassava can receive more support from the government and other organizations and companies, who should work together to create good market conditions, and to improve cassava research, extension and production in Cambodia.

REFERENCES

Ministry of Agriculture, Forestry and Fisheries (MAFF). 2001. Agricultural Statistics 1980-2000 and 2001. Department of Planning, Statistics and International Cooperation, Kingdom of Cambodia.

Food and Agricultural Organization (FAO). 2001. Bulletin of Statistics, Vol.2, pp. 47-48.

H.E. May Sam Oeum. 2001. Current status of agricultural research for development in Cambodia. Proc. Intern. Conference, held at CARDI, Phnom Penh, Cambodia. Oct 24-26, 2000. pp. 67-76.