

Farmers' perceptions on cassava cultivation in Cambodia

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ABSTRACT: Cassava is one of the most important upland crops of Cambodia. While improved technologies are needed for sustainable production of the crop, their adoption depends on how farmers view cassava against other crops. The objective of this study was to assess the perception of Cambodian farmers on growing cassava, relative to other upland crops. The study was conducted in Kampong Cham province in Northeast Cambodia which has the largest cassava production area in the country. Secondary data on production and price of cassava and other crops were collected, and 45 households in four cassava production zones were interviewed to obtain information on farmer's perceptions on cassava and other crops. The results showed that production of cassava and other upland crops in Cambodia has increased substantially during recent years, reflecting increased market demand and improved prices. Farmers in the study area in Kampong Cham province regard rice and cassava as their priority crops, and have a greater preference for growing them than other crops, including maize, soybean, mungbean, peanut, sesame and rubber. Rice, however, is grown mainly for domestic consumption, while cassava is grown as a source of cash income. The marketing aspects of the crop, i.e., good price and easy to sell, were the most important considerations for farmers' strong preference for cassava relative to other upland crops. With the current trend of favorable marketing conditions, cassava production in Cambodia is anticipated to expand further, while farmers are also likely to adopt improved technologies that will sustain or improve their cassava yields, even if involving extra input costs. These findings can potentially be used as a basis for the further development and extension of technologies for sustainable production of cassava in Cambodia.

Keywords: Cassava production, upland crops, farmers' preference, farmers' attitude, technology adoption.

Introduction

Upland crop production has played an important role in contributing to household incomes in upland areas of Cambodia, accounting for about 4% of national GDP (ADB, 2007). As the self-sufficiency in rice production has already been achieved, Cambodia is in a position to boost production of upland crops, to help improve rural household incomes, in line with the development policies of the government. Over the past decade, upland crop production in Cambodia has markedly increased, especially in the last five years (MAFF, 2007). The greatest increase has been in

Kampong Cham province in Northeast Cambodia. Cassava is the upland crop that has gained greatest in popularity, reflecting a combination of a high demand for domestic use and for export, and relatively high prices. The area planted to cassava increased from 19,600 ha in 2002 to 108,122 ha in 2007, with crop yields increasing from an average of 6.24 tons ha⁻¹ in 2002 to 20.49 tons ha⁻¹ in 2007 (MAFF, 2008a). In terms of total production, cassava has now become the second most important crop of Cambodia, after rice. Its role has also changed from being primarily a food crop to becoming an industrial crop with multiple potential uses, including being an animal feed,

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a source of starch, sweetener and processed food and for ethanol production. The crop has become an important source of cash income for resource-poor farmers of Cambodia (Mariscal et al., 2007). Market opportunities in Vietnam, Thailand and elsewhere are the major driving force for these changes (Seng et al., 2009).

The currently high average cassava yield being report for Cambodia (20.49 tons ha⁻¹ in 2007) has come mainly from the expansion of the crop into new production areas where the soils are fertile, coupled with the introduction of high yielding varieties, particularly KU 50 (a variety introduced from Thailand, which is also sometimes known locally as *KM 94* or *Malay*). However, in areas where cassava has been grown continuously with little or no fertilizer inputs for many years, crop yields are rather low. The crop also generally faces other production constraints that lower the yields obtained by farmers, relative to its yield potential. It is anticipated that new areas of production will experience such constraints in the future and high yields will be difficult to maintain without the adoption of improved production technologies.

Cassava, however, is not the only crop that has shown a significant recent expansion in Cambodia; a number of other upland crops have also shown significant increases in both the area under cultivation and production. This partly reflects the current Cambodian government policy of promoting crop diversification. Other crops (in addition to cassava) which have shown significant expansion in Northeast Cambodia in recent years include maize, soybean, mungbean and sugar cane (MAFF, 2007). Rubber is also a new crop that is gaining popularity among Cambodian farmers. These crops are therefore competing with cassava in terms of farmer interest

and production. Potential future production of cassava in Cambodia will reflect farmers' perceptions of the crop relative to other alternative upland crops. Knowledge of farmers' perceptions of cassava relative to other crops is therefore important for determining appropriate strategies for the promotion of the crop and the transfer of improved production technologies for sustainable cassava-based production systems. Currently, such information is not known. The objective of this study was to determine farmers' perceptions on growing cassava relative to other upland crops in the target area of Kampong Cham Province in Northeast Cambodia.

Materials and Methods

Selection of the study site

Kampong Cham province in Northeast Cambodia (11° 56' 16 " N latitude, 105° 41' 28" E longitude, 31-38 m asl), about 124 km from the capital city of Phnom Penh, was selected as the area for the study. This province was chosen because it has the largest area planted to cassava in the country (MAFF, 2008b); it also has a long history of cassava production. In this area, apart from cassava, farmers also grow a range of other crops, including rice, maize, mungbean, soybean, peanut, fruit trees, and in recent years, rubber.

A preliminary survey was conducted to obtain general information on the areas grown to cassava in Kampong Cham province, farmers' cassava cultivation practices and yield levels, together with information on other crops grown. Secondary data were also collected on climate, topography, soil type and history of cassava production. Based on the information collected in the preliminary survey and secondary data, the cassava production areas in Kampong Cham

were divided into four agro-ecological zones (Figure 1). The classification of these zones was primarily undertaken to assist with the related study on yield gaps in cassava cultivation, but it was thought that they might have some influences on farmers' perception as well. Zones I and II are located in Tbong Khmum district, Zone III is located in Dambe district and Zone IV is located in Memout and Ponea Kreak districts.

Zone I has both gravel and non-gravel red soils, while Zone II has non-gravel black soil. The landscape in both Zones I and II is gentle undulating. Cassava has been grown in these two zones continuously without fertilizer application for about 25 years. Zone III soils comprise both

gravel and non-gravel black soils. Cassava is the main crop grown on gravel soils which are of low quality and paddy rice and other upland crops are usually cultivated on the non-gravel soils. The landscape in this zone is gentle undulating. Zone IV is in the districts of Memout and Ponea Kreak on the eastern side of the Mekong river. Cassava has been grown in this zone for about ten years. The main soil type in this zone is a non-gravel red soil called basalt, which is classified as having good productivity and is also suitable for planting rubber and other upland crops (White et al., 1997). The landscape is gentle undulating and the yield obtained from cropping cassava is higher than for other zones.

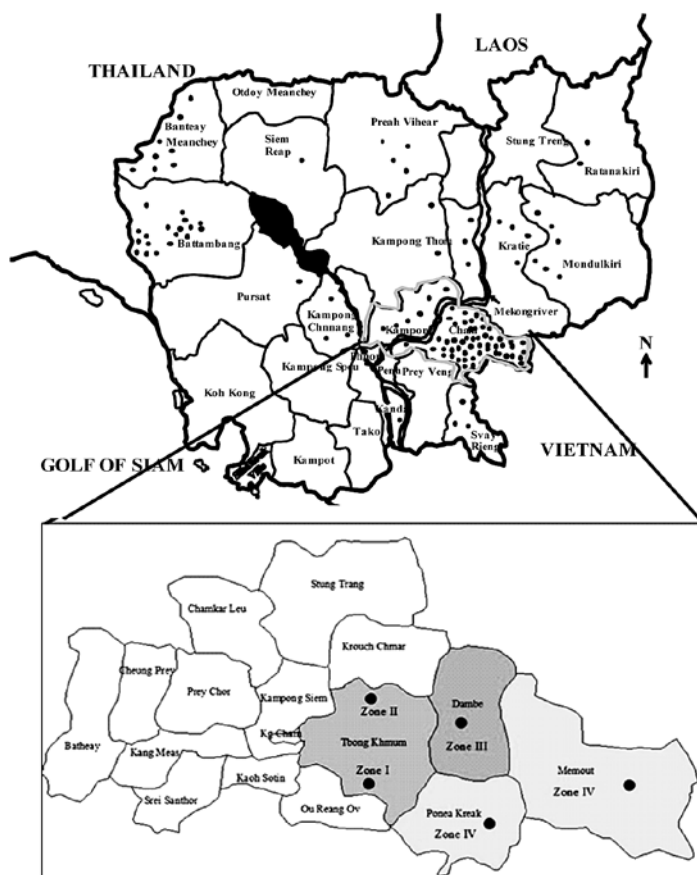


Figure 1 Distribution of cassava growing areas in Cambodia in 2007 (each dot represents 1,000 ha), and location of Kampong Cham province and zones of cassava production in the area.

A village with a large area of cassava cultivation from each zone was selected for the detailed study. The selected villages were Vihear Loung and Tmor Pich in Tbong Khmum district (Zones I and II), Kok Srok in Dambe district (Zone III), and Kondol Chrom in Ponea Kreak district (Zone IV).

Data collection and analysis

Secondary data were collected on production and prices of the major crops of Cambodia over the past ten (1998-2007) and eleven (1998-2008) years, respectively, on cassava production in selected provinces in 2001 and 2007, on production, processing, marketing and utilization of cassava in Kampong Cham province in 2007, and on other crops grown in the province in 2007. This data was then used for an examination of production trends for individual crops throughout the country and on current cassava production and marketing in Kampong Cham province, to provide a background to understanding the perceptions of farmers on the cultivation of cassava.

A formal survey with detailed questionnaire was used to obtain data on farmers' perceptions on the growing of cassava, relative to other crops. The survey was conducted during December 2009 to February 2010. It was planned that detailed interviews would be undertaken for 12 households in each zone (with associated cassava crop sampling for a related study on yield gaps). However, early harvesting of the cassava crop by some farmers resulted in the crop cuts for yield gap estimates were done with 10 households in Zone 2 and 11 households in Zone

4; 12 households were sampled in Zones 1 and 3, as planned. A total of 45 households were covered by the survey. The number of farmers interviewed in each village represented about 70-80% of the cassava growing households in each village. Prior to the survey, the commune and village leaders were approached to get permission to conduct the survey, and to obtain secondary information on cassava growers in each village, and their past yield records. The farmers were then classified into those who achieved high yields and those who achieved low yields, in previous cassava crops. Farmers in each group were randomly selected to provide representative samples of households which had obtained high and low cassava yields in the past, with the condition that they were willing to be interviewed and allow crop cutting in their cassava fields. Before the interviews, the farmers were visited to solicit their assistance, and to make appointments for interviews.

The questionnaire included questions on the crops grown by the farmer in the previous year (2009), the crops generally grown in the area, the number of years that the farmer has grown cassava and the reasons for growing the crop, the advantages and disadvantages of each crop grown in the area, the first, second and third choice of crops preferred by the farmer, and the reasons for giving that order of preference, the lowest acceptable price of cassava for continued growing the crop, and the crop selected to replace cassava if the cassava price became unacceptable (Table 1).

Table 1 Questions asked in the questionnaire on farmers' perceptions of cassava.

No	Question
1	What crops did you grow in 2009?
2	What are the crops generally grown in your area?
3	How many years have you grown cassava?
4	What are the reasons for your decision to grow cassava?
5	What are your views on the advantages and disadvantages for each crop that is grown in your area?
6	What is the crop that you would like to plant most, and why?
7	What is the crop that you would like to plant second, and why?
8	What is the crop that you would like to plant third, and why?
9	What is the lowest price of cassava for you to continue planting the crop?
10	If cassava price becomes too low to be acceptable to you, what crop will you select to replace it?

Data obtained from the questionnaire were analyzed by comparing the relative frequencies of households in the different categories as described in the individual questions, both within the individual zones and across all zones. The assessment on farmers' perceptions on cassava relative to other crops was done by considering the collective responses of the farmers to all the questions.

Results and Discussion

Trends in production of cassava and other crops in Cambodia

Over the past 10 years, cassava cultivation and production in Cambodia has rapidly increased, with harvested area expanding from 8,208 ha in 1998 to 108,122 ha in 2007, while production has increased from 66,534 tons in 1998 to 2,215,427 tons in 2007 (MAFF, 2008b). In addition to cassava, production areas for maize, soybean, mungbean and sesame also increased markedly, with the exception of the two years, 2006 and 2007, in which the planted areas for soybean and sesame showed a marked decline (Figure 2). During these two years, the area

for cassava increased sharply, suggesting that cassava might have taken over soybean and sesame in some production areas. Over the same period, the area of peanut production showed only a slight increase, while that for sugar cane remained relatively unchanged.

It is generally recognized that increases or decreases in production of a crop normally reflect farmers' responses to market demand and prices. During 1998-2003, the prices of all major crops of Cambodia fluctuated, increasing in some years but decreasing in other years (Table 2). For cassava, the price was around 18 US\$ ton⁻¹ during 1998-1999, dropped to 16.3 US\$ ton⁻¹ in 2000, increased to 18 and 19.6 US\$ ton⁻¹ in 2001 and 2002, respectively, and again dropped to 16.3 US\$ ton⁻¹ in 2003. In 2004, the prices for most crops increased substantially, particularly cassava, maize and sesame, and remained at that level until 2006, then increased markedly again in 2007, except for sesame. For cassava, the price during this period increased 2.5 folds, from 24.4 US\$ ton⁻¹ in 2006 to 61.6 US\$ ton⁻¹ in 2007. In 2008, however, the price dropped to 40.5 US\$ ton⁻¹, but was still almost double that of 2006. The prices for maize,

soybean and peanut, on the contrary, continued to increase further in 2008, while for sesame there was also a significant price increase (Table 2).

The increase in cassava price in the recent years has been due mainly to an increase in number of processing factories, creating high market demand and strong competition among the factories in buying cassava root directly from farmers. The reduction in cassava price in 2008 was probably the result of a big increase in cassava production from the large scale expansion in the area planted to cassava, associated with weak market linkage at local level, although overall demand was high. A local survey in 2009 revealed further increase in the price of cassava to US\$ 65 ton⁻¹ (Source: Survey, 2009).

In Cambodia, cassava production is concentrated in seven provinces - Bateay Mean Chey, Battambang, Kampong Cham, Kratie, Monduliri, Pailin and Phreah Vihear. Among

these, Kampong Cham province has the largest planted area and highest production. Harvested areas, production and yield of cassava for these provinces in the period 2001 and 2007 are summarized in Table 3. Big increases in the harvested area and production are evident for all provinces, particularly Kampong Cham, in which the harvested area of cassava increased from 4,740 ha in 2001 to 53,789 ha in 2007, while production increased from 67,051 tons in 2001 to 1,082,660 tons in 2007. In the three provinces of Battambang, Kampong Cham and Pailin, cassava yields also increased substantially. For example, in Kampong Cham province average yield increased from 14.15 tons ha⁻¹ in 2001 to 20.12 tons ha⁻¹ in 2007. This yield increase largely reflected the expansion of cassava cultivation into newly opened land where the soils were still quite fertility. In addition, many farmers also adopted more suitable higher yielding varieties.

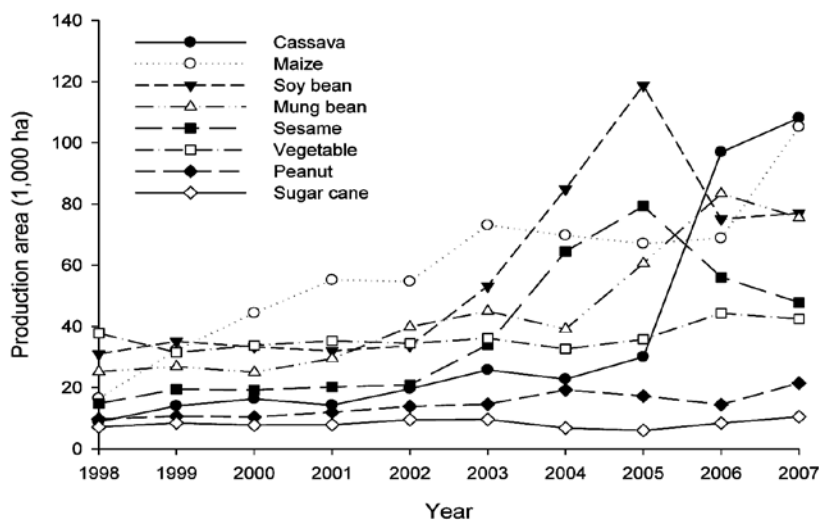


Figure 2 Trends in area of cultivation for important crops in Cambodia in the period 1998-2007. Source: MAFF (2008).

Table 2 Prices (US\$ ton⁻¹) of selected crops in Cambodia during 1998-2008.

Year	Rice	Cassava	Maize	Soybean	Peanut (in-shell)	Sesame
1998	157.6	18.7	157.6	288.4	644.4	673.0
1999	110.3	18.3	186.3	206.2	451.1	481.0
2000	96.3	16.3	162.7	308.5	394.0	546.8
2001	105.2	18.0	122.6	247.2	430.2	531.9
2002	120.1	19.6	74.1	434.6	449.4	621.2
2003	105.2	16.3	96.6	324.2	629.2	487.0
2004	133.5	24.9	124.5	352.8	631.2	822.4
2005	146.9	26.3	135.4	307.9	656.2	763.2
2006	136.5	24.4	148.7	304.7	853.0	889.6
2007	177.5	61.6	239.2	468.4	986.2	862.9
2008	198.9	40.5	293.8	500.2	1119.4	981.7

Source: FAOSTAT (2010).

Table 3 Harvested area, production and yield of cassava in selected provinces of Cambodia in 2001 and 2007.

Province/City	Harvested area (ha)		Production (ton)		Yield (ton ha ⁻¹)	
	2001	2007	2001	2007	2001	2007
Bateay Mean Chey	8	8,047	120	83,205	15.00	10.34
Battambang	146	17,825	1,898	623,875	13.00	35.12
Kampong Cham	4,740	53,798	67,051	1,082,660	14.15	20.12
Kratie	334	7,118	3,016	65,485	9.03	9.20
Mondulhiri	52	5,806	546	89,993	10.50	15.50
Pailin	7	6,517	84	241,129	12.00	37.00
Preah Vihear	120	4,834	1,200	51,493	10.00	10.65

Source: Ministry of Agriculture Fisheries and Forestry (MAFF) (2008b).

Current production and utilization of cassava in Kampong Cham province

In Kampong Cham, rice is the primary crop for which the majority is produced for home consumption. Harvested area of rice in 2007 was 219,277 ha, accounting for approximately 60% of the cultivated land in the province. Cassava is the second most important crop in the province, with 62,300 ha being harvested in 2007, or approximately 17% of the cultivated land area

(DOA, 2008). Other important crops in the province include soybean, maize, sesame, tobacco, vegetables and mungbean, with harvested areas for each crop in 2007 ranging from 2 to 6% of the cultivated land in the province (**Table 4**).

There are sixteen districts in Kampong Cham province, of which six are major cassava producing areas. These districts include Memout (20,740 ha), Dambe (15,940 ha), Stung Trang (11,026 ha), Ponea Kreak (6,765 ha) and Tbong

Khmum (5,136 ha). Average yields in these districts in 2007 were in the range of 16-17 tons ha⁻¹ (Table 5). Cassava roots are used for making starch for human consumption. Some varieties can be consumed directly after boiling or roasting, and this type of cassava is sold directly in local markets. Both roots and leaves are utilized for making silages for animal feed, while the waste from factories can also be used as animal feed as well as a fertilizer. Some farmers use cassava starch for making bread and other food items,

including noodles, sago pearls (granule tapioca) and traditional desserts. In addition to selling fresh roots, farmers also make dry cassava chips that can be stored for several months until the cassava price improves. Most fresh roots, dry chips and starch in Kampong Cham province are exported to Vietnam, while the remainder is used locally as sago and noodles. Recently, cassava has become the most important industrial crop in the province.

Table 4 Harvested area, production and yield of major crops in Kampong Cham province of Cambodia in 2007.

Crop	Harvested area		Production (tons)	Yield (tons ha ⁻¹)
	ha	%		
Rice	219,277	60.8	704,253	3.21
Cassava	62,300	17.3	1,006,814	16.16
Soybean	21,003	5.8	25,208	1.2
Maize	14,715	4.1	66,385	4.51
Sesame	13,305	3.7	8,518	0.64
Tobacco	7,844	2.2	13,116	1.5
Vegetables	7,419	2.1	107,846	14.54
Mungbean	6,689	1.9	5,134	0.76
Other crops ^{1/}	8,013	2.2	38,393	1.21

^{1/} Including peanut, sweet potato, sugar cane, cotton and jute.

Source: Department of Agriculture (DOA), Kampong Cham (2008).

Table 5 Harvested area, production and yield of cassava in certain districts in Kampong Cham province of Cambodia in 2007.

District	Harvested area (ha)	Production (tons)	Yield (tons ha ⁻¹)
Memout	20,740	331,840	16.0
Dambe	15,940	255,040	16.0
Stung Trang	11,026	187,442	17.0
Ponea Kreak	6,765	108,240	16.0
Tbong Khmum	5,136	82,176	16.0
Other districts	3,985	42,076	10.6
Total	63,592	1,006,814	

Source: Department of Agriculture (DOA), Kampong Cham (2008).

In the Kampong province, there are four large and one medium cassava starch factories owned by private enterprise; their processing capacities range from 100 to 1,000 tons of fresh roots day⁻¹. Most of these factories were built in 2007. In addition, there are 295 small scale starch processing plants and 27 small plants producing noodles and sago pearls; these processing plants are owned by local farmers, and all are located in Tbong Khmum district. The capacity of these small plants ranges from 3-5 tons of fresh root day⁻¹ (DOA, 2008). According to information obtained from the various factories and local farmers, the price of fresh cassava root in the province peaked in 2007 at up to US\$70 ton⁻¹. This price reflected the competition among the cassava processing factories for raw cassava material for processing. The high price then stimulated a rapid and large expansion in the area planted to cassava, resulting in excessive production in 2007. This coupled with weak market linkage at local level caused the price to drop to about US\$28 ton⁻¹. The price then increased to US\$ 65 ton⁻¹ in 2009 as demand for the crop was high.

Crops grown by survey households and their experience in growing cassava

The results of the household survey indicated that farmers in the study area normally grow more than one crop, with the number of crops grown by the surveyed households ranging from 3 to 5 crops in Zone 1 (cassava, rice, rubber, cashew nut and vegetable); 2 to 4 crops in Zone 2 (cassava, rice, mungbean and soybean); 1 to 3 crops in Zone 3 (cassava, rice and rubber), and 2 to 3 crops in Zone 4 (cassava, rice and rubber). Sugar cane, mango, acacia, tobacco, maize, rambutan and jack fruit are also being grown in these zones by other farmers (Table 6).

The experience in growing cassava of the households surveyed in the different zones also varied. Farmers in Zones 1 and 2 had experience in growing cassava for 6-28, and 6-20 years, respectively, while those in Zone 3 had 1-10 years experience, and those in Zone 4 had only 2-7 years experience (Table 7). This information was also reflected the duration (years) of cassava production in the different zones, with Zones 1 and 2 having the longest periods of cassava production and Zones 3 and 4 the shortest periods of production.

Table 6 Crops currently grown by sampled farmers and in the different cassava production zones in Kampong Cham province of Northeast Cambodia.

Zone	Crops grown by sampled farmers		Other crops grown in the area
	No./HH	Crop	
Zone 1	3-5	Cassava, rice, rubber, cashew nut, vegetables	Sugar cane, mango, acasia
Zone 2	2-4	Cassava, rice, mungbean, soybean	Rubber, cashew nut, tobacco, maize, peanut, sesame
Zone 3	1-3	Cassava, rice, rubber	Cashew nut, vegetables, sugar cane, mango, acasia, mungbean, soybean, maize
Zone 4	2-3	Cassava, rice, rubber	Cashew nut, vegetables, sugar cane, mango, rambutan, jack fruit, acasia

Farmers' perceptions of cassava cultivation

The results of the farmer survey on the farmers' reasons for growing cassava listed the following in decreasing order of priority: (i) ease of growing the crop; (ii) good market prices; (iii) ease of selling the crop produce; and (iv) ability to grow the crop on poor soils. The average frequencies that these factors were listed for Zones 1 to 4 were 89, 80, 59 and 26% of sampled households, respectively (**Table 7**). No farmers indicated that the basis of their selection of cassava was on account of a low labor input requirement. It was also noted that in the old cassava production areas (Zones 1 and 2), the frequency that farmers listed its ability to be grown on poor soils was much higher than for the new production areas (Zones 3 and 4). The relative frequencies for the 'ability to grow cassava on poor soils' as a reason for growing the crop were 25, 60, 8 and 9% of households in Zones 1, 2, 3 and 4, respectively. For all farmer respondents in all zones, aspects of growing the crop (easy to grow and can be grown on poor soils) and marketing issues (good prices and easy to sell) appeared to be equally important in influencing farmers' decisions relating to growing cassava.

In the survey interviews, farmers were asked to rank the crops they grew based on their preferences. The results (**Table 8**) showed that cassava and rice were the two most preferred crops, overwhelmingly outranking other crops grown in the area. Over all households in the four zones, 46.7% ranked cassava, 46.7% ranked rice, and the remaining 6.7% ranked rubber as their most preferred crop. For the crop of second choice, 46.7% selected cassava, 35.6% selected rice, and the remaining households selected

either rubber or cashew nut or vegetables or mungbean, with frequencies ranging from 2.2 to 6.7%.

There were, however, differences in ranked preference between rice and cassava by farmers in the individual zones. More farmers in Zone 1 (67%) and Zone 2 (60%) ranked cassava as the most preferred crop, while a lesser number preferred rice than cassava (8 and 40% of households in Zones 1 and 2, respectively). The ranking of cassava and rice for Zones 3 and 4 was the reverse of that in Zones 1 and 2, with 75% of farmers in Zone 3 and 64% of farmers in Zone 4 indicating rice as their preferred crop rather than cassava (data not shown). These differences between zones might reflect the longer history of growing cassava in Zones 1 and 2, relative to Zones 3 and 4, which are new production areas. Nevertheless, both cassava and rice were the most preferred crops in all four zones, when compared with other crops grown in the area.

When asked what crop farmers would grow in place of cassava if cassava prices became too low to be acceptable, rubber was the farmers' choice in all households in Zone 1, 40% of households in Zone 2, 83% of households in Zone 3 and 91% of households in Zone 4 (**Table 9**). It was noted that, in Zone 2, the number of farmers who chose legumes (mungbean, soybean and peanut) to replace cassava, was the same as the number who chose rubber, while some farmers in Zones 2 and 3 indicated that they would continue to grow cassava even if the price was low. Overall, the results clearly indicated that, if the price became unfavorable, rubber would be its potential competitor for agricultural land.

Table 7 Length of time that cassava has been grown and reasons for growing cassava for individual households surveyed in the four cassava production zones in Kampong Cham province of Cambodia.

Zone	No. of HH	Years of cassava cropping	Reason for growing cassava (% of HH) ^{1/}				
			Can grow in poor soil	Easy to grow	Easy to sell	Good price	Requires less labor
Zone 1	12	6-28	25	83	83	92	0
Zone 2	10	6-20	60	90	40	80	0
Zone 3	12	1-10	8	92	58	67	0
Zone 4	11	2-7	9	91	55	82	0
Average			26	89	59	80	0

^{1/} Each household gave more than one reason/ multiple response question.

Table 8 Preference ranking of crops by cassava growers in all production zones in Kampong Cham, Cambodia.

Crop	First choice		Second choice		Third choice	
	No. of HH	% ^{1/}	No. of HH	% ^{1/}	No. of HH	% ^{1/}
Cassava	21	46.7	21	46.7	3	6.7
Rice	21	46.7	16	35.6	2	4.4
Rubber	3	6.7	2	4.4	2	4.4
Mungbean	0	0.0	2	4.4	8	17.8
Vegetables	0	0.0	2	4.4	6	13.3
Cashew nut	0	0.0	1	2.2	0	0.0
Soybean	0	0.0	0	0.0	1	2.2

^{1/} Percent of 45 total households surveyed.

Table 9 Preferred alternative crops if cassava prices becomes too low.

Crop	Zone 1		Zone 2		Zone 3		Zone 4	
	No. of HH	%	No. of HH	%	No. of HH	%	No. of HH	%
Rubber	12	100.0	4	40.0	10	83.3	10	90.9
Legume	0	0.0	4	40.0	1	8.3	0	0.0
Cassava	0	0.0	2 ^{1/}	20.0	1 ^{1/}	8.3	0	0.0
Maize	0	0.0	0	0.0	0	0.0	1	9.1
Total	12	100.0	10	100.0	12	100.0	11	100.0

^{1/} These households gave the response that they would still grow cassava regardless of the price.

Farmers' views on the advantages and disadvantages for the different crops they grew are summarized in **Table 10**. Most farmers rated its potential to provide a 'good income' as the main advantage of growing cassava, with other advantages listed including 'high prices', 'easy to sell', 'high yields', and 'grows well'. The disadvantages of growing cassava were listed as unstable prices, soil fertility depletion and labor intensive. In contrast to cassava, food security was the advantage listed by most farmers for selecting rice, with selling ability and low production costs being listed as other advantages; susceptibility to insect damage was listed as

a disadvantage. For rubber, long-term income, daily income and high income were viewed as the crop's advantages, while soil degradation and time taken to generate income were seen as the main disadvantages. Good income was the advantage for both cashew nut and vegetables, while the advantage of mungbean was potential as a source of both income and food. It was noted that, except for rice which is the staple food, good income and price were seen as the advantages for all the other crops. This indicates that Cambodian farmers are commercially oriented in their production of upland crops, including cassava.

Table 10 Views of farmers on advantages and disadvantages of the crops they grew in 2009.

Advantages	No. of HH	Disadvantages	No. of HH
Cassava		Cassava	
Good income	33	Unstable price	3
High price	2	Decreases soil fertility	1
Easy to sell	2	Labour intensive	1
High yield	4		
Grows well	2		
Rice		Rice	
Food security	40	Susceptible to insect damage	3
For sale	1		
Low expenditure	1		
Rubber		Rubber	
Long-term income	3	Soil degradation	1
Daily income	3	Take time	1
High income	2		
Cashew nut		Cashew nut	
Good income	4	Low yield	1
Good price	2	Low price	1
Improve soil	1		
Vegetables		Vegetables	
High income	3	Susceptible to insect damage	2
Fast income	1	Labour intensive	1
Mungbean		Mungbean	
Income + food	11	Susceptible to insect damage	1

The sample farmers in the present study were all cassava growers, thus, the farmers' perceptions presented here are only those of cassava growers, and may not reflect the perceptions of non-cassava growers. The study was limited only to cassava growers as it was aimed at assessing the likelihood of adoption of improved technologies for sustainable production of the crop. It was hypothesized that if the cassava growers still view cassava highly relative to other crops, it is likely that they will accept improved technologies even if extra inputs are required. Different questions concerning farmers' perceptions on cassava were asked to cross-check the farmers' responses, and the results indicated close agreements among the farmers' responses to those questions.

The results clearly show that cassava growers in Kampong Cham province in Northeast Cambodia consider rice and cassava as their priority crops, which are grown primarily for home consumption and for cash income, respectively. Farmers' preferences for these two crops are much higher than other crops, including maize, soybean, mungbean, peanut, sesame and rubber. As cassava and rice are grown in different areas (cassava is grown in the uplands while rice is grown in the lowlands), they do not compete with each other for production land.

Although the farmers' responses for their reasons for growing cassava appeared to indicated equal importance of aspects of growing the crop (easy to grow, can grown on poor soils) and crop marketing (good prices, easy to sell) in determining their preference for cassava, their rating of priorities indicated that aspects of marketing the crop were the most important considerations. Their responses to this question

for other crops also suggest that Cambodian farmers are highly commercially oriented in relation to their choice of upland crops. The rapid increases in market demand and associated good price of cassava in Cambodia in recent years, clearly explains why Cambodian farmers rate cassava highly when compared with other upland crops. The future demand for cassava in Cambodia is expected to continue to increase, reflecting an increasing domestic demand for cassava processing industries and export. Good ongoing prices for the crop can be anticipated. Rubber appears to be the only crop that has the potential to compete with cassava. However, the growing of rubber requires a high level of investment and it takes a considerable time to get returns on the initial investment. Only well-off farmers will be able to consider growing rubber. With the current trends in market demands for cassava, it is believed that rubber will not be its serious competitor in the near to medium term.

It is anticipated that cassava cultivation in Cambodia will continue, with a further expansion in the area planted to the crop. Currently, most cassava cultivation in Cambodia is done with little or no fertilizer inputs (Sopheap, 2008). Like other crops, continuous planting of cassava without fertilization will result in a decline in soil fertility and an associated reduction in crop yields (Howeler, 2000). Without improved agronomic practices, soil erosion can potentially be a serious problem when farmers grow cassava on sloping lands (Howeler, 2002). To sustain cassava production, improved technologies particularly relating to soil fertility management and conservation are needed, some of which will require extra inputs.

It is well recognized that farmers' decisions on the adoption of new technologies are influenced by a number of factors. These considerations include not only the characteristics of the technologies, but also farm and household considerations (Feder, et al., 1985; Roger, 1993; Shiferaw and Holden, 1998). However, technology characteristics are believed to have the stronger influence in shaping farmers' perceptions towards new technology adoption (Adesina and Zinnah, 1993; Batz, Janssen and Peter, 2003; Herath and Tekera, 2003). The perceptions of farmers come from their evaluation of the economic and socio-technical aspects of the new technology. The economic considerations include profitability, price, marketability and cost, while the socio-technical considerations include compatibility, complexity, trialability and observability (Roger, 1993). It has also been found that farmers' perceptions relating to profitability, output price and marketability are the main economic criteria determining the adoption of new technologies (Akinola, 1986; Neguta and Parikh, 1999). Profitability in the immediate or short-term is also preferable (Baidu-Forson, 1999). Under the favorable marketing conditions for cassava in Cambodia, developing technologies for improving production and profitability should not be difficult. The strong farmer preference for the crop based on marketing and production considerations found in this study, suggests that improved technologies that are compatible with other household activities will likely be associated with a positive perception of farmers towards their adoption, even when such technologies require extra input costs.

Conclusions

The results of this study indicate that cassava growers in Cambodia view cassava highly when compared with other potential upland crops. No difference in the perception on cassava of farmers in the different zones was observed. With the expectation of continuing favorable marketing conditions for cassava, farmers are likely to adopt improved technologies capable of sustaining or even further improving their production of cassava, even if associated with extra input costs. This finding can be used as a basis for the development and transfer of improved technologies for sustainable production of cassava in Cambodia.

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