



## Changes in Cassava Yields with Trimmed Leaves for Eri-culture in Kampong Cham Province, Cambodia

**KUMIKO KAWABE\***

Graduate School of Agriculture, Tokyo University of Agriculture, Tokyo, Japan /  
Research Center, Institute of Environment Rehabilitation and Conservation, Tokyo, Japan  
Email: kumiko@khmergreennature.com

**MACHITO MIHARA**

Faculty of Regional Environment Science, Tokyo University of Agriculture, Tokyo, Japan

**KEISHIRO ITAGAKI**

Faculty of International Agriculture and Food Studies, Tokyo University of Agriculture, Tokyo, Japan

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**Abstract** Cassava (*Manihot esculenta*), a host plant of eri silkworm (*Samia Cynthia ricini*), is one of the main crops, followed by rice in Cambodia. As it was not long ago that eri-culture was introduced in Cambodia, the research related to eri-culture and eri silkworms in Cambodia has not been developed. Especially, trimming methods of cassava leaves have not been studied yet. Accordingly, attention has been paid to evaluate the suitable amounts of leaves trimmed for eri-culture without affecting cassava tuber yields. So, this study dealt with the potential percentage of cassava leaves trimmed for eri-culture in Cambodia. In the experimental field at Royal University of Agriculture located in Phnom Penh, cassava, variety called KM 94, was cultivated from November 2011 to July 2012 for 8 months. After 4 months passed from planting, the leaves were trimmed at 0%, 20%, 40%, 60%, 80% and 100%, respectively. At 8 months passed from planting, the yields were compared amongst plots of different trimmed percentage, and the suitable amounts of leaves trimmed for eri-culture without affecting cassava tuber yields were discussed. The experimental results showed that yields of 100% trimmed were significantly smaller than that of 0% to 80% trimmed. Additionally, there was no significant difference in yields amongst plots trimmed 0% to 80%. It was concluded that cassava leaves can be trimmed up to 80% without affecting cassava tuber yields.

**Keywords** eri-culture, eri silkworm, cassava, trimmed leaves

### INTRODUCTION

Eri-culture, raising eri silkworms (*Samia Cynthia ricini*), has been conducted widely in Southeast Asia, such as southern China, Thailand, Vietnam and Cambodia. Although its origin is Assam province in India, eri silkworm became the only one kind among various wild silkworms which domesticated in the same manner of mulberry silkworm and it has introduced to many countries where host plant of eri silkworm can be found or cultivated (Photo. 1). Host plants of eri silkworm are the leaves of castor, cassava or papaya which are very easy to cultivate in the tropical or subtropical areas. The most attractive points of eri-culture for local farmers are that eri-culture can start with low input, for example the leaf of cassava or castor is costless and rearing materials such as bamboo tray or net are easy to find in local areas, and eri-culture can provide local farmers not only cocoons but also pupae that includes high nutrition of protein.

Eri-culture has introduced in local villages of Kampong Cham province, Cambodia in October 2010 by the international NGO for aiming to promote environmental awareness and income generation for local farmers to tackle with local problems regarding agriculture.

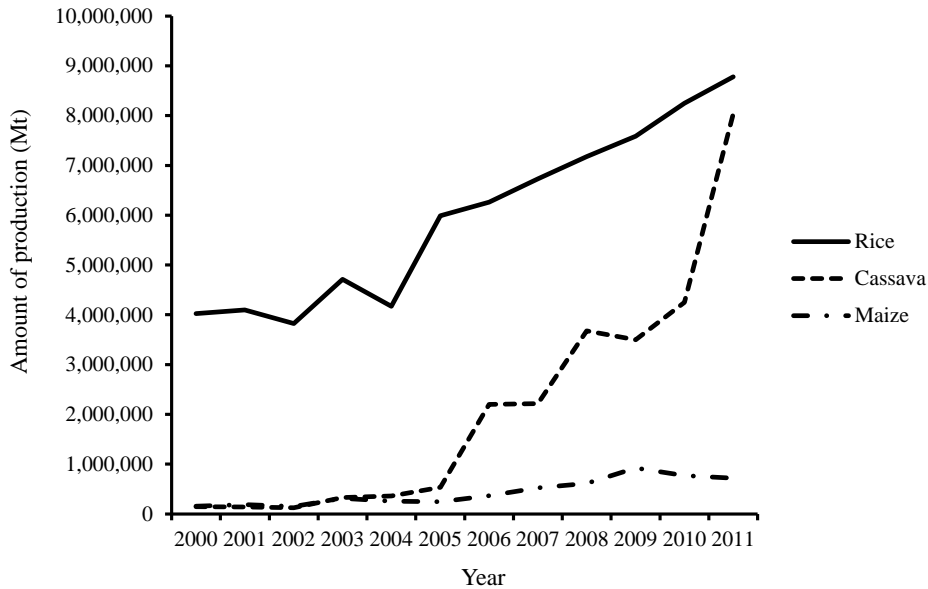
Agriculture is the main industry in Cambodia, and the statistics shows that 80% of total

population lives in rural areas and 70% of total population is engage in agriculture or related sectors (Central Intelligence Agency, 2011). The government places the first priority on agriculture, but at the same time it is very important for local people to sustain their living. However, local farmers in Cambodia still have difficulties to earn enough income from agriculture due to lack of infrastructure, knowledge, technology and information.

Cassava is one of the main crops followed by rice in Cambodia, and its yields has been increasing according to the statistics of FAO as shown in Fig. 1, due to the high potential of food security. In the research area, Kampong Cham province, the harvesting areas and yields of cassava have been increasing dynamically in recent years. Normally cassava farmers get income from tuber yields; however there may be high possibility to receive other income by using cassava leaves. So, eri-culture can be one of the options to utilize the leaves, and it can be useful for local farmers to generate more income from agriculture.



**Photo. 1 Cultivating eri-silkworms**



Source: FAO stat (2011)

**Fig. 1 Trend of production in Cambodian top 3 crops**

**OBJECTIVE**

The objective of this paper is to evaluate the suitable percentage of cassava leaves trimmed in mid-flow of cultivating without any effects on tuber yields of cassava in the research site. One of the main obstacles for local farmers to continue eri-culture was to gain enough amounts of fresh leaves for rearing eri silkworm during dry season. A host plant of eri silkworm, cassava leaf, has rarely been used after harvesting tubers in Cambodia. So, attention has been paid to the effect on cassava yields after trimming certain amounts of leaves during its growing period. As the appropriate

trimming methods have not yet been studied, the methods for eri-culture are also discussed in this study. It is expected that the results would be available to extend the utilization of cassava leaves for eri-culture in Cambodia.

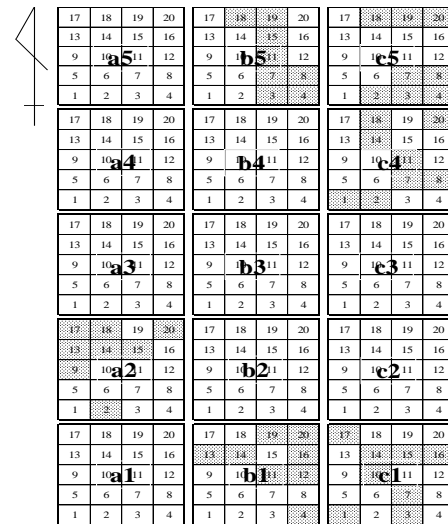
**METHODOLOGY**

This experiment was conducted at the experimental field in the Royal University of Agriculture (RUA) located in Phnom Penh, Cambodia (Photo. 2). The variety of cassava named KM 94 was chosen for the experiment, as the variety has been widely cultivated by local farmers in Kampong Cham province. Each experimental plot was a 4 m x 4 m square at 30 cm of planting interval as shown in Fig. 2. There were 20 cassava trees in each of the 15 plots, so totally 300 cassava trees were planted and cultivated from November 2011. Numbering of the plots was done from the southwestern plot along west side as “a1” to “a5”, from the southern plot to north for the middle lane as “b1” to “b5”, and from the southeastern plot along east side as “c1 to c5”.

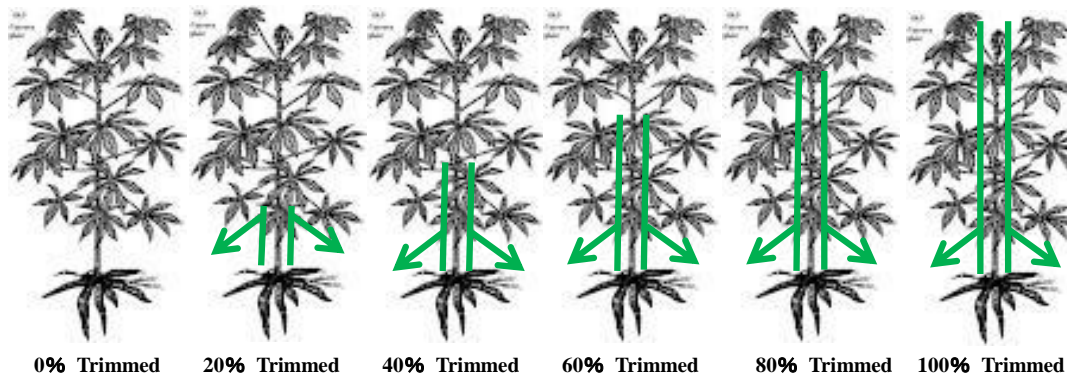
Ensuring the growing conditions in each plot, all cassava trees were measured by height after 4 months of planting, and 48 cassavas in 6 plots with no significant difference in height were used for the further experiment (meshed plots in Fig. 2). Trimmed percentage was decided for each plot, “c5” for 0%, “c4” for 20%, “c1” for 40%, “b5” for 60%, “b1” for 80% and “a2” for 100%, respectively (Fig. 3). Also, meteorological conditions, such as temperature, humidity and rainfall, were observed at the experiment field in the Royal University of Agriculture during the experimental period.



**Photo. 2** Experimental field at Royal University of Agriculture



**Fig. 2** Experimental plots at RUA, Cambodia



**Fig. 3** Trimming methods from 0% to 100%

## RESULTS AND DISCUSSION

### Meteorological Data Observed during the Experiment

Meteorological conditions were observed from July 2010 to July 2012 at the experimental site in Royal University of Agriculture, Cambodia. The observed period covered whole the experimental period from November 2011 to July 2012. During the experimental period from November 2011 to July 2012, higher and lower temperature ranged from 30 degree Celsius to 37 degree Celsius and from 20 degree Celsius to 26 degree Celsius, respectively. Also, the monthly rainfall was from 0 mm to 190 mm. The trends of temperature and humidity from November 2011 to July 2012 were similar with that from November 2010 to July 2011. However, there was less rainfall from December 2011 to February 2012 comparing to that from December 2010 to February 2011 as shown in Fig. 4.

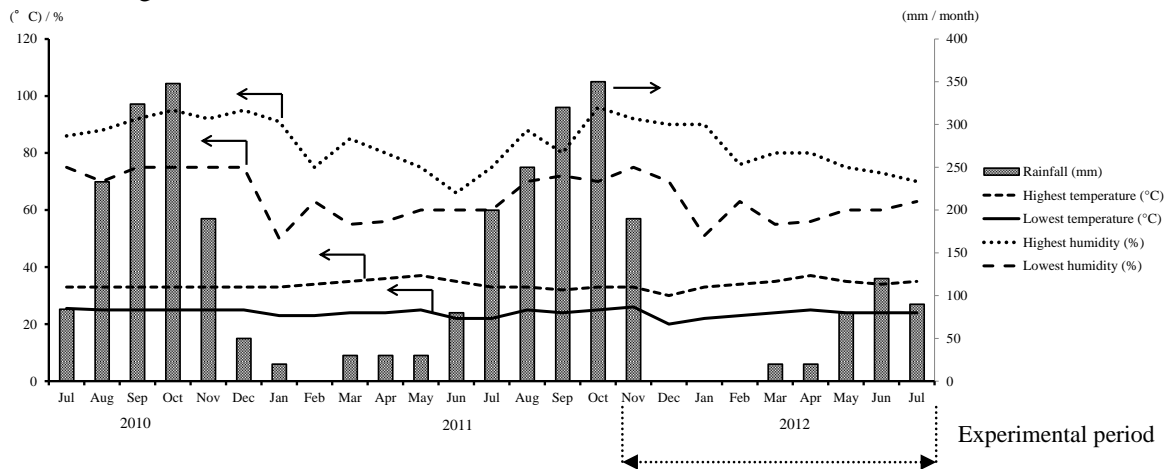


Fig. 4 Meteorological conditions observed at experimental field from July 2010 to July 2012

Table 1 Height of selected cassava trees in each plot

Name of plot	c5	c4	c1	b5	b1	a2
Height of each cassava tree (cm)	93	86	99	90	107	94
	109	94	102	100	96	112
	110	113	108	94	101	94
	93	102	103	91	90	104
	105	99	101	93	89	98
	113	113	101	105	101	96
	-	95	90	105	99	97
	-	105	102	100	88	91
Average	103.8	100.9	100.8	97.3	96.4	98.3

### Selection of Cassava for Trimming

In March 2012, after 4 months passed from planting, the heights of 300 cassava trees were measured. Eight plants in each of selected 6 plots which indicated no significant difference in height were selected for further experiment (Table 1). This is to ensure that selected cassava trees grew similarly although there were various factors affecting to the growth of cassava trees such as soil nutrients, moisture, solar radiations, and other plants effects, so on.

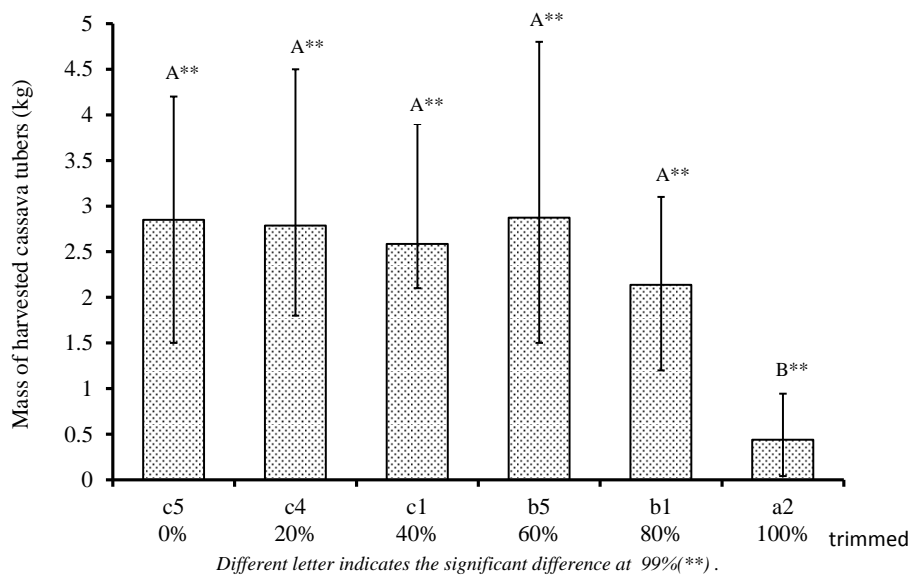
And then, amounts of cassava leaves from the lower part were trimmed at 0%, 20%, 40%, 60%, 80% and 100% (Fig. 3) in March 2012. The plot was selected as “c5” for 0%, “c4” for 20%, “c1” for 40%, “b5” for 60%, “b1” for 80% and “a2” for 100%, respectively (Fig. 2).

### Changes in Cassava Yields with Trimmed Leaves

The leaves of selected cassava were trimmed at 0% (c5 plot), 20% (c4 plot), 40% (c1 plot), 60% (b5 plot), 80% (b1 plot) and 100% (a2 plot), respectively (Fig. 3). After 4 months passed, cassava tubers were harvested and the mass of tubers in each cassava tree was measured in July 2012.

The experimental results were summarized in Fig. 5. It showed that the yield of 100% trimmed leaves was significantly smaller than that of 0% to 80% trimmed. Also, there was no significant difference in the yield among plots trimmed 0% to 80%. It was considered that trimmed cassava trees at 0% to 80% could recover the function of photosynthesis with reproducing cassava leaves. However, photosynthesis was not enough to grow cassava tubers for cassava trees trimmed at 100%.

Also, the fresh mass of trimmed cassava leaves at 0% to 80% was measured for cultivating eri-silkworms at middle flow of harvesting cassava as shown in Table 2. Apparently, there was a tendency for the fresh mass of trimmed cassava leaves to be larger with the increase in percentage trimmed. It indicated that 202.42 g of fresh cassava leaves were harvested from one cassava plant of 80% trimmed for cultivating eri-silkworms.



**Fig. 5** Effects of trimmed amounts of cassava leaves on mass of harvested cassava tubers

**Table 2** Fresh mass of selected cassava leaves in each plot from 0% to 80% trimmed

Name of plot	c5 (0% trimmed)	c4 (20% trimmed)	c1 (40% trimmed)	b5 (60% trimmed)	b1 (80% trimmed)
Fresh mass of cassava	0	42.72	90.90	137.41	232.74
leaves	0	28.98	55.80	281.20	185.21
trimmed (g)	0	35.39	62.88	169.51	290.75
	0	13.92	106.92	159.19	129.42
	0	45.58	84.99	79.81	163.67
	0	23.25	92.51	191.71	220.66
	-	17.63	81.69	160.84	220.49
	-	34.09	111.89	145.82	176.44
Average (g)	0	30.20	85.95	165.69	202.42

### CONCLUSION

Cassava (*Manihot esculenta*), a host plant of eri silkworm (*Samia Cynthia ricini*), is one of the main crops in Cambodia, and its harvested areas and yields have been increasing in the last five years and it is estimated to expand year by year.

Eri-culture, the raising of eri silkworm, a kind of wild silkworm originated in Assam province, India, was introduced to Cambodia in October 2010. Since then, farmers face the difficulty to ensure fresh leaves for feeding eri silkworm. So trimming methods of leaves should be studied. Accordingly, attention has been paid to evaluate the suitable amounts of leaves trimmed for eri-culture without damaging cassava yields.

KM 94, one of cassava variety that is widely adopted by local farmers in Cambodia, was cultivated from November 2011 to July 2012, a period of 8 months, at the experimental field in Royal University of Agriculture located in Phnom Penh. After 4 months passed from planting, the leaves were trimmed at 0%, 20%, 40%, 60%, 80% and 100%, respectively. At 8 months passed from planting, the yields were compared among plots of different trimming percentage and discussed the suitable amounts of leaves trimmed for eri-culture without damaging cassava tubers. The results showed that the yields of 100% trimmed were significantly smaller than that of 0% to 80% trimmed. Moreover, there was no significant difference in yields amongst plots trimmed 0% to 80%. Accordingly, it was concluded that cassava leaves can be trimmed up to 80% without damaging cassava yields.

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