



TECHNICAL REPORT

STUDY ON RATTAN SHOOTS PROCESSING

by

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Promotion of Sustainable Utilization of Rattan from Plantation in Thailand

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1. Literature review on rattan products and rattan shoot

Introduction

Rattans are climbing palms that have been utilized for centuries in several Asian countries and their economic importance is second to the forest trees. (7)

Rattans are mainly used to make furniture, household utensils and home decorators. (3) However, the use of rattan shoots as vegetable has been mentioned in many areas. According to (Renuka) (4) Rattan's young leaves, roots and shoot tip has been used as medicine and as vegetable by some indigenous people in Bangladesh.

Some people in Thailand and also in the Lao People's Democratic Republic use young rattan shoot as vegetable too. The Forest Research office, Royal Forest Department of Thailand is now launching an extension programme on growing rattans for edible shoots in the northeastern and aims at extending it to the north, the central part and also to the south.

In Thailand there are more than 3000 rai (6.25 rai = 1 hectare) edible rattan shoot in Varij phoom, a district of Sakol Nakhon province. And recently the rattan for edible shoot has been cultivated at Ban Non-suka phoom, Kabinburi district, Prajinburi province. These rattans give shoots throughout the year and they give more shoots in rainy season. The rattan shoots are mostly used to make a curry called "Kang om vine". However, they can be fried as other vegetables. But the shoots have to be blanched to reduce bitterness before frying.

The study on rattan plantation for edible shoot on Sakol Nakhon province by Wanida and Yanyong. (8) had given many valuable sources for

shoot processing such as the shoot produced in a day during rainy season (table1); the comparison of the shoots produced in rainy season and dry season and also the cost benefit of rattan cultivation in 8 rais are shown in table 2 and 3.

The study on rattan nutritive values for edible shoot by Hu Chao Zhong (1984) and Liu Yaorong *et al.* (1985) has reported about the nutritive values of *Calamus sp.* and *Calamus Simplicifolius* . The detail is show in table 4.



Fig. 1 Edible rattan shoot

Table 1 The quantity of rattan shoots in rainy season.

District	No. of distributors	No. of shoots per one distributor	No. of shoot per day
Muang	22	120	2,640
Kootbark	24	100	2,400
Kusumal	1	80	80
Kamtakla	1	100	100
Towngoy	3	70	210
Namoon	3	80	240
Banmuang	3	80	240
Pannanikom	6	80	480
Pangkon	2	80	160
Vanornnivas	2	105	210
Varijaphum	7	90	630
Koksrisupan	4	80	320
Sawangdandin	3	80	270
Songdown	2	90	180
Agasamnuay	2	100	200
Total			8,360

Table 2 The estimated production of rattan shoots in 1992 (Unit: shoot) in Sakon Nakhon province.

Locality (District)	Per day (rainy, survey)	Rainy season (90 days)	Dry season (30% production, estimated)	Total
Muang	2,640	237,600	71,280	308,880
Kootbark	2,400	216,000	64,800	280,000
Kusumal	80	7,200	2,160	9,360
Kamtakla	100	9,000	2,700	11,700
Towngoy	210	18,900	5,670	24,570
Namoon	240	21,600	6,480	28,080
Banmuang	240	21,600	6,480	28,080
Pannanikom	480	43,200	12,960	56,160
Pangkong	160	14,400	4,320	18,720
Vanornnivas	210	18,900	5,670	24,540
Varijaphum	630	56,700	17,010	73,710
Koksrissupan	320	28,800	8,640	37,440
Sawangdandin	270	24,300	7,290	31,590
Sorngdown	180	16,200	4,860	21,060
Agasamnuay	200	18,000	5,400	23,400
Total	8,360	752,400	225,720	978,120

Table 3 The cost benefit analysis of rattan cultivation in 8 rais.

Item	Year				
	1	2	3	4	5
<u>Cost</u>					
- Ploughing twice	2,000	1,920	1,920	1,920	1,920
- Seedling (2,000 x 20 B)	40,000	-	-	-	-
- Labour cost					
(2 men x 50 B x 12 days)	1,200	-	-	-	-
(2 men x 50 B x 12 days)	-	2,000	-	-	-
(2 men x 50 B x 12 days)	-	-	5,000	5,000	-
(2 men x 50 B x 12 days)	-	-	-	-	6,000
- Agriculture tools	600	-	-	-	600
- Tools for harvesting	-	500	-	-	-
- Accessories for seedling production	-	-	3,100	3,600	3,100
- Interests	-	3,504	4,137.92	5,270.52	6,533.77
Total cost	43,800	7,924	14,157.92	15,790.52	18,153.77
Accumulative cost	43,800	51,724	61,881.92	43,672.44	18,153.77
<u>Revenue</u>					
- Shoot quantity (unit: shoot)		(2,000)	(12,000)	(20,000)	(20,000)
- Shoot (2B/shoot) revenue		4,000	24,000	40,000	40,000
- Seedling quantity			500	1,500	1,500
- Seedling (20B/seedling) revenue			10,000	30,000	30,000
- Total revenue		4,000	34,000	70,000	70,000
Benefits	-43,800	47,724	27,881.92	26,327.56	51,846.23

Unit : Baht

Table 4 A composition of Nutritive Values in Edible Rattan Shoot, Bamboo shoot and Vegetables.

Species	Energy Kcal/100g	Protein mg/100g	Fat percent	Fiber mg/100g	Total sugar mg/100g	Ca ppm	Mg ppm	Zn ppm
Calamus sp.	63.5	4120	0.42	1130	3220	1614	117.68	48.9
Calamus	48.48	3010	0.468	801	44	515	40.6	323.9
Simplicifolius	40.72	1930	0.487	665	25	675	43.6	169.5
Daemarocrope Margaritae Bamboo shoot (27 varieties)	21	2650	0.49	580	2500	12	-	-
Vegetables (11 varieties)	27.58	1450	0.16	940	5060	63	-	-

*HU Chaozhong 1984. Liu Yaorong et.al. 1985.

Development of rattan for edible shoots in the Lao People's Democratic Republic (2)

Although globally rattan is seen principally as a cane-producing plant, in the Lao People's Democratic Republic (and also in northeastern Thailand) rattans also supply edible shoot tips. These are consumed locally or exported to Southeast Asian communities in France, the United States and elsewhere.

The trade in edible rattan shoots from wild plants is large, unquantified and essentially unregulated. *Daemonorops jenkinsiana* thrives in the north in areas of shifting cultivation and appears to be the main source of shoots for the markets there. Its profusely clustering clumps survive fire, deforestation and repeated shoot removal very well. The cane of this species is not highly sought after, so trade in its shoots has little effect on overall commercial cane production. However, in some places valuable cane producing species are targeted, and this trade is of greater concern.

Rattan plantation development is beginning to get under way in the country, and plantations for edible shoot production are a dynamically growing subsector. Small-scale nursery trials have been made for six or seven species with commercial potential. Only one or two very small trials of plantations for cane productions have begun, but one species (*Calamus tenuis*) has already become a major commercial success in plantations for edible shoot production (Sengdala and Evans, 1999; Belcher, 1999; Evans and Sengdala, 1999). Many fields begin producing saleable shoots only a year or so after planting and can then be harvesting monthly for many years thereafter, offering a return that is competitive with rice production. Rattan prefers sites where regular flooding would damage most other crops.

In the Lao People's Democratic Republic the techniques for rattan cultivation for edible shoot production were first developed in 1994, inspired by large-scale commercial planting in Thailand of three species (mainly *Calamus viminalis* with some *Calamus siamensis* and *C. tenuis*) which began three years earlier (Jarenrattawong, 1997; Evans and Sengdala, 1999) It is estimated that more than 50 planters have planted areas of more than 100 ha planted in at least five provinces.

The outlook for expanding edible shoot production is much better than that for cane production. There is a large domestic market, and the Lao People's Democratic Republic competes only with Thailand in supplying the export market. Furthermore, planting is spreading rapidly without the need of special policy support because, unlike cane, shoots of *C. tenuis* offer a rapid and proven return on the open market.

The edible shoot sector seems to be the most promising area for support of rattan development. The Lao Forestry Research Centre, Oxford University and Kew Gardens (the latter two are in the United Kingdom) have drawn up a programme, and funds are currently being sought.

The shoot subsector could also offer some spin-off benefits for the cane sector. The plantations have little potential for conversion to cane production because the rattan is grown in open sun with no available climbing supports. However, the abundance of cheap seedling and the widespread expertise in growing these species will make cane plantations easier to establish if economic conditions become attractive in the future.

Properties and uses of rattan

Rattans are very useful in pharmaceutical. Some types of rattans for example *Calamus rotang* Linn., *Calamus ornatus* Blume, and *Calamus acathophyllus* Becc. Etc. use whole plant for making medicine.

Perry, L. M. (1980) reported that *Calamus acathophyllus* Becc. Is prescribed for treating malaria and jaundice; the roots are part of a compound preparation against nausea.

Burkill, I.H. (1966) found that *Calamus ornatus* Blume, the ashes of its stem are used in treating chronic or returning, yaws. An infusion of the root is drunk to lessen pain in child-birth and ethanol (50%) extract of aerial parts antianeur.

In central and south India found that the *Calamus rotang* Linn., the roots are astringent, acrid bitter, cooling, expectorant, alexeteric, antidyenteric, hypotensive, depurative, antiinflammatory, diuretic, febrifuge and tonic. The leaves are acrid, bitter, cooling, astringent and laxative and are useful in vitiated conditions of pitta, skin diseased, leprosy and pruritus. The seeds are astringent, acrid, sour, depurative and expectorant, and are useful in vitiated conditions of kapha, cough, skin diseases and pruritus. The sprouts are acrid, sweet and thermogeni and are useful in tithed condition of vata and kapra. (Sala, 1994)

2. Rattan shoot productions: Canning, sun-drying and dehydration of rattan shoot

Introduction

As fruits and vegetables are perishable items, therefore these can not be stored without putrefaction under ordinary conditions. This aim can be achieved either by sun-drying or by dehydration, the former one being suitable for tropical and subtropical regions while the latter one can be used anywhere, which involves drying of fruits and vegetables under controlled temperature and humidity conditions. This is more common, modern method and extensively used throughout the world.

A part from drying dehydration, canning is another vital aspect of their preservation. In canning also the technique adopted is not universal and need changing conditions for different fruits and vegetables. This too requires certain preconditions to be fulfilled before they are actually canned.

Different fruits and vegetables require different types of cans, varying strengths of brine or sugar syrup, exhaust condition and processing times.

Rattan shoot is a vegetable, so it is included with other vegetables.

Raw material:

Rattan shoot, which is used for canning, sun-drying or dehydration is the soft edible part of the shoot after removing the hard covering part. It is white or cream in color with a little bitter characteristic taste. The taste which is accepted by consumers.

Pre-treatment:

Rattan shoot after peeling gets deterioration rapidly due to oxidation of enzymes. This can be stopped by keeping the peeled shoot in 0.1 percent sodium metabisulphite solution.

Canning of rattan shoot

Various processes for canning of rattan shoot.

1. Cutting and grading:

The rattan shoots are cut into equal length and they are graded to obtain a pack of uniform quality as regards to size, color etc.

2. Pre-treatment:

During cutting and grading the shoots are put in 0.1 percent sodium metabisulphite solution.

3. Blanching:

The cut shoots are blanched in 0.1 percent sodium metabisulphite solution acidified with 0.5 percent citric acid. The blanching time takes 10 minutes, follows by cooling in 0.1 percent sodium metabisulphite solution. This will help to eliminate microorganism inactivate enzymes and also reduce bitterness of the rattan shoots.

4. Can filling:

The cans are filled with either 2 percents hot brine solution or 10⁰Brix hot syrup solution.

5. Exhausting:

It is necessary to remove all air from the contents.

6. Processing:

Rattan shoot likes small bamboo shoot (*Thyrstachys siamensis*) in its structure. The small bamboo shoot can be processed in boiling water. Therefore rattan shoot may be able to be processed in the same way.

Experiment on canning of rattan shoot.

(In this experiment, bottles are used in place of cans)

Experimental data:

1. The soft edible part of the rattan shoot which is used for canning, sun-drying or dehydration is about ten percents of the whole rattan shoot.
2. Approximate lengths of rattan shoot is 3.25 inches.
3. Approximate diameter of rattan shoot is 0.25-0.50 inches.
4. Approximate number of the rattan shoot in one bottle is 15-20 pieces
5. Bottle's capacity is 6 oz.

Procedure:

Rattan shoots are peeled, cut and graded then put in 0.1 percent sodium metabisulphite solution. They are blanched in sodium metabisulphite solution, acidified with citric acid, followed by cooling in 0.1 percent sodium metabisulphite solution. After that the shoots are arranged in bottles, filled with either hot brine or hot syrup solution up to a level (a head space is 4.5 millimeters). They are exhausted for ten minutes then the cap is closed on each bottle. These bottles are immediately processed in boiling water for 30 minutes, then they are taken out of the boiling water and let them cool in open air. After cooling, the bottles are labeled and stored at normal temperature.

Examination of the rattan shoot production

1. The rattan shoot in bottles were examined for microorganism at a period of 3 months, 6 months by Department of Medical Science.
2. The fresh rattan and rattan shoot in bottle were analyzed for nutritive value by nutrition division, Department of Health.
3. Sensory evaluation of rattan shoot in brine and rattan shoot in syrup by 55 panelists from people in Sakon Nakhon and Bangkok provinces. The interval number has value 1-5, one scale of degrees of like (hedonic) : 1 = dislike very much, 2 = dislike slightly, 3 = neither like nor dislike, 4 = like slightly, 5 = like very much

Results :

1. There is no microorganism founds in rattan product. The detail is shown in table 5.
2. The result of nutritive value of fresh rattan and rattan products are shown in table 6. The nutritive value of rattan products showed little change from fresh rattan shoot in protein, fat and fibre. The energy (Kcal) of rattan shoot in syrup is more than rattan shoot in brine and fresh rattan. Because sucrose in syrup give energy.
3. The result of sensory evaluation between two treatments, rattan shoot in brine and rattan shoot in syrup are shown in table 7. From the table 7, means of sensory evaluation is between 3.69 to 4.90. So the result is between neutral to like slightly. It means that the products is accepted by panelists.

Table 5 The analysis of microorganism in the rattan shoot products.

Name	pH Value	Bacteria	Yeast and Mould
Rattan shoot in syrup	4.3	Not found	Not found
Rattan shoot in brine	4.3	Not found	Not found

Note: Acid resistance bacteria (at 37 °C and 55 °C)

Department of Medical Science, Ministry of public Health, 2002.



Fig. 2 Canning of rattan shoot

Table 6 The Nutritive value analysis of 100 grams edible part.

Sample name	Fresh Rattan shoot	Rattan shoot in brine	Rattan shoot in syrup
Energy (Kcal)	32	28	80
Moisture (g)	92	92	80
Protein (g)	2.51	2.19	3.20
Fat (g)	0.62	0.70	0.66
Fibre (g)	2.53	NA	NA
Vitamin A (RE)	2	3	NA
Vitamin B1 (mg)	0.16	0.04	NA
Vitamin B2 (mg))	0.13	0.07	NA
Vitamin C (mg)	14	4	NA
Vitamin E (mg)	0.45	0.85	NA
Sodium (mg)	10.8	224.0	25.3
Potassium (mg)	361	148	87
Magnesium (mg)	48	33	26
Calcium (mg)	69	40	52
Ion (mg)	0.45	0.42	0.21
Zinc (mg)	2.81	1.61	1.51
Copper (mg)	0.31	0.14	0.20
Iodine (microgram)	2.4	41.5	4.4

Note : NA = Not Analysis

RE = Retinal equivalent (Beta-Carotene)

Nutrition Division, Department of Health, Ministry Public Health, Bangkok, 2002.

Table 7 The sensory evaluation of rattan shoot in brine and rattan shoot in syrup.

Product	means				
	color	odor	flavor	texture	acceptance
rattan shoot in brine	3.80	3.69	3.76	3.80	3.80
rattan shoot in syrup	3.98	3.89	3.82	4.09	3.95

Note :

- 1 = dislike very much
- 2 = dislike slightly
- 3 = neither like nor dislike
- 4 = like slightly
- 5 = like very much

Conclusion:

This rattan shoot product is in good texture, color and flavor. There is no difference between the fresh rattan shoot and the processed rattan shoot, when it is used to make a curry. (This consumer test is done on 5 local people of the rattan growing area.) The rattan shoot canning industry, the processing should be done in a retort under the steam pressure of 10 pounds per inch, in 15 minutes for 6 oz. bottle, instead of taking 30 minutes in processing under boiling water.

The rattan shoots which are packed in brine or syrup, one used as raw material for further food processing such as “Kang-vai”

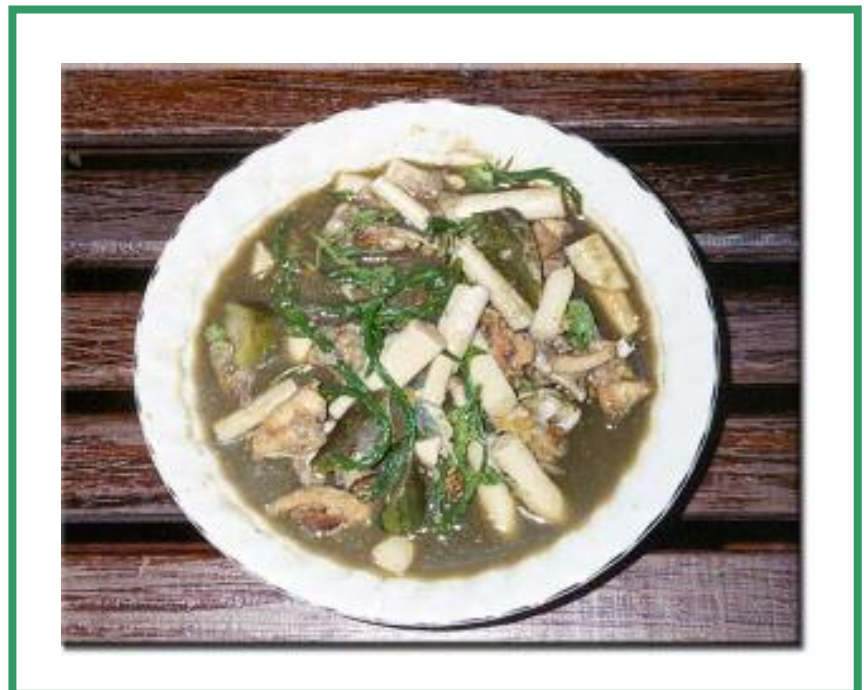


Fig. 3 Kang-vai

Sun-drying and dehydration of rattan shoot

Thailand is a sub-tropical country so it is good for the sun-drying and dehydration of rattan shoot.

Experiment on sun-drying and dehydration of rattan shoot.

Experimental data :

1. The soft edible part of the rattan shoot which is used for sun-drying and dehydration is about ten percents of the whole rattan shoot.
2. The dehydration ratio is 8 :1
3. The rehydration ratio is 1 :3.
4. Moisture content of the product is 6 percents. (U.V. Moisture tester).

Procedure :

Rattan shoots are peeled, cut into pieces suitable for making curry, then put in 0.1 percent sodium metabisulphite solution acidified with 0.5 percent citric acid. The blanching time takes 10 minutes, follows by cooling in 0.1 percent sodium metabisulphite solution. After cooling the shoots are drained and spread on mats or trays and keep in the sun for drying. The sun-drying product will take three to four days to be dried up. However, dehydration of rattan shoots at 70 degree Celsius take about 10 hours. And the product is better in texture and color.

Results :

1. Drying of rattan shoot is possible for both methods
2. The dehydration product is better in texture and color.

Conclusion:

Dehydration method should be used to dry rattan shoot for commercial purpose. Rattan shoots which are used as medicine, some the rattan shoot

posses a characteristic bitterness and many medicine compounds. The natives of many countries, used rattan shoots as medicine for treatment of many diseases; the shoot and root are boiled in water and the solution is used as medicine. Therefore, the other rattan shoot can be done by drying and grinded the rattan shoots into small pieces, packing in a small pouch to be used as a packed-Ceylon tea. If this is done in industries, the hot air dryer should be used for drying.



Fig. 4 Dehydration of rattan shoot

3. Acknowledgment:

We would like to thank you Nutrition Division, Department of Health, Ministry of Public Health, Bangkok for the valuable analysis of nutrition.

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