

## Kalparasa and Its Value-Added Products

**Bhoomika, H. R. and Sriganda, D. D.**

Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Mudigere, KSNUAHS, Iruvakkki, Shivamogga

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### Introduction

Coconut (*Cocos nucifera* L.) is known as 'Kalpavriksha' in the ancient Indian literatures, which means 'tree that provides all the necessities of life'. It is also called 'The tree of wealth' or 'The tree of life' in other parts of the world. Coconut has many uses, including providing food and oil for millions and ornamental aesthetics.



Kalparasa (coconut sap) in sanskrit means 'life essence' of coconut tree. Coconut sap, normally called as neera, is a natural health drink, which is traditionally collected from the coconut spadix and consumed largely by the rural population. It is the phloem sap, rich in sugars, protein, minerals, antioxidants, vitamins and utilized by the plant for the growth and development of nuts.

The sap is highly predisposed to fermentation and, therefore, collection of fresh and unfermented sap is a challenging task in coconut. Lime is commonly used as a fermentation inhibitor, by coating the inside of the collection container. Even with the lime application, the sap gets partially fermented and becomes unfit to be marketed as a health drink. The fermented sap is called 'toddy' which is a traditional alcoholic beverage. The lack of proper method of collection and suitable inhibitors to prevent fermentation led to the inclusion of both fermented (toddy) and unfermented (neera) sap under the category "toddy".

### Low and fluctuating price of coconut products

Compared to most other oil-bearing crops, yield from coconut is very low. On the average, one hectare of coconut yields about a ton as compared to oil palm's four tons. The situation is further worsened by the increasing area of coconut getting senile. Numerous pests and diseases have further reduced productivity coconut plantations are affected by root wilt and an effective control measure has yet to evolve. According to reports, the disease is causing an annual loss of 1000 million nuts or about 150 000 tons of copra equivalent, in Kerala State.

In Indonesia, there is the natuna wilt. Bud rot disease is, however, common to most countries. But in some cases, the cause of certain disease has not been identified. Natural calamities, which most often are unpredictable, likewise cause heavy toll on the industry.

#### **Traditional method of sap collection (Neera):**

The initial preparation of the spadix to be tapped is same as described above. As soon as the sap starts oozing from the cut surface, tappers apply clay, some type of gummy material or leaf extract to the sliced surface. Though, tappers say it stimulates the flow of sap, it appears to prevent the internal seepage of the sap in the space available between the peduncles. Because of the upright or vertical (forms an angle of 20 to 300 to the main axis) position of the spadix in the crown, the sap from the cut end doesn't easily trickle to the pot below, instead it moves along the surface of the spadix. Hence, a coconut lamina is tied along the circumference of the cut end through which the sap trickles down to the pot.

The sap is then collected in an open earthen pot or bamboo sac connected to the cut end of the spadix. In order to prevent fermentation of sap, lime is coated on the inner surface of the pot. The sap collected by this method is oyster white in color and emanates a harsh odour. The sap collected without applying lime is used exclusively for the preparation of toddy, an alcoholic drink. Since, the sap is collected in the open it is often contaminated by insects, ants, pollen and dust particles in addition to the chemicals, clay or leaf extract.

#### **CPCRI method of sap collection (Kalparasa):**

In the sap collection method developed at the institute a simple connector as described below is attached to the cut end of spadix, instead of the traditional application of clay or other materials, to ensure the free flow of hygienic sap and a coco-sap chiller is connected for the collection of sap, instead of the traditional earthen pot.

#### **Advantages of CPCRI ice-box technology over traditional method of collection.**

1. The sap collected is zero alcoholic, fresh and hygienic sap is devoid of lime, clay, leaf extract
2. etc.,
3. Free from contamination by insects, ants, pollen and dust particles.
4. Freshly collected sap can be preserved fresh for long duration under freeze or sub zero
5. condition ( $<0^{\circ}\text{C}$ )
6. The sap collected by this method is a ready to serve natural health drink.

7. Products like natural coconut sugar, jaggery, confectionery and honey can be prepared without the addition of lime and other chemicals.
8. Since it is completely closed system no emission of volatiles and thus do not attract harmful
9. insects to coconut palm
10. Fabrication is simple and parts required are relatively cheaper and can be prepared from locally
11. available material.
12. It is easy to operate and anyone can adopt it with one- or two-days training.
13. The device is not only suitable for the collection of sap from coconut but also can easily be connected to other sap yielding palms.
14. It is easy to handle as compared to the traditional method and hence, men and women (who are skilled climbers) can easily tap for Kalparasa.

#### Quality attributes of Kalparasa

Distinct differences are noticed between the Kalparasa/neera collected by CPCRI technique and traditional method as shown in Table 1 and Fig. 11. Fresh sap collected by CPCRI technique is slightly alkaline in pH, golden brown or honey colour and sweet and delicious.

Fresh sap when left exposed to atmosphere undergoes initial lactic acid fermentation, middle alcoholic fermentation and final acetic fermentation consequent on the action of micro-organisms. As the sap gets fermented, it becomes acidic and the pH reduces. The freshly collected sap starts fermenting within 2 to 3 hours under ambient temperature and the pH starts declining. The pH of completely fermented sap is around 3.5. The sap stored in freezer (-1 to -3°C) remains fresh and no change in pH is observed. Fresh sap (pH 7.5) has around 15% sugars. It decreases to about 6% at pH 4. During the same period, the reducing sugar level increases up to 5%. Therefore, to be sold as fresh juice the sap should have a pH of around 7, golden brown color, sweet and delicious and free from debris. Sap with pH less than 6.5 cannot be used for fresh juice or sugar preparation.

**Table 1: Quality attributes of Kalparasa and neera**

Attributes	Kalparasa	Neera
Soluble solids	15.5 to 18	13 to 14
pH	7 to 8	6 or below 6

Colour	Light orange and honey color	Oyster white
Debris, insects, pollen, dust	Absent	Present
Flavour	Sweet and delicious	Harsh odour
Pathogens, chemicals and extraneous matter	Absent	Present
Microbial load	Low	High

#### Biochemical constituents:

Kalparasa is rich in sugar, minerals and proteins. It is also a rich source of phenolics and ascorbic acid. Kalparasa contains high amounts of essential elements such as N, P, K, Mg and micronutrients (Zn, Fe, and Cu). The biochemical constituents, minerals and vitamin composition of Kalparasa. Since, it is rich in minerals and vitamins it is considered as one of the best natural health drinks. It can be promoted as an instant energy provider, as a functional food or nutraceutical drink. It is good for persons in post operative care due to high content of electrolytes. It is a body cooler and is good for digestion and with no known side effects. Frequent consumption of Kalparasa is to prevent diseases like jaundice and keeps one healthy. It is best consumed during summer.

**Table 2: biochemical and mineral composition of kalparasa (per 100ml)**

Biochemical parameters	Average
pH	7.18
Total sugar(g)	15.18
Reducing sugar(g)	0.554
Amino acids (g)	0.245
Protein (g)	0.165
Phenolic (mg)	5.100
Antioxidant activity (mM TE)	0.321
Sodium (mg)	90.60
Potassium (mg)	168.4
Phosphorus (mg)	3.900
Manganese (mg)	0.012
Copper (mg)	0.031
Zinc (mg)	0.020
Iron (mg)	0.053

**Table 3- Vitamin content in fresh coconut sap**

Vitamin	Value (mg/100 ml)
Thiamine	77.00
Riboflavin	12.20
Pyridoxal	38.40
Pantothenic acid	5.200
Nicotinic acid	40.60
Biotin	0.170
Folic acid	0.240
Inositol	127.70
Choline	9.00
Vitamin B12	Trace
Vitamin C	17.50

### Health benefits of Kalparasa

A recent study conducted by the Indian Institute of Science; Bangalore shows that neera can help cure liver diseases. The study proves that neera is particularly useful in treating liver diseases following consumption of alcohol. The magical property of neera to remove "acetaldehyde" (the toxic metabolic product of ethanol causing liver damage) was proven in the study. It has also been shown to boost the activity of a normally functioning liver.

Neera is safe and perhaps the best health drink for persons suffering from diabetes. This is because of its low glycemic index (GI). The GI is a measure of how quickly and how high a particular food item raises the blood sugar level by releasing glucose into the blood stream. The use of neera and its by products gives the same sweetness without causing spikes in blood sugar level compared to the traditional sweetening agents.

It has been medically proved that Neera is better than mineral water and it also has less calorific value, apart from being sweet and delicious. Neera could become a nutritious drink offering a healthy alternative to aerated beverages if it is commercialized in a proper way.

### Tapping techniques

#### Selection of palm and inflorescence:

Coconut trees can be tapped at an early age as soon as it attains yield stability. Generally, healthy trees which bear more fruits tend to yield more sap. Tapping is done in unopened inflorescence. The development of female flowers inside the spathe (about 60 cm

long) causes a swelling at the base, which is an indication of appropriate stage for tapping (Fig. 1a). The inflorescence selected for tapping is first tied around with a strong coir or plastic rope to prevent it from bursting (Fig. 1b). The spadix is then trained by a gentle uniform beating using a mallet (Fig. 1c) and hand massaged (using the palms) (Fig. 1d) all over, twice a day, in the morning and in the evening for a week. After 4-5 days of stroking, 7-10 cm tip is sliced off (Fig. 1e) and in a week's time sap starts oozing out from the cut.



**Ideal palm**



**Ideal spadix ready for tapping**



**Spadix tied with rope**



**Uniform beating using a mallet**



**Massaging the spadix**



**Slicing stip after 4-6 days of stocking**

### **Tapping frequency:**

Tapping is done twice a day (in the morning and evening). Each time 1 to 2 mm spadix is sliced using a sharp knife and can be tapped in this way for 40 to 45 days, depending on the tapper's skill, seasonal conditions, and nature of the palm. A single spadix can be tapped until it is reduced to a stump of about 10-15cm length. About three weeks before reaching this point, another spadix is prepared in order to ensure continuity of sap production. At a time, two to three spadices can be tapped simultaneously from a tree.

### **Kalaparasa yield**

Sap yield is influenced by both genotype and environment; it varies from day to day, season to season, spadix to spadix and tree to tree. Talls and hybrids are known to produce

more Kalparasa as compared to dwarfs. A healthy tree can produce 1.5 to 3.0 l of sap per spadix per day and can produce on an average 60 to 80 l of sap in 40 to 45 days. Coconut produces 12 to 14 spadices per year almost one per month. Even if six spadices are tapped and the remaining are allowed to produce nuts, around 400 l of sap and few fruits can be produced. The sap yield is also influenced by the skill of the tappers. Highly skilled tappers can tap the spadix for two months as against 30-45 days of average tapping period.

### **Shelf-life enhancement of Kalparasa**

Concerted efforts have been made to improve the shelf life or extend the storage period of Kalparasa so that it can be transported to distant places for marketing. Some of the commonly used techniques are sanitation, refrigeration, filtration, centrifugation, deaeration, pasteurization etc. in addition to the use of commonly available preservatives. However, most of these have been used to purify fermented neera (improving pH value, removing odour etc.), and make it a palatable drink and improve the shelf life. However, it is relatively easy to process and improve the shelf life of Kalparasa collected by CPCRI method where in the juice quality is intact. Simple pasteurization of the unfermented sap in polypropylene (PP) bottles could extend the shelf life of kalparasa up to 45 days at 4°C to 6°C, which otherwise required to be stored at -1 to -30°C. The pasteurized and bottled sap maintained all the qualities of fresh Kalparasa as shown in Table 4 except for slight decrease in delicacy. More importantly this bottled sap is devoid of preservative.

### **Value Added Products**

**Coconut sugar, jaggery and honey:** Kalparasa contains about 15% sugars and considerable amount of nutrients, which can easily be converted to various value-added products. Coconut sugar, jaggery and honey are obtained by evaporating the water of unfermented sap at 115°C. The viscous and fairly thick hot sap (Brix 60 to 70) is cooled to get coconut honey or syrup. Further heating, the sap become more viscous and thicker in consistency, is poured to moulds of either coconut leaf or steel to obtain jaggery.

Thicker consistency of the syrup upon further heating, with continuous stirring to avoid charring forms sugar granules. At this stage the liquid will change into crystal form and it is immediately cooled. While cooling, it is stirred continuously to break the lumps. The sugar obtained is sieved to get uniform particle size and to produce quality product.

Traditional heating and evaporation method in open pans for processing value added products is cumbersome and can affect quality due to non-homogeneous heating. Alternatively double jacketed oil filled vessels ensure uniform heating and better-quality products. Conversion ratio for coconut honey is 51:1 kg honey.

Coconut sugar is also known as coconut palm sugar, coco sugar or coco sap sugar. Unlike cane sugar which supplies only calories, coconut sugar supplies calories and nutrients. It has high mineral content as compared to brown sugar and refined cane sugar, and is a rich source of potassium, magnesium, zinc and iron. When compared to brown sugar (prepared from sugar cane molasses), coconut sugar has double the amount of iron, four times the amount of magnesium and over 10 times the amount of zinc. In addition to this, it contains all essential amino acids required for protein synthesis, and rich in B complex Vitamins like B1, B2, B3 and B6.

#### **Sweets and confectionaries from Kalparasa:**

Kalparasa has high potential for value addition due to its health benefits. Sweets and confectionaries prepared from normal sugar and jaggery can be prepared by substituting with kalparasa sugar/jaggery/syrup/honey. Some of the products which can be produced from kalparasa include spicy Jaggery, cookies, chocolate, neera cake, fruit spread, squash, ice-cream etc. Diversified products could be produced from coconut neera by adopting simple technologies requiring not much of capital investment. At house hold levels, it could provide employment opportunities to a sizeable population. When the production is organized in a cooperative sector like Farmer Producer Organisations (FPOS), adequate quality control is necessary for the production of good quality products.

#### **Future prospects**

The recent advancements in fresh and unfermented coconut sap collection, bottling and processing into value added products and its health benefits has led to a sudden surge in domestic market for Kalpa Rasa and domestic and international market for coconut sugar. Apart from assuring stable and lucrative income to the coconut farmer, switching to Kalpa Rasa tapping provides multiple advantages to economy, environment, farmer and consumer, as listed below: Infusion of billions to GDP and that too in a de centralized and distributed form (to farmers, labourers, retail sales, technicians etc.).





The potential to develop new and indigenous technologies for Kalparasa by-products (Honey, Sugar, Jaggery) and value added products (ice creams, toffees, syrups, jam, pudding, cake, snacks etc.) would be a boost to the local economy. Coconut growers in most of the countries are small farmers. The low and unpredictable world prices for copra and oil has resulted in a scenario where it has become increasingly difficult for small farmers to depend on coconut production for their livelihood.

Experiences from countries where coconut is allowed for tapping like in South Sumatra suggest that it is 8 to 10 times more profitable than selling nuts. A tapper earns per day two to three times more than a field worker. An important advantage for the tapper is that he has a daily income throughout the year. Similarly, in Philippines, a sequential coconut toddy and nut production system is able to provide the small-scale coconut farmers with incomes nearly 10 times higher per hectare and per year compared to the traditional practice of producing nuts only.

Organic cultivation is practiced at least in certain regions like Lakshadweep Islands of the country. Many farmers in other states too have recently turned towards organic cultivation of coconut. Hence, there are high prospects of production of organic coconut neera/sugar and its export in the international market.

Adoption of CPCRI technology for the collection of fresh, hygienic and unfermented sap and its sale in roadside kiosks has showed very encouraging results, for its promotion as ready to serve drink. Promotion of this technology will help to revive the economy of the coconut sector. Many rural areas are likely to benefit from a new source of self-employment and sustainable income once the potential of tapping palm trees for ready to serve drink or sugar production has received the full attention it deserves from policy makers.

It is estimated that even if 10 per cent of the 2 million ha coconut trees in the country are tapped, with conservative yield of a litre a day, 36,000 crores can be generated annually of which 25 to 30 per cent will be the farmer's share. It is expected to improve the livelihood of coconut farmers, generate employment opportunity to rural youth and women and provide nutritional security.

### **Conclusion**

Coconut inflorescence sap collected using novel CSCM is fresh, unfermented and devoid of extraneous materials compared to sap collected by traditional method. Nutrient

richness makes coconut sap superior than other fruit juices. As sugar and other nutrients are preserved in sap collected by CSCM, it could be easily processed into various value-added products like sap concentrate and coconut sugar without addition of chemicals. These products are rich in vitamins, phenols, flavonoids and antioxidants. These natural products have huge demand in the domestic as well as international market. Kalpa Rasa is superior over sugar palm and sugarcane juices in nutritional properties and antioxidant activities.

