



## Value addition in palmyra palm (*Borassus flabellifer* L.): A potential strategy for livelihood security and poverty alleviation

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According to the United States Department of Agriculture, value-added agriculture occurs whenever a change in the physical state or form of an agricultural product or the adoption of a production method or handling process leads to an enhancement in the customer base for the product and a greater portion of the consumer's expenditure spent on the product accruing to the producer (Boadu, 2016). By this definition it can be understood that value addition involves change in the physical form of the agricultural produce which leads to its greater acceptability, extended availability, enhanced market viability and increased cost to benefit ratio for the grower of the agricultural produce. The spatial and temporal availability of the produce is enhanced and it becomes less sensitive to price fluctuations in the market. Value addition involves commoditization of the agricultural produce. Therefore, value addition is desirable from both the producer's as well as the consumer's point of view and has aptly been termed as secondary agriculture. India is one of the 12 mega-gene country of the world harboring two biodiversity hotspots *viz.*, the Western Ghats and the Eastern Himalayas. India is bestowed with 49000 species of plants, including about 17500 species of higher plants. It is one of the Vavilovian centers of origin and primary and secondary center of diversity of important cultivated plants of the world (Anonymous, 2007). However, with the increasing population pressure, India is facing serious challenges of food security, unemployment and environment degradation. In order to sustain the agricultural production and address the challenges of food and livelihood security, agricultural diversification has to be adopted while minimizing the dependency on main staple crops (Thakur, 2014). Introduction of new species in the agricultural production system in India is the need of the hour to increase the resiliency of agriculture. India is blessed with a large number of species of minor fruits,

specific to different geographic areas. However, their use is restricted to their areas of occurrence due to lack of value addition. These fruits are suitable candidates for popularization through value addition and income generation and thus livelihood security to the marginal farmers. They can potentially reduce the dependency on few major species while diversifying the agricultural production system and making it sustainable. The family Arecaceae of monocot plants has many species which can be considered as minor fruits and can be subjected to value addition for livelihood security and poverty alleviation. One such species is Palmyra palm (*Borassus flabellifer* L.). It is a promising species in the trumpet vine family,



Arecaceae that is native to Indian sub continent and also found naturalized in South-East Asian countries (Mohan *et al.*, 2016). It is known by various names such as Palmyrapalm, toddy palm or wine palm (Gummadi *et al.*, 2016). In Hindi and its subsidiary dialects it is known as *taad* while the extracted sap from inflorescence is called *Taadi*.

Palmyra palm is referred to as tree of life with several uses including food, beverage, fibre, medicine and timber (Arulraj and Augustine, 2008). It is a multipurpose tree of great utility which plays an important role in the day-to-day life of rural poor of India. The Palmyra palm is described as one of the most useful plant in the peninsular India as the Palmyra palm based processing industries engage a significant chunk of human labour. It is easily cultivated and can be spotted growing in wild, in agricultural fields and sporadically even on wastelands.

For centuries, Palmyra palm has been tapped in order to produce fresh juice (sweet toddy), fermented drinks (toddy, wine, and arak), syrup (honey), brown sugar (jaggery) or refined sugar. Most tapped palm trees do not only produce sap but are multipurpose (edible fruits, building materials, fuel, fibres, wax, etc.) and their socio-economic importance is immense for the rural poor.

Mahatma Gandhi, the father of the nation, reportedly called Palmyra palm, a remedy against poverty (Dalibard, 1999). Palmyra palm is considered as a total palm as each and every part of the tree has economic use. In many parts of the country, Palmyra palm is the main source of livelihood for the poor people as they derive a substantial part of their income from this plant. The different products obtained from different parts of Palmyra palm are described as under.

– *Toddy (Neera)*: The sap extracted from inflorescence of Palmyra palm is called 'Neera'. Neera is typically the most economic produce of Palmyra palm. It is good source of minerals like calcium, phosphorus and iron and vitamins like vitamin A, niacin, thiamin and riboflavin. Neera acts as laxative and diuretic. Alcohol builds up naturally in neera when left undisturbed for a few hours.

– *Endosperm*: Jelly like endosperm of young fruit (60 – 70 days) of Palmyra palm is very nutritive and is a summer delicacy.

– *Tuber (Apocolon)*: Mature tuber is brittle and breaks off easily which is a rich source of carbohydrates. Optimum time for harvesting of tuber is 135 days after sowing.

– *Fruit*: The soft orange-yellow mesocarp pulp of the ripe fruit is sugary, dense and edible. It is rich in vitamin A and C. The ripened fibrous outer layer of the palm fruits can also be eaten raw, boiled or roasted.

– *Spongy haustorium*: The haustorium formed during germination of seed nut is a spongy sweet delicacy.

– *Seedlings*: The peeled seedlings of Palmyra palm are eaten fresh or sun-dried, raw or cooked in various ways. They also yield starch, which is made into gruel, with rice, herbs, chili peppers, fish or other added ingredients.

**Value added products:** Every part of Palmyra palm can be used for value addition and can be processed into a range of edible as well as non edible products (Table 1).

**Edible value added products from Palmyra palm :**

– *Toddy*: Toddy is obtained by tapping the tip of the inflorescence and collecting the dripping juice in hanging earthen pots. The juice so collected before morning is refreshing and the light drink is called *Neera* which is cool in nature. It has a sugary sweet taste. The toddy ferments naturally within a few hours after sunrise. It is locally popular as a beverage called *Tadi*. It is distilled to produce the alcoholic liquor called palm wine, arrack, or arak. Rubbing the inside of the toddy-collecting receptacle with lime paste prevents fermentation and this

sap is called sweet toddy, which yields jaggery, molasses, palm candy and vinegar. The trade involving toddy and associated products is carried out predominantly by the tappers who generally belong to the poorest section of the society. The trade involves indigenous technology and has good employment potential besides being a source of subsistence earning to the tapper community.

– *Toddy palm wine*: The toddy palm wine is an alcoholic beverage made using the fermented flower sap of palm trees. Toddy wine is white and sweet with a strong smell but mild taste. The tapped sap of the palm flower undergoes natural fermentation due to yeast which is present in the sap itself. Fermentation starts soon after the sap is collected and within two hours it becomes reasonably high in alcohol yet less than 4 per cent. However it has a very short shelf life which is 24 hours (Reddy, 2016).

– *Palm jaggery*: It is also called as palm *gur*. It is highly priced due to its nutritional and medicinal properties. It has an earthy, intense taste reminiscent of chocolate. The jaggery is processed from the unfermented tree sap (neera). Initially sap is collected in slacked lime treated earthen pots by tappers. The cleared sap after lime sedimentation and filtration is transferred in to the boiling galvanised iron pan on a traditional furnace and boiled at 110°C. Neera gets transformed in to viscous fluid which is poured in to wooden moulds and allowed to harden. About 8 litres of neera is required to get 1 kg of jaggery. The quality of *gur* can be improved by precipitation of lime with carbon dioxide or citric acid or unripe tamarind fruits before boiling the juice (Vengaiah *et al.*, 2013). Major problem of jaggery storage is blackening of colour in short period.

– *Palm sugar*: Neera, free from debris is boiled in an alloy vessel adding small quantity of superphosphate. After uniform boiling the liquid is allowed to cool. After removal of sediments it is heated to 110°C for 2 hours until it reaches honey like consistency. The fluid is then allowed to cool and poured in to a crystallizer. After forming sugar crystals, it is centrifuged to collect sugar and dried and powdered to store.

– *Palm tamarind candy*: Neera is heated for 2 hours to obtain the honey like consistency. The syrup is then transferred to mud pots. Ripe, dry and shelled tamarind fruits devoid of seeds are added in to the syrup. About 1 kg of fruit is required for 10 litres of syrup. The pot is closed tightly with cloth and vessels are kept in a shock proof, cool and dry place for 130 to 180 days. Sugar crystallises on the sutures of tamarind and the fruits turn into delicious candies.

**Table 1 : Value addition in palmyra palm**

Plant part	Value added products
<b>Edible value added products</b>	
Inflorescence sap	Toddy, Jaggery, Sugar, Honey, Wine
Fruit	Toffee, Spread, Jam, Pickle, Sweets (Burfi), Beverages (RTS, Squash, Nectar)
Kernel	Canned products
<b>Non-edible value added products</b>	
Leaf	Mats, Baskets, Fans, Hats, Umbrellas, Buckets, Writing Material, Fence, Fibre extracted is used to make brushes and handicrafts
Fruits	Fibre extracted is used to make toys and fancy items
Stem	As poles for sheds construction and as timber source.

– *Palm spread*: For the preparation of palm spread, firstly the fruit pulp is extracted by using water (1:1) and heat (70° C for 10 min) to ensure maximum pulp recovery. The extracted pulp is mixed with other ingredients (sugar, skim milk powder, small cardamom and citric acid) and heated on a low flame with continuous stirring till the TSS reaches 65–68 °Brix. Cooked material is then removed from heat, filled into broad mouth sterilized bottles, capped, labeled and stored (Chaurasiya *et al.*, 2014).

– *Palm toffee*: Palm toffee is prepared by mixing fruit pulp with sugar, skim milk powder, glucose, maida and starch as ingredients. The mixture is cooked with constant stirring for up to 40 minutes. The end point is determined following drop test in water. The container is then removed from heat; the toffee mixture is spread on an aluminium tray which is smeared well with oil/butter and kept overnight in air. Then the toffees of desirable size and shape are cut, wrapped with butter paper and stored at room temperature (Diwate *et al.*, 2004).

– *Palm burfi*: For palm burfi preparation, khoa, butter and lime water are used along with fruit pulp and sugar.

– *Palm Pickle*: Small fruits of Palmyra palm are pickled in vinegar.

– *Canned Palm*: Jelly-like kernels of half grown soft shelled seeds of palm are canned in clear, mildly-sweetened water for exportation purposes.

– *Other products*: Ripe fruit pulp can be processed into soft beverages, jam and other delicious food items and sweets.

#### **Non-edible products from palmyra palm :**

– *Leaves*: The leaves are used for thatching roofs, screening as fence, as mats, baskets, fans, hats, umbrellas, buckets, sandals etc. Senesced leaves are utilized as fuel for cooking. The leaves after using for thatching and fencing when replaced are used by the farmers as organic fertilizer.

– *Matured fruit*: Mesocarp of the matured fruit yields small quantities of fibre. This fibre is used for making fancy decorative items and toys.

– *Stem*: Palmyra palm trunks are used either as live poles in construction of thatch sheds or as timber in replacement of wooden poles.

**Petiole and leaf blade**: Tough and long fibre extracted from petiole is used for making of ropes used in building of houses and boats. The fibre extracted from leaf blades is hard, stiff and very resistant. The petiole fibre and leaf blade are used to make products such as brushes and handicrafts artifacts etc.

A significant proportion of rural population from the natural ranges of palmyra palm in India is involved in obtaining and preparation of different products from different parts of palmyra palm trees. It is one of the best example of indigenous value addition and generally does not involve any sophisticated technique or equipments. Therefore, palm-based processing industries seem to be suitable and viable alternative for sustainable livelihood of the poor communities involved in palm growing and processing. Value addition in palmyra palm may assist in development of rural communities through small-scale investment. It has also contributed in conservation of elite germplasm, enhanced marketability and increased income. Post-harvest technology of palmyra in relation to value added products like *neera*, jaggery, palm sugar, candy, based products, tuber based bakery products, pulp based beverages and spongy endosperm needs to be refined and popularised. Many types of value added products from Palmyra palm are being produced at both household and commercial levels in the natural range of palmyra palm. It is necessary to employ modern methods to extend storage life of the value added products from palmyra palm for better distribution and also processing techniques to preserve them for utilization in the off-season. Moreover,

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