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## Value addition in underutilized fruits

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**Abstract**

A large number of underutilized fruit species have originated in Indian subcontinent. Many of these fruits or their plants parts have been used in folk, Ayurvedic and Unani medicines since time immemorial. Several fruits were introduced in India during colonial period. Most of them adapted to climatic conditions of India but remains underutilized crops. These fruits also have several medicinal properties and were used by the native people of their respective origin of centres. Some the fruits such as bael, aonla, jamun, tamarind, karonda, wood apple, kokum etc were known for their use in Indian pharmacopeia. The exotic fruits such as sour sop, rambutan, mangosteen, avocado, water apple, durian, passion fruit, carambola etc. have been reported for their different medicinal importance. Many underutilised fruit species originated in the Indian subcontinent. Many of these fruits or the parts of their plants have been used for a very long time in conventional, Ayurvedic, and Unani treatments. Several fruits were introduced to India during the colonial era. Despite being neglected crops, the bulk of them have adapted to the Indian climate. Since these fruits also have a lot of medical properties, the native people of their various origin regions used them. Indian pharmacopoeia was well renowned for using fruits like bael, aonla, jamun, tamarind, karonda, wood apple, and kokum, among others. Exotic fruits like sour sop, rambutan, mangosteen, avocado, water apple, durian, passion fruit, and carambola offer a number of recognised health advantages. Numerous chemical compounds, including flavonoids, quinolizidine, alkaloids, triterpenes, stilbenes, tannins, steroids, coumarin, saponins, triterpenoids, glycosides, taraxerone, cryptoxanthin, and taraxerol, among others, are present in these fruits. These displayed a range of biological actions, including anti-inflammatory, analgesic, diabetic prevention, antipyretic, antioxidant, hypoglycemic, hepatoprotective, and anti-cancerous. There has been a lot of research done on these fruits as the focus on plant-based therapies has shifted in recent years. Thus, an effort has been made to consolidate the information about the underutilised fruits in this article.

**Keywords:** Underutilized fruits, ayurvedic and unani medicines, fruit species

**Introduction**

Fruits that are underutilised are those that, despite being edible by humans, are substantially less appealing than other common fruits, have less market demand, are grown to a limited scale, and are not often grown in structured plantations with the use of inputs. These fruits are also referred to as small fruits, less desirable fruits, underutilised fruits, prospective fruits, stray fruits, wild fruits, etc. Underutilized fruit species have the tolerance to persist in adverse climate conditions and operate as life support species in vulnerable ecosystems and extreme environmental situations. Underutilized food crops may help with food security, nutrition, health, revenue creation, and environmental services if they are used effectively. Unused fruits are a valuable source of fibre, polyphenols, vitamins, and minerals that have health advantages (Narzary *et al.*, 2013) <sup>[8]</sup>. Wild fruit consumption lowers the chance of developing a number of illnesses, including diabetes, cancer, coronary heart disease, and neurological disorders, among others (Rajurkar and Gaikwad, 2012) <sup>[10]</sup>. The majority of locals are aware of the health benefits of under-consumed fruits cultivated nearby. Additionally, these crops are essential for the nutrition and way of life of rural and tribal populations, as well as for the creation of jobs and income. The majority of underused fruits are well-liked by consumers and have special potential for value addition through processing and product development.

**Role of underutilized fruits in food and livelihood security**

In order for everyone to live an active and healthy life, they must always have physical, social, and economic access to enough, safe, and nutritious food that satisfies their dietary needs and food preferences.

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Contrarily, the definition of livelihood security is as having sufficient and ongoing access to income and resources to meet one's basic needs (such as having enough access to food, drinkable water, healthcare facilities, educational opportunities, housing, and free time for community involvement and social integration). A mix of on- and off-farm occupations that together offer a variety of food and money procurement options make up livelihoods. Each household can therefore have a variety of entitlements that make up its means of subsistence. India is experiencing major issues with food security, unemployment, and environmental degradation due to the country's growing population pressure. In order to proceed toward the aim of ensuring security of food supply, a diversification away from an over-dependence on staple crops will be crucial. Staple crops face significant problems in the near future (Thakur, 2014)<sup>[16]</sup>. Consumers are paying more attention to the nutritional value of the foods they purchase nowadays. The preference is for nourishment obtained from natural resources rather than chemicals and synthetic foods. These underutilised fruits are the main source of income for the underprivileged and are crucial in the fight against malnutrition. The underutilized fruit crops play an important role in ensuring the livelihood security of rural communities by one or more of the following ways (Mayes *et al.*, 2011)<sup>[7]</sup>:

- Reduce the risk of over-dependency on very limited numbers of major staple food crops
- Help the poor for subsistence and income
- Increase sustainability of agriculture through a reduction in inputs
- Help to preserve and celebrate cultural and dietary diversity,
- Use marginal and wastelands for agricultural purposes to meet the ever

#### Value addition in underutilized fruit crops

The process of altering or transforming a product from its initial state to a more valued state is known as value addition (Sharma *et al.*, 2014)<sup>[12]</sup>. The practise of boosting an agricultural commodity's economic value and consumer appeal is known as value addition. Agricultural products can benefit from a variety of value-adding technologies, including packaging, labelling, dehydration and drying, freezing, processing, and preservation processes. Processing agricultural products after harvest rather than selling them as-is after harvest increases the overall value of the produce. Fruit is a perishable good, and as a result, enormous amounts of it are lost due to a lack of resources and expertise for effective handling, distribution, marketing, and storage. Additionally, enormous quantities of perishable fruits produced during one season lead to a market surplus and become rare during future seasons. In order to avoid a glut and make better use of the excess fruit during the off-season, food preservation is crucial to the conservation and improved usage of fruits. Different popular fruits are grown all throughout the world, and both domestic and commercial production of value-added products is widespread. It is necessary to employ modern methods to extend storage life for better distribution and also processing techniques to preserve them for utilization in the off-season in both large and small scale (Jena, 2013)<sup>[5]</sup>.

In addition to having acceptable taste characteristics, underutilised fruits are treasure troves of various health-promoting compounds. In addition to improving economic status, adding value to these fruits would also benefit

consumers' health and nutritional status. A crucial alternative for lowering the post-harvest losses of these nutritious fruits and for serving throughout the off-season is to add value through processing and preservation. The underused fruits have a lot of potential for processing and value addition. Numerous underused fruits should be investigated for potential value addition in commercial processing. The most popular processed foods are jam, ready-to-drink fruit drinks, chutneys, sweets, pickles, squashes, and concentrate, among others (Singh *et al.*, 2008). In this context, value addition of some important underutilized fruits has been explained in detail:

- Jackfruit (*Artocarpus heterophyllus* Lam.)
- Palmyra Palm (*Borassus flabellifer* L.)
- Karonda (*Carissa Carandas* L.)
- Tendu/Kend/Kendu (*Diospyros melanoxylon*)
- Piar/ Chironji (*Buchanania lanzan Spreng*)
- Indian Hog Plum /Amra (*Spondias mangifera* Willd.)

#### Value Addition in Jackfruit

Jack fruit has a lot of potential for value addition, and it can be used to make more than 100 different products, from the immature stage to the fully matured state. Few producers and consumers are aware of the significance of the fruit, seed, and rind. Therefore, value addition is crucial to both making use of the extra fruits that are available during the season and enhancing the farmers' ability to make a living.

#### Value Added Products from Unripe Jackfruit

1. **Chips:** Jackfruits that are unripe or raw are used to make chips. Slices of the proper thickness are cut, then blanched for five minutes in boiling water at 95°C. The slices are then dried for the following six hours at 70°C after one hour at 60°C. The slices are then deep-fried in edible oil at 160°C. When the slices begin to turn pale yellow in colour, they are taken off the heat, mixed with salt, and packaged (Bhuyan *et al.*, 2013)<sup>[2]</sup>.
2. **Pickle:** Unripe jackfruits are used for preparing pickle. Small pieces are made from bulbs and seeds and they are mixed with oil, salt and spices before packing.
3. **Brined product:** Mature green jackfruits are washed with clean water, peeled and cut into small pieces. Then they are kept in 8% salt, 1.25% acetic acid, 0.1% KMS and 91.65% water solution. Then the materials is poured into air tight plastic container and stored in cool and dry place (Bhuyan *et al.*, 2013)<sup>[2]</sup>.
4. **Ready to cook (RTC) jackfruit:** The jackfruit is washed, peeled and cut into suitable sized pieces. These pieces can be preserved and packaged with minimal processing to prepare ready to cook jackfruit products.
5. **Dehydrated jackfruit:** The unripe mature bulbs can be blanched and dehydrated for further use throughout the year.

#### Value Added Product from Half-Ripe Jackfruit

1. **Jackfruit Candy:** For candy preparation half-ripe jackfruit (Medium hard flesh) is selected and washed. Then it is cut into 1.0 cm x 0.5 cm x 0.5 cm pieces and blanched in hot water at 95 °C for 4 minutes. After that the pieces are immersed in 2% calcium lactate and 0.1% KMS for 2 hours and drained. The pieces are then dipped into sugar solution of 25, 35, 45, 50, 60 and 70 °Brix at 12 hours interval. The slices are drained and washed with clean water to remove adhering syrup followed by drying at 70°C in a cabinet dryer until the moisture content

reaches to 10%. The product is packed in polypropylene pouch and stored at room temperature (28-32 °C) (Bhuyan *et al.*, 2013)<sup>[2]</sup>.

### Value Added Products from Ripe Jackfruit

Between 20 and 25 percent of the jackfruit's edible part (pulp) or bulbs are recovered. After cutting the fruit into different pieces, the bulbs are manually removed from the fruit. A tiny amount of vegetable oil is applied to the hands before the seeds are extracted from the bulbs since the fruit contains sticky latex.

**Jam:** It is prepared from the pulp of ripe fruits with additives. Bulbs from a fully ripe jackfruit are blended and boiled for 5-7 minutes to extract juice. Then 700 g sugar and 10 g pectin is added to 1 kg jackfruit pulp and cooked until the TSS reaches to 64° Brix, then citric acid (0.25%) is added.

End point is determined through flake test and the jam is poured while hot in sterilized bottle and stored at room temperature

- 1. Jackfruit Rind Jelly:** Fully matured ripe jackfruit are harvested and washed with clean water. Rind is separated and cut into small pieces. Then, 1.5 litre water and 2.0 g citric acid is added for each kg rind and the contents are boiled for 35 minutes and the juice is extracted from the rind. To this juice, 700 g sugar and 200 mg citric acid is added and the juice is then cooked until the TSS reach to 65°Brix followed by addition of citric acid. The jelly is then poured into sterilized bottle and stored at room temperature.
- 2. Jackfruit leathers:** Fully ripe jackfruit is washed and bulbs are taken after removing the seeds. These bulbs are blended with 10-15% sugar and boiled for 5-7 minutes for extracting juice. After this KMS @ 0.1g/kg is added and then further boiled for 3-5 minutes. The mixture is concentrate with steam jacketed pan and spread in a stainless steel tray. The tray is put in a cabinet dryer and dried for 20 hours at 60 °C until the moisture content reaches to 20%. After cooling, it is cut into pieces of desirable sizes and stored after packaging.
- 3. Nectar:** The bulbs are passed through pulping machine and pulp is made by mixing around 10% hot water. Nectar is prepared from this pulp.
- 4. Canning:** The unripe bulbs are canned with a small quantity of citric acid while the ripe bulbs can be preserved in sugar syrup or in the form of sweetened pulp for upto one year. This pulp can be used for preparing other value added products like squash, ready to serve (RTS) drink, chutney, toffee etc. and for flavouring icecreams, custard, beverages and bakery products.
- 5. Ready to eat (RTE) products:** Ripe jackfruit bulbs can also be preserved with minimal processing into ready to eat convenience food product. But this product has a limited shelf life and has to be stored and transported under refrigerated conditions.

### Value Addition in Palmyra Palm

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.

### Edible Value Added Products

- 1. Toddy:** Toddy is made by tapping the inflorescence's tip and collecting the dripping juice in earthen pots that are suspended from hooks. The juice that was collected the

night before is reviving, and the light beverage known as Neera has a sensation that is quite cold. It tastes sweet and syrupy. A few hours after daylight, the toddy naturally ferments. It is well-known locally as the beverage "Tadi." It undergoes distillation to create the alcoholic beverage known as palm wine, arrack, or arak. After the fermentation is stopped by applying lime paste to the inside of the toddy-collecting container, the sap is known as sweet toddy and produces jaggery, molasses, palm candy, and vinegar. The tappers, who are the poorest of the poor, are occupied to capacity this trade. The trade involves indigenous technology and has got good employment potential besides giving good earnings of the tapper community.

- 2. Palm Jaggery:** It also goes by the name palm gur. As a result of its medical qualities, it is very expensive. It has a flavour that could be described as intensely earthy or as tasting like chocolate. The unfermented tree sap is used to make the jaggery (Neera). Tappers first gather sap in earthen containers that have been treated with slacked lime. The clarified sap is transferred to the boiling galvanised iron pan on a conventional furnace and cooked at 110°C after lime sedimentation and filtration. Neera is changed into a viscous fluid and then poured into wooden moulds where it is allowed to harden. 1 kg of jaggery requires about 8 litres of neera. Jaggery has beneficial nutritional and therapeutic properties. The quality of gur can be improved by precipitation lime with carbon dioxide gas or citric acid or unripe tamarind fruits, before boiling the juice (Vengaiiah *et al.*, 2013)<sup>[17]</sup>. Major problem of jaggery storage is blackening of colour in short period which needs to be corrected.
- 3. 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 into crystallizer. After forming sugar crystals, it is centrifuged to collect sugar and dried and powdered to store.
- 4. Palm honey:** Neera is heated for 2 hours to obtain the honey like consistency. The syrup then is transferred to mud pots. Ripe, dry and shelled tamarind fruits devoid of seeds are added into the syrup. About 1 kg of fruit is required for 10 liters of syrup. The pot is closed tightly with cloth and vessels are kept in a shock proof, cool and dry place for 130-180 days. Sugar chrysalizes on the sutures of tamarind and the fruits become delicious.
- 5. Toddy Palm Wine:** Toddy wine is white and sweet with a strong smell, however it tastes better. The toddy palm wine is an alcoholic beverage made using the fermented flower sap of palm trees. 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%. However, it has a very short shelf life which is 24 hours (Reddy, 2016)<sup>[11]</sup>.
- 6. 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 minutes) to ensure maximum pulp recovery. The extracted pulp was mixed with other ingredients (sugar, skim milk powder, small cardamom and citric acid), heated at 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 at both room and refrigerated temperature (Chaurasiya *et al.*, 2014)<sup>[3]</sup>.

7. **Palm toffee:** Palm toffee is prepared by mixing fruit pulp with required ingredients (sugar, skim milk powder, glucose, maida, starch), cooking and stirring the mixture upto 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 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.
8. **Palm burfi:** For palm burfi preparation khoa, butter and lime water are used along with fruit pulp and sugar.
9. **Palm pickle:** Small fruits of palmyra palm can be pickled in vinegar.
10. **Canned palm:** Jelly-like kernels of half grown soft shelled seeds of palm are canned in clear, mildly-sweetened water and exported.
11. **Other products:** Ripe fruit pulp can be processed into soft beverages, jam and other delicious food items and sweets.

#### Value Addition in Karonda

Some of the value added processed products that can be prepared from karonda are discussed below with their method of preparations:

1. **Karonda Candy:** For preparing candy, the sliced or whole unripe fruit of karonda is blanched in 500 ppm potassium metabisulphite with hot water treatment. Then these prepared slices or fruit were steeped in syrup of 60, 65, 70° Brix with the addition of citric acid containing cane sugar and jaggery at different concentrations. The sugar and jaggery solution initially prepared at concentration of 60°Brix. After 24 hours of steeping in each treatment, the syrups were drained and their concentrations were increased by °Brix every time until the concentration reached up to 70°Brix. The slices or whole fruit as per treatment impregnated in each treatment was drained free of syrup and rinsed immediately with the tap water and dried in shade for 24 hours. After drying, the candy was packed in 250 gauge polythene bags and stored under ambient condition (Patil *et al.*, 2014)<sup>[9]</sup>.
2. **Karonda Jam:** Different coloured fruits of karonda from purple to deep red are available in India which are used to make jam. Ripe fruit is full of acids and micro and macro nutrients which combine well with sugars and used to prepare a variety of jams. The fruits possess significant amount of pectin therefore it is suitable for making commercial jam or jelly. Fresh and undamaged karonda fruits are washed properly and cut into halves. The seeds are removed and the fruits are placed in heavy bottom pan containing water. The fruits are boiled in water till they become tender. Then sugar (1150 g sugar/kg karonda pulp) is added and stirring is continued till the end point was judged through drop test, TSS (68 to 70%) and by sheet test. For the preparation of smooth jams the tender fruit can be passed through a sieve so a smooth pulp is obtained and then sugar is added. Once cooled, pack it in a glass bottle. According to FPO specifications, a jam should contain a minimum of 68% TSS in the final

product and the fruit content in the final product should not be more than 45% (w/w). This jam can be stored for at least three months without undergoing any deterioration (Wani *et al.*, 2013)<sup>[18]</sup>.

3. **Karonda pickle:** Firm and mature fruits were selected, washed and wipe dried. The fruits are individually crushed lightly to create cracks. Chillies were slit vertically and cut in to pieces. For the preparation of cured karonda pickle the crushed fruits were mixed with salt and allowed to cure for 30 days. After curing all other ingredients (Green chillies - 250 g, mustard oil - 300 ml, salt -250g, fennel seed -60g, mustard seed dhal - 100g, chilli powder -10g, kalunji seeds -5g) were mixed thoroughly and stored in a bottle. The contents were stirred on alternate days by shaking the bottles on alternate days of curing (Hiregoudra, 2012)<sup>[4]</sup>. Karonda pickle is easy to prepare and ready to eat. This pickle can be stored for at least four months.
4. **Karonda chutney:** The spices (green chillies 25g, jaggery 40g, garlic cloves 2g, cumin seeds 6g, coriander leaves 20g, salt 15g, curry leaves 2g) were ground to a fine paste in an electric mixture and the unripe karonda fruits (100g) were added and ground to an acceptable fine texture.
5. **Karonda powder:** Karonda fruits are subjected to blanching at 85 °C for 5 minutes followed by sulphitation with 0.5% KMS for 15 minutes to improve its colour. The fruits are then ground coarsely and dehydrated in cabinet drier at (60±1) °C or sundried. Dried products are then packed and stored in a cool and dry place (Srivastava and Kumar, 2006)<sup>[14]</sup>.
6. **Karonda beverages:** Various types of beverages like ready to serve (RTS) drinks, nectar, squashes can be prepared from karonda juice/pulp using the methods of Srivatsava and Kumar (2006)<sup>[14]</sup>. Moreover, karonda juice can be blended with guava, papaya and pineapple juices in different proportions and the combination of karonda juice with pineapple juice showing best organoleptic quality and acceptability (Shaheel *et al.*, 2015)<sup>[15]</sup>.
7. **Karonda syrup:** The ripe fruits of karonda are boiled with baking soda and salt. For every cup of juicy pulp half tea spoon of baking soda is added and boiled in one liter of water at 100 °C. The mixture is then boiled down one half of the original quantity, removing the rising scum in the process and juice is again strained. For every cup, a quarter cup of sugar is added. The mixture is again boiled for 40 minutes. The cooled syrup is poured in to sterilized bottle and sealed (Arif *et al.*, 2016)<sup>[11]</sup>.
8. **Osmo-air Dried Karonda:** It is prepared by blanching the unripe karonda and dipping in 70°Brix solution.
9. **Canned Karonda:** Karonda fruit can be canned with sugar syrup.
10. **Karonda flavoured ice cream:** Pulp obtained from ripe fruits can be incorporated as natural flavouring agent in ice-creams. Ice-cream with 20 per cent karonda pulp has shown good overall acceptability (Gaikwad *et al.*, 2005)<sup>[10]</sup>.
11. **Karonda flavoured milk:** Utilization of karonda juice in the manufacture of flavoured milk was explored by Hanwate *et al.* (2005). The flavoured milk containing 10.0 per cent karonda juice and 7.5 per cent sugar recorded highest acceptability.
12. **Natural colorant:** A natural ‘food colourant cum nutraceuticals supplement’ was prepared from the ripe

karonda fruits. The formulation had been named as 'Lalima'. 1 ml of this pigment suspension formulation is sufficient to give optimum red colour for one serving of any colourless beverage (100 ml) such as lemonade (Arif *et al.*, 2016)<sup>[1]</sup>.

### Value Addition in Chironji

- 1. Fruits:** The chironji fruit has a sweet, juicy flavour. The fruit can be used to prepare a variety of value-added goods as squash, ready to serve (R.T.S.) drinks, and nectar following juice extraction, even if the juice recovery is fairly low due to the big seed size. Fruits can also be kept as fruit powder by locally drying them in the sun or in a cabinet dryer under regulated conditions. Furthermore, fruit pulp can be used to create fermented drinks like wine.
- 2. Chironji Nuts:** Despite the fact that chironji nuts and kernels have been used widely, no equipment exists to process them. Chiromani nuts are typically shelled by hand, though occasionally local machinery is used. The seeds are traditionally prepared by soaking them in water for 24 hours, rubbing the skin off by hand, and then drying. Breaking a dried nut with a stone slab or hammer, then separating the kernel from the hull, are the next steps (Kumar *et al.*, 2012)<sup>[14]</sup>. The chironji nuts are then put into polyethylene bags or glass jars for storage. Chironji nuts are used to make a variety of sweet dishes, including halwa, kheer, laddu, and paak. They can also be used to make sweets like dry fruit.
- 3. Chironji Oil:** Chironji kernel contains about 52% oil. The kernel is used for extraction of chironji oil. This extracted oil is used mostly in cosmetic manufacturing and substitute for olive and almond oils (Siddiqui *et al.*, 2014)<sup>[13]</sup>. Sometimes this oil is also used by native people as edible oil.

### Value Addition in Amra

- Unripe fruit is eaten as a vegetable and added to stews because of its sour flavour. It can also be made into a variety of goods with additional value like chutney, pickles, panna, etc. Unripe fruits can also be cut into slices and dried outside to make dried fruit powder, which is then used as a flavouring in a variety of dishes.
- The acid flavour of ripe fruit is watery and virtually odourless. Even when fully ripe, the slightly fibrous pulp is quite acidic. Fruits can be used to make beverages like squash, nectar, and RTS drinks, as well as value-added items such as jams, pickles, jelly, and chutney.
- Unripe fruit has a sour flavour and is eaten as a vegetable and added to stews. It can also be prepared in several value added products like chutney, pickles, panna etc. The unripe fruits can also be sliced and dried under sun to be converted into dried fruit powder which can be used as a flavouring agent in various cuisines.
- Ripe fruit has a watery, almost odourless acid taste. The somewhat fibrous pulp is very acidic, even when fully ripe. Fruits can be used to prepare value added products like pickles, jams, jelly, chutney and beverages like squash, nectar and RTS drinks.
- Flowers of the tree can also be cooked or can be used as salad.
- Flower buds are also used for preparing pickle.
- Leaves have a sour flavor and are used for flavouring in stews.

### Conclusion

Fruits that aren't used often have a lot of potential for commercial cultivation. The acreage and production of these lesser-known fruits and their processed goods need to be increased. Some small-scale businesses also use some underutilised fruits to make pickles, chutney, jam, and jelly, among other products. However, due to the good production of several of these fruits, including jackfruit, bael, palmyra palm, tamarind, karonda, chironji, jujube, aonla, etc., there is a huge opportunity to build a large-scale fruit processing industry. Government and non-government organisations should play a crucial role in the production, marketing, value addition, and popularization of these underutilised fruits since it is a long-term plan to exploit the nutritional and therapeutic benefits of these underutilised fruits. A variety of stakeholders, including the producers, local gatherers, sellers, and workers engaged in the production, gathering, selling, transporting, and packaging of underused fruits, may see an improvement in their standard of living through this industry. Additionally, it is necessary to create cutting-edge, low-cost value-added processing technologies to be used in small- and cottage-scale companies to produce a variety of products with additional value.

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