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Status and Role of Underutilized Fruits in India

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Abstract
Minor fruits are a group of fruits presently growing in a scattered and unattended way on roadsides, homestead land, wasteland, etc. In general, fruits which though are consumable to human beings but relatively less palatable than other major fruits, which have lesser demand in market, which are grown to a limited extent only and are not usually cropped in organized plantations with application of artificial agro-inputs are considered as minor fruits. They are in general hardy and grow well even in fragile soil and climate and having potential for intensive exploitation. Attacks by deadly pests and diseases are relatively less in many of these crops. They multiply and grow spontaneously rather than coming to extinction. Since the area under each of these fruit trees is insignificant, they are popularly known as 'minor fruits'. In India, many under-utilized fruits grow without much care largely in the homestead, fallow and forest areas as well as at roadside and railway lines. Those are adapted to the local climate, are highly nutritious and contribute to poverty elevation and household food security of rural people and play a significant role in herbal medicine. Though a wide range of diversity of underutilized fruit crops exists in diverse agro-ecological zones of India, there are no organized orchards and no recognized cultivars for almost all of these minor or underutilized crops and some of those are being eroded from the plant-wealth list.

Introduction
India is bestowed with a varied agro-climate, which is highly favourable for growing a larger number of fruit crops. India accounts for 10% of the world's total fruit production. Mango, banana, citrus, pineapple, papaya, guava, litchi and grape, among the tropical and sub-tropical fruits; apple, pear, peach, plum, apricot, almond and walnut among the temperate fruits. India leads the world in the production of mango, banana, cheeku and acid lime and in productivity of grapes per unit land area. India is the largest producer of mango, banana, cheeku and acid lime. But as compared to major fruits, minor fruit cultivation is much less although there is lots of scope for minor fruit production in India due to its diverse agro-climate. In a general sense, those fruits which have less acreage and are available in lesser quantity in the market are generally called as minor or underutilized fruits. Species are underused because markets are lacking altogether or are not available to sectors of the agricultural community. Models for the adoption of new species with a view to income generation (at regional or national level) might be valuable.

India holds a unique position of many minor and underutilized fruit species in its diverse agro climatically zones. Apart from medicinal and nutritive value, underutilized fruits play an important role in crop improvement, ecology and food security and income.

Most of these fruits have not been tapped in both fresh and processed form, in spite of their potential in the domestic and international markets. Research has been carried out on different aspects of underutilized fruits but the results are still unavailable.

Background

Mankind depends on a very limited number of crops to meet the needs of staple dietsand on a very limited number of major non-food crops to meet associated needs. In general, a small number of varieties occupies large areas for these cultivated species. Nevertheless in the past human societies depended on a much wider range of species for food, fiber, health security and other needs.

Only about 30 crop species provide 95% of the world's food energy whereas over 7,000 species have been known to be used for food and are either partly or fully domesticated. This large array of plant species spans those recognized to be underutilized to those that are recognized as important minor crops. However, with modernization of agricultural practices many have become neglected due to their being held in low esteem and some have been so neglected that genetic erosion of their gene pools has become so severe that they are often regarded as lost crops.

Underutilized fruit crops of india

Blackberry, bael, barbados cherry, breadfruit, bilimbi crabapple, chestnut, chironji, custard apple, date palm, hog plum, jamun, karonda, karonda,kendu, kokam butter tree kodampulli, lanson, lotka, loquat mulberry, mahua, manila tamarind, phalsa, rose apple, sapida, star apple, star gooseberry, Surinam cherry, tamarind, wood apple, white sapota, seabuckthorn, wild apricot, etc. (Table 1).

Table 1.

Sl. No.	Name of minor fruit	Scientific name	Distribution	Plant description	Important uses
1.	Barbados cherry	*Malpighia glabra*	Grown in humid to warm tropics	Plants are spreading shrub, plant 4 m height, withstand frost and drought	Good source of Vit-C (1000-4000 IU) and protein bark yield tannin
2.	Bilimbi	*Averrhoa bilimbi*	Humid tropics	Fruits are gherkin like; seeds covered by fatty layer which contain 6% oxalic acid	Seeds contain 6% oxalic acid. Fruit used for pickles, curries and preserves
3.	Cape gooseberry	*Physalis peruviana*	All over India	Herbaceous, erect growing, perennial, fruits enclosed by large persistent calyx	Good source of Vit-A (1000-5000 IU), fruits used for fresh eating and jam preparation
4.	Chironji	*Buchanania lanzan*	Subtropical, mostly found in drier region	It is a small tree having dark coloured fruits	Fruits and seeds are edible, used as dry fruit, gum from tree used in textile industry
5.	Hog plum	*Spondias mombin*	Grown in humid tropics of South India	Very large tree, pear shaped yellow fruits	Fruits are used for jelly making. Infusion of leaf and fruits is used as expectorant
6.	Indian almond	*Terminalia catappa*	Grown throughout the hotter parts of India	Also known as Singapore or tropical almond	Seeds (kernels) are edible, bark and fruits are used for tanning
7.	*Garcinia indica*	Mostly found in Western Ghats	Evergreen tree, fruits have sweetish to acidic	Fruit is used or juice making, dried pulp used in curries for	*Garcinia indica*

			pulp	souring, seeds are used for making kokam butter and in soap making	
8.	Kokam butter tree	*Garcinia indica*	Mostly found in Western Ghats	Evergreen tree, fruits have sweetish to acidic pulp	Fruit is used or juice making, dried pulp used in curries for souring, seeds are used for making kokam butter and in soap making
9.	Lanson (langstarduku)	*Lansium domesticum*	Grown in humid tropics	Symmetrical medium size tree, spherical, 5 cm diameter fruits, edible pulp are juicy and translucent	Pulp can be preserved in syrup
10.	Surinam cherry	*Eugenia uniflora*	Widely distributed in tropics and subtropics	An ornamental shrub, sub-globose (3 cm diameter) 8-ribbed fruit, pulp is soft and juicy	Fruits are used as fresh and jelly making
11.	Sapida	*Baccuarea ramiflora*	Found in subtropical Himalayan regions, Assam and Burma	Evergreen tree, plant height 15 m or more. Fruit globose in shape and yellowish brown in colour. Seeds are embedded in rose coloured pulp	Rich source of Vit-C, protein and iron. Seeds are used against vomiting and asthmatic trouble. Every plant part is used against snake bite and scorpion string
12.	Seabuckthorn	*Hippophae* spp.	It is distributed in J&K, HP, Uttaranchal and some parts of Arunachal Pradesh (cold desert region)	It is deciduous, dioecious, drought resistant, shrub/tree (0.5-18 m)	Fruits are store house of nutrition, many bioactive substances, antioxidants, vitamins (Vit-C: 40 to 2500 mg 100 g-1 pulp), flavonoids and many minerals
13.	Manila tamarind	*Pithecellobium dulce*	Distributed throughout in India	Attractive tamarind like pod, pulp is crisp, sweet and edible	Used as hedge plant, pulp is used for making delicious drink
14.	Khirni	*Manilkara hexandra*	Central and peninsular India mostly on tribal belt of Gujarat	Tree is hardy and thrives well on rocky, gravelly, saline and sodic soil. Tree is medium size evergreen with spreading growth habit. It bears oval, sweet edible fruit with one or more seeds. It is commercially used as rootstock for vegetative propagation	Used fresh or dried, young fruits are boiled; seeds fried and roasted taste like peanut, carbohydrate 27.74%, Vit-C: 15.62 mg 100 g-1; seeds contain 24.6% edible oil (ryan oil) and fatty acids like palmitic acid (18.9%), stearic acid (14.1%), oleic acid (63.2%), linoleic acid (2.7%)
15.	Mahua	*Madhuca latifolia*	Found in dry region of north and central India (Eastern UP, MP, Maharastra, AP, Bihar, Orissa and	Mahua is a deciduous. Flowers (corolla), a rich source of fermentable sugars (glucose, fructose, and maltose) is a useful	Flowers rich source of sugar, vitamins and minerals. Seed produce oil used in industrial purpose and reduce blood pressure. Dry

			Gujrat. Also on waste lands of Rajasthan)	bio-resource	husk is used for making absolute alcohol
16.	Kendu	*Dyospyrus melanoxylon*	Found mainly on dry region. Orissa, Chhattisgarh, West Bengal	It is drought hardy; trees having weak branches, leaves are big	Dried flowers are use in urinary treatment, skin and blood disease. Seeds are used in mental disorder. Leaves are used for bidi making by tribal people
17.	Lotka	*Baccaurea sapida*	North eastern states mainly northern part of West Bengal	It is a slow growing, evergreen, dioecious, short to medium height, shade loving plant species.The bearing habit is cauliflory and fruits appear in bunch. Fruits are roundish to oval and yellow-yellowish brown in colour when matured	Consume as fresh fruit. Fruits having good source of Vit-C (178 mg), cure skin disease. Fruit peel is good source of pectin (14.1%)
18.	White sapota	*Casimiroa edulis*	Tropical high land to subtropics, found in southern India	Tree medium in size, fruits are yellow with a sweet, pleasant flavoured pulp and large seeds, rind is bitter	Use in beverages

Classification of minor fruits based on different climatic zones of India

Broadly the country can be divided into tropical, subtropical and temperate regions. Within each broad category there are differences due to rainfall, humidity, altitude, etc. Considering these aspects six different horticultural zones have been identified so that appropriate choice of the crops can be made and development is planned. According to these zones minor fruit crops are classified below:

Temperate climate zone: Minor fruits like crabapple, chestnut, wild apricot, blackberry, seabuckthorn, etc., can be grown in this climatic condition.

Southern tropical climate zone: In this climate minor fruits like ber, custard apple, aonla, bael, karonda, jamun, wood apple, Barbados cherry, bilimbi, hog plum, kokam butter tree, rose apple, star apple, star gooseberry, Surinam cherry, white sapota, kodampulli, etc. can be grown successfully.

North-eastern subtropical zone: The parts are Bihar, Assam, Meghalaya, Manipur, parts of West Bengal, Uttar Pradesh, etc. The crops are mahua,karonda, passion fruit.

North-western subtropical region: This includes parts of Jammu andKashmir, Himachal Pradesh, hills of Utter Pradesh, South of Punjab and Haryana.The crops are phalsa, date palm, ber, custard apple, tamarind, loquat, amlok, behmi, kaliphal, wild apricot, pecan, lasoda, ker, etc.

Central tropical zone: South Madhya Pradesh, Chattisgarh, Gujarat, Maharashtra, Orissa and West Bengal. Under this zone crops are fig, mahua, phalsa, khirni.

Coastal tropical humid fruit zone: Kerala, Goa, Diu Daman, Tripura, coastal parts of Maharastra, Andhra Pradesh, West Bengal, Tamil Nadu, Orissa, Karnataka. Under this zone the minor fruit crops are bilimbi, breadfruit, hog plum, lanson, tamarind and kokum butter tree.

Scope of minor fruit production

Utilization of fallow land: There is a vast scope of minor fruit cultivation in our country because total area under horticultural crop is very small and it is about 9% of total cropped area and fruit occupy 29% of total horticultural area. Area under fallow land is more. So, we can utilize this untapped fallow and degraded lands for cultivation of minor fruit crops. We can use all this available land to better contribute to rural income, in order to alleviate shortages of fuel wood, small-timber and fodder, especially for income-poor rural communities.

Hardy nature of plants: Underutilized crops are found in numerous agricultural ecosystems and often survive mainly in marginal areas. These crops are hardy in nature and they are free from diseases and pests. They can grow without much care, they do not require irrigation, fertilization although they have great demand in national and international market and there is also a growing consumer interest in biological/organic agriculture, for which many underused species offer advantages.

Tolerance to adverse soil and climate: A large number of less-known fruit species which have immense potential for commercial exploitation under stress condition, are yet to be utilized to their full potential.

Fruit crops like ber, phalsa, dateplam, bael, wood apple, etc. are capable of growing on waste land where other crops fail to grow. Thus fruit cultivation has bright scope. They are highly valued for nutritional and neutraceutical value of their fruits and also for their ability to grow successfully even under adverse agro-climatic condition. In view of increasing population pressure, decline per capita land availability and escalating input cost, diversification of Indian Horticulture with hardy and high value indigenous fruit crops is necessary for boosting fruit production. Sustainability of some fruit crops under stress conditions are mentioned below:

- ✓ High tolerance (ESP 40 to 50 ECe 12 to 15 dS m-1): e.g., date palm, ber, woodapple.
- ✓ Medium tolerance (ESP 30 to 40 and ECe 9 to 12 dS m-1): e.g., aonla, tamarind, jamun, lasoda, karonda, mahua, phalsa, khirni and custard apple.
- ✓ Weak tolerance (ESP 20 to 30 and ECe 6 to 9 dS m-1): e.g., guava, citrus, mango, bael .
- ✓ Susceptable (ESP <20 and ECe<6 dS m-1): e.g., banana, papaya and pineapple.
- ✓ Drought tolerant crops: ber, sapota, aonla, phalsa, lasoda, kair, custard apple, karonda, fig, etc.
- ✓ Highly tolerant to acidic soil: strawberry, woodapple, bael, loquat and avocado.

Nutritional value: The majority of the Indian population resides in village areas and they suffer from malnutrition. There is a great demand for fresh fruits because fruits are a rich source of vitamins and minerals. Fruit is considered as 'protective food' due to its availability of vitamins and minerals in readily available from. Due to this reason the scope of fruit cultivation becomes inevitable. In order to overcome malnutrition problems of arid, hilly and tribal people it is necessary to enhance the production of minor fruits, which can be done by increasing production and area under fruit crops. Nutritional content of some minor fruits is shown in Table 2.

Table 2.

Sl. No.	Different Vitamins	Sources
1.	Vit-A (retinol)	Persimmon (2710 IU), cape goose berry (1000-5000 IU), loquat (1528 IU), jackfruit (175-540 IU), tree tomato (150-500 IU), phalsa (419 IU), bael (55 mg)
2.	Vit-B12 (riboflavin)	Bael (1.19 mg) wood apple, ber
3.	Niacin	Bael (1.1 mg), custard apple, wood apple
4.	Vit-C (ascorbic	Barbados cherry (1000-4000 mg), seabuckthorn (40-2500 mg), aonla (600 mg),

	acid)	Indian ber (50-150 mg), carambola, custard apple (37 mg), jamun (18 mg), phalsa (39 mg)
	Different minerals	**Sources**
5.	Calcium	Tamarind (0.74%), karonda (0.16%), wood apple (0.13%), bael (0.09%), aonla (50 mg), wood apple (130 mg), phalsa (129 mg), ber (30 mg), and date palm (0.3 g)
6.	Phosphorus	Wood apple (110 mg), date palm (0.1 g), aonla (20 mg), karonda (600 mg), custard apple (23.5%) and tamarind
7.	Iron	Karonda (39.1%), date palm (10.6%), ber (300 mg), sapota (2 mg), aonla (1.2 mg), phalsa (3.1 mg) and custard apple (1.9 g)
8.	Organic acids	Aonla, jamun, tamarind
9.	Protein	Wood apple (7.3 g), tamarind (3.1 g), custard apple (1.6 g), chironji and bael (1.8 g)
10.	Carbohydrate	Dry karonda (67.1%), date palm (67.8%), bael (31.8 g), custard apple (23.5 g), jamun, phalsa (14.7 g), wood apple (15.5 g), ber (12.8 g) and tamarind (70.8 g)
11.	Essential fatty acids	Chironji, karonda and wood apple
12.	Calcium	Tamarind (0.74%), karonda (0.16%), wood apple (0.13%), bael (0.09%), aonla (50 mg), wood apple (130 mg), phalsa (129 mg), ber (30 mg), and date palm (0.3 g)

Nutritional security: For a balanced diet we need minimum 85 g fruit head-1 day-1. To meet this requirement in terms of vitamins and minerals for our increasing population above 120 crores both area under minor fruit and production has to be increased. Minor crops help in greater demands for increased dietary diversity for novel and nutritionally healthy foods.

High medicinal importance: Apart from nutritive value, minor fruits have also medicinal value. A diet predominated by seasonal fruits and taking controlling food is said to be a boon and to increase the longevity of life. Some examples are: aonla is the main ingredient of 'chyavanprash' which is famous for its therapeutic value in the Ayurvedic system of medicine; unripe bael fruit can cure diarrhea, constipation and dysentery with certainty; jamun fruits are helpful in curing diabetes. Thereby the expanding demand for herbal remedies, both internationally and in situations where modern pharmaceuticals are unavailable or too expensive for local populations.

Produce value-added products: With the advancement of postharvest technologies, installation of agro-industries, storage and transport facilities, there is great demand for minor fruits throughout the year as most of the fruits are used for preparation of value-added products. This will encourage the growers to go for minor fruit cultivation. Different processed product of different minor crops are shown in Table 3.

Table 3.

Sl. No.	Processed product	Name of fruits
1.	Jam	Jamun, karonda, aonla, mulberry, soursop, tamarind, wood apple
2.	Jelly	Tamarind, jamun, karonda, tamarind
3.	Preserved	Ber, aonla, ker, sangri, karonda, bael, karonda, soursop
4.	Candy	Aonla, karonda, tamarind
5.	Glazed fruits	Tamarind, annanas, aonla
6.	Confectionary	Amra, aonla,tamarind
7.	Juice/syrup	Aonla, ber, bael, jamun, karonda, phalsa, mulberry
8.	Beverage/squash	Pomegranate, soursop, wood apple, tamarind
9.	Wine	Mahua, jujube, ber, indian fig, karonda,
10.	Chutney	Karonda, woodapple, aonla
11.	Sauce	Karonda, tamarind, woodapple, pomegranate
12.	Pickle	Jujube, tamarind, ker, lasora, gonda
13.	Dehydration	Aonla, karonda, ker, bael, ber, custard apple
14.	Frozen puree	Bael, karonda, ker, phalsa tamarind, custard apple
15.	Canning	Ber, aonla, jamun, ker

New market opportunities: New tools are available to transform useful plant species into diverse products or to extend the shelf life of perishable crops and products. The movement of people across countries and regions provides opportunities for strengthening markets of underutilized crops and breeds in which immigrants identify their own culture and traditions. Tourism represents an increasingly important source for supporting local commodity chains built around underutilized species. The high standard of living in industrialized countries generates demands for more natural food and environmentally-friendly products, a demand which can also be met by underutilized species.

Improving socio-economic condition of tribal people: Most of the tribal population resides in remote, hilly, forest and degraded areas. Adaptation of suitable minor fruits cultivation region-wise helps to earn money, fuel and their engagement which create a socio-economic impact for their sustainability.

Minor fruit as ecological security: Most of the underutilized/minor fruits can tolerate adverse ecological conditions (drought, shallowness of profile, cold and wet soil). They can be grown in wasteland also.

Environmental changes and ecosystem stability: Climate changes, degradation of land and water resources have led to a greater appreciation of those crops to stress and difficult environments where they play a strategic role in maintaining a diversity rich and hence more stable environment. The effects of globalization and the opening up of new markets internationally.

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