



Potential and prospective of underutilized fruits for conventional food, nutritional security and income generation in hilly region of Tripura

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Tripura is one of the important states of the North-Eastern Region. It's weather is characterized by warm and humid subtropical climate with three distinct seasons, viz. summer, monsoon and winter with four different cropping seasons like *Khariff*, *Rabi*, *Summer* and *Jhum* cultivation in forest during pre-monsoon and late monsoon periods, which favours the luxuriant growth of various underutilized fruit crops. In addition to the major fruits grown (Mango, Litchi, Pineapple, Orange, Banana and Jackfruit) in this state, there are many underutilized fruits exist naturally in forest as well as in cultivable areas. These fruit plants are playing a vital role in providing nutritional and economic security to the poor masses in rural areas but the commercial importance and market value of these underutilized fruits is unknown to them. This paper lists the edible underutilized fruits and their uses for further exploration

Tripura is located at 22° 56' to 24° 32' latitude and 91° 10' to 91° 10' to 92° 21' longitude. The geographical area of Tripura is about 10,491sq km of which 60 per cent constitute forest and remaining 40 per cent is available for cultivation. In India, more than 58 per cent people are dependent on agriculture for their livelihood and Tripura is not an exception. Agriculture is an important sector in the state, which contributes 26 per cent of the State GDP of which the major contribution is from horticultural fruit crops (Pineapple, Litchi and Oranges), Vegetables (Potato TPS), Plantation Crops (Cashew nut, Coconut, Rubber and Tea), Spices (Ginger, Turmeric and Black pepper), etc. More than 75 per cent of the population either directly or indirectly depends on agriculture. The small and marginal farmers contribute about 90 per cent of total farming community and the average size of land holding is 0.97 ha which is the lowest among the seven other North-Eastern states. The state weather is characterized by warm and humid subtropical climate with three distinct seasons, viz. summer, monsoon and winter with four different cropping seasons like *Khariff*, *Rabi*, *Summer* and *Jhum* cultivation in forest during pre-monsoon and late monsoon periods. This state has many rivers out of which the important ones are Juri, Deo, Manu, Dhalai, Thowai, Haora, Mahari, Buriganga and Gomati which are mainly seasonal. Tripura receives an average rainfall of 2065 mm. The monsoon breaks in May-June and continues for about 4-5 months. The people of Tripura are nature

loving and it is evident from naming the place with tree name, *i.e.* *Sal bagan* (a place where sal is grown), *Litchi bagan* (a place where litchi is grown), *Tala mura* (a place where palmyrah is grown), *Khejur bagan* (a place where wild dates is grown), *Ambasa* (Mango and wild mango found), *Jam juri* (a place where jamun is grown), *Kola bagan* (a place where banana is grown), *Padya pukur par* (a place where lotus is grown), etc. Keeping all above points in view the genetic resources of underutilized fruits was discussed in this paper.

The crops, which are neither grown commercially on large scale nor traded widely, may be termed as underutilized fruits. These fruits are cultivated, traded and consumed locally. The popularity of these fruit crops varies from locality to locality, which however, can be enhanced to a greater extent through publicity. The underutilized fruit crops have many merits. These are easier to grow and hardy in nature, producing a crop even under adverse soil and climatic conditions. Most of them are very rich sources of vitamins, minerals, and other nutrients such as carbohydrates, proteins and fats. Since, the underutilized horticultural crops have a long history of consumption, the local people are aware about their nutritional and medicinal properties. Moreover, these are cheap and readily available. The horticultural crops are contributing 3.14 per cent of the total geographical area of the region. The region is one of the richest reservoirs of genetic variability and diversity of different horticultural crops,

which exist in plant types, morphological and physiological variations, reactions to diseases and pests, adaptability and distribution.

Scope of underutilized fruit crops: In Tripura, there are wastelands of different kinds *viz.*, tilla land, slopy land, terrace, acidic soils, uncultivated fallow lands, which are unfit for supporting cultivation of high input demanding crops. Such lands can easily be put to use for growing low input crops in order to diversify the present day agriculture, which is so inevitable in view of the increasing population pressure and fast depletion of natural resources as well as the growing and changing human needs in the region. The average productivity of the horticultural crops is just half of the national productivity in NEH region. As grain farming is proving un-remunerative in the undulating topography of hilly tracts, which is deprived of irrigation facilities, despite government of India's has been putting forth endeavours to uplift the region, vast potential remains unexploited. It becomes possible to exploit the untapped potential of the region through location specific horticulture and subsequently expanding the area under horticultural crops. Production of underutilized fruit crops can also be increased through adoption of scientific technologies. Apart from nutritive value, underutilized horticultural crops are particularly more important for medicinal properties and famous for the retentive value in Ayurvedic medicine. Mostly people are familiar with the medicinal properties of locally grown horticultural crops.

Important underutilized fruits: Underutilized fruits are losing their place in today's commercialized world. These fruits may not pay much money to the growers but deserve a place in our diet due to distinct tastes, flavours and uses. There are a large number of edible underutilized fruits in Tripura, a few of which needs to be domesticated and exploited for their potential importance. Several fruits (jack fruit, jamun, carambola and amra) being raised on a limited scale in home gardens, small farms or as backyard trees, and many fruits also come up naturally in forest from where the local people gather them for consumption. But cultivation of these fruits on a commercial scale is not yet attempted. Some minor fruits considered to be as delicacies today have been described.

Jamun *Syzygium cuminii* (Linn.): Skeels belongs to family Myrtaceae, popularly used as an avenue tree and as wind breaks. This is an evergreen tree-attaining medium to large size. Trunk is thick and greenish white in colour, leaves opposite, single elliptic or ovate, 7.5-12.5 cm long, pinnately veined with lateral veins close together. Inflorescence is a panicle, petals white, numerous anthers and fruit is a

berry, purplish red and seeds are polyembryonic in nature. The fruit has considerable nutritive value. It is a rich source of iron apart from minerals, sugars and proteins Fruit pulp contains about 88 per cent moisture, 0.7 per cent protein, 0.1 per cent fat, 19.7 per cent carbohydrate and 0.4 per cent minerals. Apart from fresh consumption, it can be processed into various products like fruit beverages, carbonated drinks, jam, jelly, squash, wine, vinegar and extraction of carotenoids. Jamun squash is very refreshing drink during summers and is preferred by diabetic patients. Its vinegar is also widely used due to its cooling and digestive properties. Seeds can be dried and powdered, which is reported to reduce sugar level in urine. Wood has very good timber value with tolerance to insect and fungus.

The jamun tree grows well in deep loam, well-drained soil. Clay or sandy soils are not fit for its cultivation. Early rains at the time of fruit development are beneficial. Jamun is mostly propagated by seed. The seedling trees produce the fruits of variable size and quality hence vegetative methods of propagation are preferred. Patch budding method during March results in good success. The budded plants can be easily transplanted during February-March or August-September at a distance of 10-12 m in well-prepared pits. Jamun plants need regular irrigation for its good growth during early stage. Fully grown trees must be irrigated regularly during May and June when the fruits are developing. The actual manurial requirement of jamun is not known. However, 20 kg of farmyard manure/tree/year should be applied during the pre-bearing stage. The dose may be increased upto 80 kg/tree to a fully bearing tree. Seedling trees start bearing 8-10 years after planting, while grafted ones after 6-7 years. The ripe fruits are picked individually. The yield of a tree varies from 60 to 100 kg/year.



Jamun

Kamrakh

Kamrakh *Carambola* (*Averrhoa carambola*): It is native of Malaysia and belongs to Oxalidaceae. Tree is slow growing, short trunked evergreen tree with a much branched, bushy canopy that is broad and rounded. Mature trees can reach 10-12 m tall. The spirally arranged

alternate leaves are 15-25cm long, with 5-11 nearly opposite, ovate-oblong leaflets that are 3.75-8.00cm in length. The fragrant flower is pink to lavender in colour, one cm in diameter, perfect borne in clusters in axils of leaves on young branches or on older branches without leaves. Fruits are succulent, 7-9 cm long and having prominent ridges. There are two types namely, sour and sweet types found in Tripura. Fruits ripen in September-October and again in January-February. The sour types can be a substitute for tamarind in culinary preparations. Fruits are mostly used for table purpose and also used for making jam, jelly, pickle, squash and as salad. It has the property of curing jaundice and diarrhoea. The tree can be grown successfully on sandy to clay soils. The plant is raised mainly by seeds which take 4-5 years to produce fruits. The tree is globose and reaches a height of about 30 feet. The trees should be planted at a distance of 30 feet. In north Indian conditions flowers are borne in the rainy season and fruits ripen during winter and spring. A tree yields 50-100 kg fruits

KARAUNDA- Karaunda (*Carissa carandas* Linn.) is well-known as a protective hedge plant due to its strong axillary spines. This plant produces berry-like fruits. The fruits attractive in colour, are commonly used for pickles and preserves. Karaunda is one of the best fruits for jelly-making, grown in plains. It is very rich in vitamin A content. The tree is 3-4 m tall, shrub and evergreen in nature. It is very hardy and can be grown in any type of soil. Two types of karaunda are commonly grown, one with dark purple, almost black fruits, and the other is pink and white. The plant is commonly grown from seeds. Seeds should be sown just after extraction from the ripe fruits during August-September. The plant once established takes care of itself even without irrigation. In hedges, the planting distance varies from 1 to 2 m. Plants come in bearing 2 years after planting

Kathal (Jackfruit): Kathal (*Artocarpus heterophyllus* Lam.) is becoming more popular. The fruit is commonly used by the housewives for cooking and making pickles. The ripe fruits are very tasty and a rich source of minerals and vitamins. A tender fruit come in the market in spring and continues until summer as a popular vegetable. The wood of tree is used as timber for making furniture as it is rarely attacked by white ants.

Kathal prefers a rich, deep, loam soil with very good drainage. It can be planted in the field during February-March and August-September at 10-12 m apart. The plant is sensitive to drought as well as excessive moisture conditions hence proper care is needed for its successful cultivation. Each tree produces 50-200 fruits in a year with an average weight of 6-20 kg/fruit depending on the type during March-June. The individual fruit is clipped carefully with the help of secateur, packed in gunny bags and sent to the market. It is a tropical evergreen fruit tree reaching 15-20 m height. Leaves are oblong, oval or elliptic in shape, 10-15 cm long, alternate, glossy and dark green in colour. The tree is monoecious, califlorous, bearing male and female flowers. The male flowers are produced amongst leaves above female flowers, and when mature, become covered in pollen that falls rapidly after flowering. This tree is multipurpose providing basic requirements like food, fuel, fodder, medicinal and industrial products. It is a nutritious fruit, rich in vitamins A, B and C, potassium, calcium, iron, proteins and carbohydrates. Young fruits are used as vegetable, for pickling or canning. Pulp of ripe fruit is eaten fresh or made to various local delicacies including chutney, jam, jelly and paste or preserved as candies by drying or mixing with sugar, honey or syrup. Pulp is also used to flavour ice cream and beverages, made into jack fruit honey, reduced to concentrate or powder, and used for preparing drinks. Seeds can be eaten boiled, roasted or dried and salted as table nuts, or they



Fig. 1 : Karaunda in bearing and harvested fully matured fruits



Kathal

can be ground to make flour and blended with wheat flour for baking. Young leaves can be used as fodder for livestock. Timber is a medium hard wood with desirable characters in making furniture, agricultural implements and musical instrument. Wood is also used in construction timber is termite proof and slightly resistant to fungal and bacterial decay. Pulp and seeds are used as tonic, warmed leaves have healing properties if placed on wounds, and latex mixed with vinegar promote healing of abscesses, snakebite and glandular swellings. A large genetic diversity still remains unexplored.

Loquat (*Eriobotrya japonica* Lindl.) is a popular fruit in north India. The plant is evergreen, very hardy, low spreading, attaining a height of about 8 m. The fruits are borne in loose clusters and are mainly used for dessert purposes. It is a rich source of vitamin A. There are many varieties of loquat. However, under Tripura conditions 'Golden Yellow', 'Pale Yellow' and 'California Advance' are recommended varieties. Since loquat is self-incompatible hence it is advisable to plant the pollinizer variety also along with the main variety. For 'Golden Yellow' and 'Pale Yellow', 'California Advance', acts as a very good pollinizer.



Loquat

Loquat thrives well on wide range of soils but well-drained, deep, sandy loam soils rich in organic matter are ideal. The plants are planted during February-March and August-September at 6-8 m apart. Loquat needs judicious irrigation for its quality fruits. During fruit growth to maturity proper moisture should be maintained. The loquat trees start bearing fruits at the age of 4 years. A fully grown, well maintained tree provides about 30-40 kg fruits in a year.

Docynia indica : Two species viz., *Docynia indica* and *D. hookeriana*, belong to family Rosaceae. It is a medium to tall deciduous tree with leaves ovate to oblong,

lanceolate, acuminate, serrate and glabrous. Flowers are either solitary or arrange in racemes of 2-3. Fruits are acidic, greenish with red tinged and eaten both as fresh and in pickles as well as in jelly preparation. Sometimes, it is used as a rootstock for grafting of apple. The resultant grafts are semi-dwarf.

*Docynia indica*

Phyllanthus acidus (Star aonla): It belongs to family Euphorbiaceae. This is an ornamental tree, 2-9 m in height with spreading, dense, bushy crown of thickish, rough, main branches. It is particularly found in Mizoram. Fruit is oblate with 6 to 8 ribs and 1-2.5 cm wide; pale-yellow to nearly white when fully ripe; waxy, fleshy, crisp, juicy and highly acidic. For consumption, flesh is sliced from the stone, or the fruits are cooked and then pressed through a sieve to separate the stone.

*Phyllanthus acidus (Star aonla)*

Mulberry: Mulberry (*Morus alba* Linn.) commonly known as 'Tut', is deciduous in nature. Its leaves shed during winters. The tree grows to a height of 5-20 m depending upon the extent of pruning it receives. The foliage is dense, ideal to serve as windbreak tree around the orchard. The fruit is considered to be a delicacy and used as dessert. It is rich in minerals and vitamin contents. Of the genus *Morus*, *M. alba* is used as a feed for silkworms, whereas *M. nigra* is cultivated for fruit. The plant is propagated by cuttings. Hardwood cuttings prepared in January root very well.



Mulberry

Mulberry is a very hardy fruit plant and does not need any care once the plant is established. It is usually grown

Table 1: Food value of minor fruits*

Fruit	Edible portion (%)	Per 100 g of edible portion										
		Moisture	Protein	Fat	Minerals	Carbohydrates (g)	Vitamin A (I U)	Thiamine (mg)	Riboflavin (mg)	Nicotinic acid (mg)	Vitamin C (mg)	Calories
Jamun	-	87.9	0.4	0.2	0.3	10.9	80	0.03	0.01	0.2	18	47
Kamrakh	-	91.9	0.7	0.1	0.4	6.1	-	-	-	-	-	28
Karaunda	98	80.8	-	-	-	-	1,619	-	-	-	1	-
Kathal	-	76.2	1.9	0.1	0.9	19.8	292	0.3	0.13	0.4	7	88
Loquat	76	88.2	0.6	0.3	0.5	9.6	933	-	-	0	0	43
Mulberry	100	85.5	0.7	0.4	0.4	12.2	16	0.06	0.09	0.2	10	55

*Source: The nutritive value of Indian foods and the planning of satisfactory diets

W.R. Aykroyd, ICMR, New Delhi, 1966

as a windbreak tree due to its dense foliage. The tree is pruned annually during December-January when it has shed its leaves. This operation encourages vigorous vegetative growth and the production of large fruit during summers. Mulberry fruit is highly perishable and hence unfit for storage. Each fruit is picked carefully by hands and marketed fresh. About 5-10 kg fruits are harvested from a tree every year. Mulberry and Phalsa fruit

Phalsa: Phalsa is perhaps the hardiest fruit crop for degraded lands; finding its place as a filler crop in the orchards of major fruit crops and thus supplementing the farmer's income. It showed good bearing with high-quality fruits in such wasteland, even in the absence of interculture operations and irrigation. Since it needs heavy pruning (upto 90 cm during February) and bears fruits on current year's shoots, older canes are also available for making baskets.



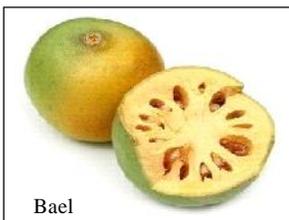
Phalsa

Dillenia indica (Elephant apple): It has originated from Indonesia and belongs to family Dilleniaceae. Locally, it is called Outenga and is found in Meghalaya, Assam and other parts of the region. Elephant apple is a spreading tree and has beautiful white fragrant flowers, toothed leaves and globose fruits with small brown seeds. The greenish-yellow fruit, which has a thick protective covering, is edible. Unripe fruits are cooked to make pickle and chutney. The juicy pulp is aromatic but very acidic.



Dillenia indica (Elephant apple)

Bael: (Bengal quince) Bael belongs to family Rutaceae and is an indigenous fruit of India. This tree is deciduous. It grows upto 6-10 m height, trifoliolate aromatic leaves are used for sacred offering in Hindu religious functions. Branches are unusual with long and straight spines. Bark is shallowly furrowed and corky in texture. Flowers are bisexual, white, sweet scented and borne in cluster. Stamens are numerous, sometimes coherent



Bael

in bundles. Ovary is oblong to ovoid, slightly tapering with numerous ovules, in cells of 8-20 in each ovary. Fruit is called *Ampisarca*, which is globose with pericarp nearly smooth, grayish yellow and about 3 mm thick, hard and filled with soft, yellow and orange colour pleasantly flavoured pulp and numerous seeds. It possesses the medicinal value, the unripe fruit is often prescribed against diarrhoea and dysentery, while ripe fruit is a tonic, laxative and good for heart. One hundred g of fruit pulp contains 61.50 g water, 1.8 g protein, 0.39 g fat, 1.7 g minerals, 31.8 g carbohydrates, 55 mg carotene, 0.13 mg thiamine, 1.19 mg riboflavin, 1.1 mg niacin and 8 mg Vitamin C. Fruit possesses aromatic pulp, eaten as such or as sherbets, squash, has medicinal value and cure for chronic diarrhea, dysentery, gastrointestinal ulcer and costiveness. Richest source of vitamin B2 (Riboflavin). Marmelosin-active ingredient present in bael, extracted from bark of the tree.

Constraints for the development of underutilized horticultural fruit crops:

The constraints are:

- Lack of awareness among the farming community about the nutritional and medicinal value of underutilized horticultural crops.
- Lack of researches lack of desirable seeds and planting material.
- Limited application of advance on-farm agrotechniques.
- Lack of application of innovative and novel technologies such as biotechnology, plasticulture for enhancement of productivity.
- Lack of about post harvest management practices.
- Limited and inadequate marketing supports and infrastructure facilities for transportation, storage and processing.
- Poor recognition of these crops in horticulture promotion programmes.
- Improper institutional arrangements and limited role played by financial institutions in setting up of agro industrial and horticulture based industrial units.

Strategies for the development of underutilized fruit crops:

- Afforestation and rejuvenation of degraded forests may be carried out with emphasis on supplementing and enriching biodiversity of edible fruit/horticultural crops. Joint forest management programmes should facilitate spread of ITK available with local communities on sustainable collection and use of various edible species.
- Domestication of potential wild species through homestead cultivation should be encouraged for avoiding

over-exploitation from natural sources. Supports are required in terms of multiplication of planting materials and their distribution besides providing market access through marketing network for perishables.

– Under-utilized horticultural crops are nutritionally rich and adapted to low input agriculture. More R and D efforts in these will add substantially to food security and nutrition *vis-à-vis* human welfare. Limited number of species needs to be targeted for detailed research and development in under-utilized horticultural crops by national programmes focusing on their conservation and use. Research needs to be geared up both on species/crops important for subsistence farming and those exhibiting potential to become commodity crops.

– Under-utilized horticultural crops are mainly grown/managed under traditional farming systems by diverse ethnic communities. Increased focus to document indigenous knowledge is required such as through ethno botanical studies. Such emphasis will help tap value additions as much of native diversity is put to multipurpose uses.

– Strategies need to be worked out particularly at national and regional levels to develop and make available promising selections/varieties, overcoming constraints of production of good seed material, planting material, in-vitro/tissue cultured material etc. This would boost production, meeting local needs, promoting domestic markets and thereby, enhance income generation of small farming communities.

– Systematic local specific crop planning in accordance with agro-climatic suitability of the region need to be done.

– Rapid expansion of infrastructure facilities with priority on market development, transport and communication needs to be done.

– The yield and quality of these crops are poor which hamper the productivity. Hence, some criteria need to be developed for commercial exploitation of these crops. The criteria may be high productivity, market demand, freedom from easier post harvest management, high nutritive value and availability of technology. Hence, special efforts are needed on the part of the research scientists to develop the suitable location specific package of practices of different horticultural crops including the development of superior varieties, and conservation of genetics resources.

– At the very onset, there is a necessity to make the farming community aware about the

– Nutritional importance of unexploited horticultural crops, *i.e.*, fruits, vegetables and

– Medicinal plants (Sharma, 2003). For this, extension

agents can organize special

– Awareness camps/campaigns, exhibition, etc., at micro and macro level conveying theme of unexploited horticultural crops. Similarly, use of mass media like radio, TV, news paper and other printed literature can play an effective role in creating awareness among the farmers.

– For proper exploitation and better economic returns from underutilized horticultural crops emphasis should be given on developing processing units in this area. It would also provide employment opportunities to the rural folk.

– Genetic erosion is very serious problem in non-traditional fruits and many land races will become extinct if these are not conserved soon. Likewise, efficient production technology and post harvest management are necessary to make the commercial cultivation of non-traditional horticultural crops feasible. The availability of non-traditional horticultural crops will go a long way in overcoming the malnutrition of the people living in these rural areas.

Conclusion: The north eastern region is bestowed with the most congenial climatic conditions for the production of under-exploited horticultural crops. Besides this, quality seeds, varieties and hybrids of these horticultural crops could be produced and exported. The increase in area and production of these horticultural crops will not only provide nutritional security and save money on import but also export of fresh horticultural crops and seed in further expected to boost region economy. These horticultural crops.

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