

Indigenous fruit resources for nutritional security of India

Indian population is growing very fast and is expected to overtake China by 2027. India stands at 101th position among 116 countries in Global Hunger Index which is a very big challenge. In many pockets, there are severe crisis for availability of quality food thus the problems like malnutrition, diabetes are arising and every second women is anaemic. Feeding safe and nutritious food to this alarming growing population seems the greatest challenge to our country. India has a rich heritage of fruits due to its diverse range of climatic conditions. But, the traditional and underutilized fruits are more nutritious and healthy in terms of nutraceuticals over the major fruit crops. The underutilized fruits contain more phytochemicals including minerals, vitamins and other secondary metabolites which help in curing several chronic diseases. The consumption of these fruits has gained popularity during the COVID 19 pandemic due to their great importance in immunity boosting. Every part of India has strong diversity of underutilized fruits such as aonla (*Emblica officinalis*), bael (*Aegle marmelos*), mulberry (*Morus alba*), phalsa (*Grewia subinaequalis*), karonda (*Carissa carandas*), ker (*Caparis decidua*), pilu (*Salvadora oleoides*), khirni (*Manilkara hexandra*) and mahua (*Madhuca longifolia*) etc., which needs to be domesticated and conserved. The exploration of these fruits is rarely attempted and emphasis must be given to explore them.

ACCORDING to the Global Hunger Index 2019, India ranks 101 out of 116 countries. It is believed that more than one-third of the world's malnourished children are in India which is not a good sign of economic progress of any country. India has failed to combat malnutrition that adversely affects the country's socio-economic progress. India is a mega-diverse country with only 2.5% of the land area, accounts for 7.8% of the recorded species of the world spread over 45,968 (11.18% of world) species of plants and 91,212 species of animals (7.43% of the world) that have been documented in its ten bio-geographic regions.

The cultivation of major fruits reaches to a new height due to their large popularity. Obviously, they are good source of energy, fat and carbohydrates but somewhat they are lacking with secondary metabolites and antioxidants. The underutilized fruits have more value of nutraceuticals and are more useful in combating the nutrients related disorders in human. The rural people of tribal belts rely on these unexplored fruit crops for their nutritional and livelihood security. Since, these fruits are lesser known but due to their high medicinal potential, they are becoming popular worldwide. Fruits like aonla, ber, bael, chironzi, khejri, phalsa, pilu, karonda etc. have been shifted to cultivation and their exploitation creates



Aonla

a valuable livelihood option for rural households during these periods of nutritional stress caused by COVID-19 pandemic. Besides, their fresh consumption, they also have good processing potential and some of the fruits like lasoda, ker, pilu and karonda have more processing value than the fresh form. The processed products are also

gaining equally importance in the market and becoming sustainable. Across India, a wide range of indigenous fruit trees are available throughout the year (Table1) for enhancement of income of farmer communities which is potential source of crop diversification and nutritional security. However, over past decades, large scale genetic loss has occurred due to urbanisation of these indigenous fruit species. Climate change is another important hindrance for minimising food production.

Reason for underexploitation of indigenous fruits

- Lack of importance and multiplication techniques
- Lack of cultivation package and practices
- Non-availability of improved varieties
- Inadequate research on diversification of crop pattern through such species
- No initiative by government to promote their commercial expansion
- Lack of marketing infrastructure and value addition technologies
- Non-preference by orchardist to establish an orchard

Table 1. Availability of indigenous fruits

Fruit	Month of availability
January - February	Aonla and Ber
March - April	Ber, Mulberry, Beal, Pilu and Khirni
May - June	Chironji, Beal, Pilu, Khirni, Lasora and Mahua
July - August	Jamun, Ker and Phlase
Sep - October	Karonda
October - November	Pomegranate, Aonla
December - January	Aonla, Ber

Nutritional and livelihood security through underutilized fruits

Indigenous fruits given the tag of ‘poor man’s food’, and their nutritional benefits just remarked as superior in comparison to exotic fruit like apple, grape, banana and citrus etc. These fruits are an immense source of minerals



Ker



Lasoda pickle

and vitamins particularly vitamin C and A (Table 2). Incorporating these fruits in balanced diet can combat problems like malnutrition and other related disorders.

In addition to that, these fruits are also good source of secondary metabolites which are lacking or present in small quantity in major fruits though the exploration of those are little known. If we look upon the iron availability in pilu (*Salvadora oleoides*) and chironji (*Buchanania lanzan*), it is very high (8.0 or more than 8.5 respectively) (Table 2). Likewise, karonda (*Carrissa carandus*), mahua (*Madhuca indica*) and khirni (*Manilkara hexandra*) are rich source of vitamin A which is useful for maintaining eye sight. Aonla (*Emblica officinalis*) and monkey pod (*Pithecellobium dulce*) are another important source of vitamin C whose consumption among rural population can boost immunity power a lot. Ker and chironji again good source of phosphorus and calcium which are very essential for muscle contraction, building strong bones and teeth, regulating heart beat and fluid balance etc. All indigenous fruit are good source of fibre so can their consumption can help in maintaining a healthy and happy digestive system. Since they are lesser used for fresh consumption, therefore, they also secure the livelihood of rural and tribal people by various value addition techniques. Fruits like khejri, pilu and jharber are used round the year after dehydration. Some of the fruits like ler, sangri, karonda, lasoda etc are used in the form of pickle and used widely as ayurvedic tonic. These products are not so commercial but are sold by the households in traditional local markets, haats, fairs and roasides for their earnings. In tribal pockets like Southern Rajasthan, Odisha, Chhattisgarh etc, these are the only source of livelihood. However, standard procedure and protocol is still a challenge.

But in past two decades, ICAR/SAU institution did significant work for standardization of package and practices for precision farming of such species (Table 3). The popularization of these fruits are done by on farm trials, through AICRP on Arid Zone Fruits, and through various trainings and seminars. Some of the research organizations, KVKs and SAU's are working in this direction.

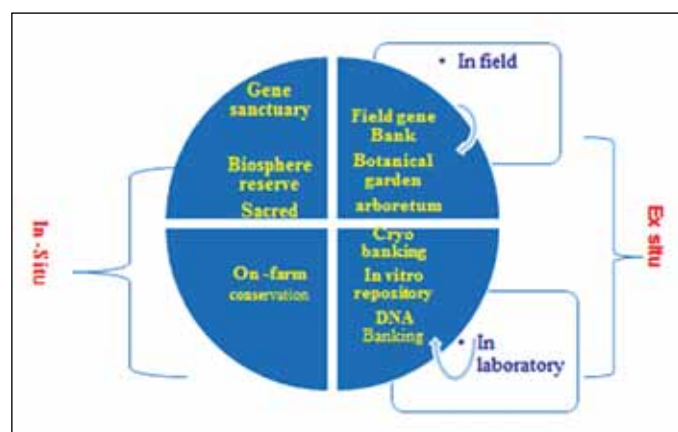
Cultivation prospects of underutilized fruits

Underutilized fruits are easy to cultivate and they are

tolerant enough to adverse climatic and soil conditions. Fruits like ber, karonda, and custard apple can be cultivated at high soil pH (8.5 or more). They can tolerate frost and high temperature upto 48°C. They can withstand in waterlogged soils. The method of propagation is also similar to that of major fruits. Ber can be easily propagated through ring budding, lasoda through T budding, custard apple and tamarind through softwood grafting. Karonda can be easily propagated through seeds and hardwood cuttings. There is no such specific fertilizers and nutrient requirements for these crops.

Indigenous genetic resource conservation strategy

Among the challenges of HGR, utilization and conservation of perennial species of economic importance is essential which can be done either *in situ* or *ex situ*. Emphasis needs to be given to the collection and conservation of such species in coming decades for such species.



Conservation strategy of indigenous resources



Phalsa is a delicious fruit of arid region

Table 2. Proximate principles of other underutilised indigenous fruits species (all value as per 100 g edible portion)

Fruit	Botanical name	Energy Kcal	Protein (g)	Fat (g)	Carbohydrate (g)	Crude fibre (g)	Ca (mg)	P (mg)	Fe (mg)	Vita-A (IU)	Vita -C (mg)
Chironji	<i>Buchanania lanzan</i>	656	19-21.6	59.1	12.1	3.8	279	528	8.5	-	5.0
Ker	<i>Capparis decidua</i>	100	5.9	1.23	20.87		153.8	50.8	2.0	-	133
Karonda	<i>Carissa carandus</i>	59.4	0.3-1.1	2.5-4.6	0.5-2.9	0.6-1.8	21	28	-	1619	9-11
lasora	<i>Cordia myxa</i>	65	1.8-2.0	1.0	12.2	0.3	40	60	-	-	-
Mahua	<i>Madhuca indica</i>		1.37	1.61	22.6	-	45	22	1.1	512	40-42
Khirni	<i>Manilkara henxandra</i>	-	0.48	2.42	27.74	-	83	17	0.9	675	15.6
Monkey pod	<i>Pithecellobium dulce</i>	78.8	2-3	0.4-0.5	18-19	1.1-1.2	13	42	0.5	25	138
Pilu	<i>Salvadorao leoides</i>	-	6.0	2.0	76	2.0	630	167	8.0	-	2.0
Jamun	<i>Syzygium cumini</i>	62	0.7	0.1-0.3	14-16	0.3-0.9	8-15	15-16	1.2	80	5.7-18
Imli	<i>Tamarindus indica</i>	-	2-3	0.6	41-61	2.9	34-94	34-78	0.9	-	44
Ber	<i>Zizyphusnu malaria</i>	-	2.0	1.0	93	2.0	60	120	7.0	-	88

Source: Malik et al. 2010

To strengthen plant genetic resources of indigenous fruit and important perennial plant species, ICAR-NBPGR initiated concerted efforts to enrich their germplasm through systematic exploration and conservation through *in-situ* and *ex-situ* methods. *Ex situ* conservation of important perennial fruit species having economic importance consists conservation of land race, cultivated types and their wild relatives with the help of designated NAGS (National Active Germplasm site).

Table 3. Germplasm maintained in gene bank of NBPGR Regional Station, Jodhpur

Name of crop	No. of germplasm maintained
Ber	26
West Indian Cherry	2
Lasoda	17
Ker	15
Aonla	41
Phalsa	19
Tamarind	01

Strategies for the improvement and promotion of underutilized fruit crops

Indigenous fruit species can play a pivotal role in mitigating malnutrition problem of the country where the availability of major fruits is either low or not accessible. In recent years, the awareness toward these species has increased due to awareness campaigns by ICAR & SAU institutions or KVK and farmers fairs demonstration or audio-video access on internet. As a result, their demand is increasing. These locally adapted species can be grown on waste lands where most of the others fruit fail to grow or cultivate. Since, these species are reservoir of minerals, vitamins and antioxidants, they can serve the purpose of achieving SDGs (1 to 3). But, their produce perishability is a cause of concern for research community. It has been estimated that about 15 to 25% of such produces goes



Tamarind is a source of value-added products

waste without reaching to consumers. Hence their value addition through SHG can boost the farmers income at grassroots level. Several production technologies have been standardized by different institutions e.g., propagation methods (rootstock selection, grafting/budding), plant spacing, canopy management, nutrient and water management, crop regulation, plant protection, and post-harvest management and value addition .

In addition to production, there is a need for skill development through entrepreneurship or self-help groups (SHG's) or Farmer Producer Organizations (FPO), etc. ICAR-CIPHET; CIAH, Bikaner and Godhra etc involve in organising training for popularising these fruits and development of value added product from these species which needs to further up scale for more entrepreneurship development. Government through its various schemes like MIDH, NHB etc. is providing subsidies for the establishment of commercial orchard, ripening chamber, cold storage and packhouse. Organization of awareness camp at tehshil /block level can popularize these indigenous species, to achieve theme 'vocal for local'.

In addition to above incentives to on farm diversity conservation, recognition through felicitation and monetary support to the people and societies involved in the conservation and utilization of such important indigenous underutilized fruit species need to accelerated.

Table 4. Improved varieties of indigenous fruit species

Fruit	Improved varieties	Institute involved for planting material supply
Bael	Goma Yashi, NB-5, NB-7, NB-9, Pant aparna, Pant Sujata, Pant Shivani, Thar divya, Thar Neelkanth	CIAH, Bikaner (Raj); NDUAT, Ayodhya (UP); GBPUAT, Pantnagar (UK)
Aonla	NA-7, NA-10, NA-6, Goma Aishwaria	CIAH, Bikaner (Raj); NDUAT, Ayodhya (UP)
Ber	Gola, Umrana, Goma Krti, Katha, Seb, Thar Sevika, Thar Bhuvraj	CIAH, Bikaner (Raj)
Phalsa	Thar Pragti, CIAH-P-1	CIAH, Bikaner (Raj)
Mulberry	Thar Lohit, Thar Harit, Delhi local	CIAH, Bikaner (Raj)
Lasora	Thar Bold, Maru Samaridi, Karan	CIAH, Bikaner (Raj)
Jamun	Goma Priyanaka, Thar Kranti, CISH-J-37	CISH, Lucknow (UP); CIAH, Bikaner (Raj)
Karonda	Thar Kamal, Konkan Bold, Marugorav, Pant Manohar, Pant Sudarshan, Pant Suvarna	CIAH, Bikaner (Raj); GBPUAT, Pantnagar (UK)
Mahua	Thar Madhu	CIAH, Bikaner (Raj)
Khirni	Thar Rituraj	CIAH, Bikaner (Raj)
Chironji	Thar Priya	CIAH, Bikaner (Raj)

Further, inclusion of a course curricula about indigenous fruit species at school level will create awareness among the children. Furthermore, the use of mass media like radio, television, newspaper and other printed and electronic media platforms can play an effective role in creating awareness about the significance of underutilized fruit crops among the growers and other stakeholders as well as consumers.

Success story

Sh. Kailash Choudhary is a progressive farmer from Kiratpura village, Rajasthan. After undertaking training on value added product of indigenous fruit species particularly of aonla, he raised his income from marginal land. At present, Mr. Kailash is not only organically producing products like amla juice, amla powder, aloe vera juice, candies, squashes, pickles, sweets but also exporting the international quality products to countries like USA, UK, UAE and Japan under brand name of K.S. Bio Foods.

Improved varieties and their source of origin

For establishment of commercial orchard, farmers can send their requisition to respective institutions well in advance so they can receive improved varieties timely.

Institutes involved in producing planting material are given in Table 4.

Market and marketing opportunities

At present, there are two major marketing channels predominant for export and promotion of these fruits. One is traditional method such as local *Mandies*, Haat, and some of the product targeted specified market. Another form is retail chain in which some of the private firms like Reliance Fresh, Pie Stores, Uphaar markets are getting involved. They take the produce directly from the tribal areas and of local people through the agents and further do the essential postharvest handling operations followed by export. These are getting commercialized owing to their high medicinal value. People in restaurants are preferring processed products of these fruits. These have significant market opportunities in future and more channels need to be framed for their commercial marketing.

For further interaction, please write to:

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SUSTAINABLE DEVELOPMENT GOALS RELATED TO FRUITS AND VEGETABLES



SDGs 2 3

Health benefits of fruit and vegetables
Harness the goodness

Fruit and vegetables have multiple health benefits. They strengthen the immune system, combat malnutrition and help prevent non-communicable diseases.



SDGs 2 3

Diversified diet and a healthy lifestyle
Live by it, a diverse diet

Adequate amounts of fruit and vegetables should be consumed daily as part of a diversified and healthy diet.



SDGs 2 3

Food loss and waste
Respect food from farm to table

Fruit and vegetables are worth more than their price. Maintaining their quality and assuring their safety across the supply chain, from production to consumption, reduces losses and waste and increases their availability for consumption.



SDGs 2 8 12 13 14 15

Innovate, cultivate, reduce food loss and waste

Innovation, improved technologies and infrastructure are critical to increase the



SDGs 1 2 3 4 5 8 11 12 15

Sustainable value chains
Foster sustainability

Sustainable and inclusive value chains can help increase production, and help to enhance the availability, safety, affordability and equitable access to fruit and vegetables to foster economic, social, and environmental sustainability.



SDGs 1 2 3 4 5 8 11 12 15

Highlighting the role of family farmers
Growing prosperity

Cultivating fruit and vegetables contributes to a better quality of life for family farmers and their communities. It generates income, creates livelihoods, improves food security and nutrition, and enhances resilience through sustainably managed local resources and increased agrobiodiversity.



SDGs 1 2 3 4 5 8 11 12 15

Source: *Fruit and vegetables – your dietary essentials*, FAO background paper, FAO, Rome















