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Sustainable Processing and Commercialization of Underutilized Fruits in North East India

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Abstract— *The Eastern Himalayan region of India are known for its diverse nature of soil, climate, topography and also rich diversity of less-known, indigenous, underutilized and ethno-medicinally important fruit crops. The underutilized or neglected fruit crops represent an enormous wealth of agrobiodiversity growing wildly in the forest and in almost every homestead and backyard without much care and attention. These crops have great potential for contributing to food security and nutrition, health (nutritional/medicinal), income generation, environmental services and combating the hidden hunger caused by micronutrient deficiencies. Though having many incredible potential, they are less or poorly documented as they have lesser demand in the market, neither they are grown commercially nor traded, lesser known to people about its cultivation, distribution and its value. Through social media and advancement of technology, some tribals have come forward to promote their ways of consuming and preserving by becoming an entrepreneur and making their products commercially available online and offline. Commercialized value-added products of some underutilized fruits from different northeast India were documented here. The commercialization of underutilized fruits in Northeast India holds significant potential for economic, nutritional, and social impacts and also holds significant potential for future research and development. It is high time that the communities, researchers and the entrepreneurs all work together to make these minor fruit crops a commercially viable fruit crop of future.*

Keywords— ***Commercialization, Eco-sustainability, Eastern Himalayan region, Underutilized.***

I. INTRODUCTION

The Eastern Himalayan region of India consist of 8 states namely Assam, Tripura, Arunachal Pradesh, Sikkim, Meghalaya, Manipur, Nagaland, and Mizoram occupying more than one-third of the country's total diversity where total area occupies 7.7% of India's total geographic areas supporting 50% of the biodiversity in the country, of which 31.58% is endemic (Rai et al., 2005; Mao and Hynniewta, 2000). The region are known for its diverse nature of soil, climate, topography and also rich diversity of less-known, indigenous, underutilized and ethno-medicinally important fruit crops which are being used by the local inhabitants in rural areas. The underutilized or neglected fruit crops represent an enormous wealth of agrobiodiversity growing wildly in the forest and in almost every homestead and backyard without much care and attention. These crops have great potential for contributing to food security and nutrition, health (nutritional/medicinal), income generation, environmental services and combating the hidden hunger caused by micronutrient deficiencies. Though having many incredible potential, they are less or poorly documented as they have lesser demand in the market, neither they are grown commercially nor traded, lesser known to people about its cultivation, distribution and its value. The fact and

figures of wild edible fruit tree species in different states of the North east region are limited and scattered (Table 1)

Table 1: Underutilized fruit crops grown in NEH Region

State	No. of species reported
Arunachal Pradesh	14 in Changlang Dist. (Sarma, 2001)
Assam	147 (Patiri and Borah, 2007)
Manipur	23 from Senapati district (Pfoze *et al.*, 2011)
Meghalaya	151 (Jeeva, 2009)
Mizoram	85 (Kar *et al.*, 2013)
Nagaland	86 (Pfoze *et al.*, 2014)
Sikkim	126 (Sundriyal *et al.*, 1998; Sundriyal and Sundriyal, 2003)
Tripura	86 (Majumder and Dutta, 2009)

But these underutilized fruits are packed with rich vitamins, minerals, antioxidant properties and serve as protective food as they have medicinal properties. They also have good flavour, colour, juice content which is an excellent ingredients to turn into value added products. These underutilized fruits are yet to be commercially utilized to their potential and their importance from the abundantly available resources is limited to people residing in rural areas. The only remedy for making the fruits commercially available for all people and also to upgrade the economic and nutritional security for tribal people is to educate the villagers about the nutritional quality of underutilized fruits and its techniques and benefits for making value added products making the fruits more useful, digestive, tasteful and convenient products.

II. VALUE ADDED PRODUCTS

Processing of underutilized fruits and converting into value added products is requisite as it gives higher value added product for human consumption, better employment opportunities to the people especially during off-season in the agricultural sectors, ensures fair returns to the growers improving their economic condition, helps in better utilization of fruits and also utilize the surplus during the off-season. In addition to real value to a food, purity, authenticity, health claims and sustainability are also key ingredients which needs to be maintained. The tribal people of Northeast region mainly processed the underutilized fruits for their consumption only and during the off season. Several states of Northeast have their own specialty of preserving and consuming the indigenous fruits though they lack the knowledge, techniques of processing and importance of underutilized fruits. Through social media and advancement of technology, some tribals have come forward to promote their ways of consuming and preserving by becoming an entrepreneur and making their products commercially available online and offline. People in the region are increasingly recognizing the potential for processing and adding value to underutilized fruits by transforming them into a variety of products such as jams, sauces, jellies, soups, candies, confectionery, pickles, fruit drinks, and dried goods.

III. COMMERCIALIZED VALUE-ADDED PRODUCTS OF SOME UNDERUTILIZED FRUITS FROM DIFFERENT NORTHEAST INDIA

1. Rhus chinensis Mill

Rhus chinensis Mill, belongs to Anacardiaceae family is commonly known as Nutgall tree or Chinese sumac (Fig.1 (a)), Heimang in Manipur, Sohmluhi in Khasi Hills and Sohsama in Jaintia Hills. It is one of the underutilized wild indigenous fruit widely found growing abundantly in North eastern parts of India, China, Japan, Korea and South Asian countries. It plays a major role in supplementing the diet of the local inhabitants of Manipur. The tiny seeded fruit (Fig.1) is a red fleshy drupe, occurring in cluster of galls with red glandular hairs on the fruit wall and acidic in taste. The fruits are rich sources of several antioxidants such as tannin, gallic acid and minerals. Traditionally, the local medical practitioners use the ripe fruits in the treatment of kidney stones and urinary complaints, intestinal worms, dyspepsia, anti-diarrhoea, stomach ulcer, and gastrointestinal disturbances.


Fig. 1(a): Rhus chinensis Mill

Since the fruit is consumed throughout Manipur, the fruit has been developed to produce processed food such as ready to eat Heimang powder, Heimang tea, and Heimang candy as given below with its process flowchart and picture of processed products in fig. 1 (b) - (d).

1.1 Heimang powder

Heimang
↓
Drying heimang under
↓
Grinding to
↓
Mixing heimang powder, sugar, salt, and chilli
↓
Packed in plastic pouches and

Fig. 1(b): Heimang Powder

1.2 Heimang Tea

Process Flochart for Heimang Tea

Heimang fruits
↓
Drying heimang under sun
↓
Grinding the fruits to powder
↓
Mixing of heimang powder and tea leave powder.
↓
Fill the mixture in tea bags.
↓
Packed and store.

Fig. 1 (c): Heimang Tea

1.3 Heimang Candy

Process Flowchart for Heimang Candy

Heimang fruits

↓

Clean and graded.

↓

Drying of fruits under sun

↓

Addition of melted jaggery to dried heimang

↓

Mixing of both ingredients

↓

Molded into small balls.

↓

Coated with small coarse sugar.

↓

Packed and stored.

Fig. 1(d): Heimang Candy

2. Wild Apple (*Docynia Indica*)

This fruit belongs to the family Rosaceae, and commonly found in Sikkim and Meghalaya. Locally called as Soh-phoh in Khasi (Meghalaya) and Heitup in Manipur. The fruits are round (Fig. 2), pear shaped and pale green colour when ripe. The taste of the fruit in the foot hill tracts ranged from medium sweetness to acidic and astringent varies with genotypes. The fully ripe fruit is eaten as fresh, while the half ripe ones are consumed as fresh and processed into pickles, salted dried or candied. This fruit product consists of polyphenol compounds, especially flavonoids and alkaloids which reduces the blood glucose concentration, and in turn have anti-obese effect in mice. The Manipur people commercialized the fruits processing them into pickle Fig. 2 (a), salted dried Fig. 2 (b) and candied. Fig. 2 (c).

Fig. 2: Wild Apple

Fig. 2 (a): Wild Apple Pickle

Fig. 2 (b): Salted dried Wild Apple

Fig. 2 (c): Candied Wild Apple

3. Passion fruit (*Passiflora edulis Sims*)

Mizoram, Manipur, Nagaland, and Sikkim states of Northeastern region of India, holds great potential for Passion fruit (*Passiflora edulis Sims*). In Manipur, it is commonly known as Shitaphal, while in Meghalaya, it is called Soh-brab. Both yellow and purple varieties are cultivated in various districts of Manipur, including Chandel, Churachandpur, Ukhrul, Thoubal, Bishnupur, and Tamenglong. There are two varieties of passion fruit, purple and yellow colour. Generally distinguished by reddish, pinkish, or purplish coloration in its stems, leaves, and tendrils. The purple passion fruit (P. edulis) is a woody, robust, perennial vine. Its fruit is ovoid and turns deep purple when fully ripe while the yellow variety (P. edulis f. flavicarpa) has a vine similar to that of the purple variety but is more vigorous in growth. Passion fruit is a rich source of vitamin A and C with high juice content. It can be eaten raw or processed to enhance the flavor of ice cream, jams, and refreshing beverages like squash. A pictorial representation of the fruit, a process flowchart for preparing passion fruit squash, and the commercially produced product from Manipur are shown below in Figures 3 and 3(a).

Process flowchart of Passion fruit squash

Passion fruits
↓
Peel and collect the pulp with seeds.
↓
Extract juice and remove the fiber and seed by filtration using muslin cloth.
↓
Add sugar, water, and citric acid.
↓
Boils the ingredients until sugar dissolve.
↓
Add preservative for flavor and colour.
↓
Fill the squash in sterilized bottle.
↓
Sealed the cap.
↓
Stored in cool & dry place.

Fig. 3:Passion fruit

Fig. 3(a): Passion fruit squash.

4. Wild olive (*Elaegnus, spp*)

Wild olive (Fig. 4) belonging to family Elaeagnaceae consists of two species such as *E. latifolia* and *E. pyriformis*, they are commonly known as Sohshang in Khasi Hills, Slangi in Jaintia Hills and Mirica tenga in Assamese. It is one of the very popular and important minor fruit indigenous to Northeast India mainly in Sibsagar (Dikho valley of Assam), Naga hills (Nagaland), Khasi, Jaintia hills of Meghalaya and Sikkim. The fruits of E. latifolia are oblong with dark pink in colour at full ripew whereas, fruits of E. pyrifomis are pyriform with slightly pointed at both ends. They are very perishable with shelf-life of only 3–5 days at room temperature (20-24 °C). The fruits are very rich source of vitamins and minerals, especially in vitamins A, C and E, flavonoids, other bio-active compounds, good source of essential fatty acids, which is fairly unusual for a fruit and are capable of reducing the incidence of cancer and also as a means of halting or reversing the growth of cancers. All parts of the fruits are edible including seed, at all stages of fruit growth. They are consumed raw with salt or used in pickle preparation, jam and refreshing drink by the tribes. The pickle shown in Fig. 4 (a) are commercially sold online and available for all people.

Fig. 4: Wild olive

Fig. 4 (a): Wild olive pickle

5. Elephant Apple (*Dillenia Indica L*)

Elephant apple belongs to family Dilleniaceae and locally called as Otenga (Assam) found in Assam, Meghalaya and other states of North Eastern region. This fruit (Fig. 5) originated from Indonesia and is a spreading tree arranged with beautiful white fragrant flowers, serrated or toothed leaves and globose fruits with small brown seeds. The greenish-yellow fruit which have a thick protective covering is edible. The juicy pulp is very acidic and the unripe fruits are used in cooking to make pickle and chutney. The elephant apple pickle shown in Fig. 5 (a) was commercial available online.

Fig. 5: Elephant Apple

Fig. 5 (a): Elephant Apple Pickle

6. Prunus Nepalensis

This fruit (Fig.6) belongs to Rosaceae family, commonly known as Sohiong in Khasi (Meghalaya) is naturally distributed in East Khasi Hills, West Khasi hill and Jaintia hills district of Meghalaya between 1500 and 2000 m altitude. It is an important indigenous nutritionally rich lesser known fruit of temperate area. The fruit are drupe, smooth fleshy round in shape, dark purple in colour at full ripe and green to pinkish colour in immature stage and the stone is hard. There are two types of Sohiong fruits based on size, viz., big and small fruit size, when mature they are bigger in size and purplish or blackish brown. This fruits eaten raw and used for processing into value added products such as wine, squash, fruit juice and jam making. The Sohiong squash (Fig. 6 (a)) and jam (Fig. 6 (b)) are commercially sold online and made available for all.

Fig. 6: Sohiong Fruits

Fig. 6 (a) Sohiong Squash

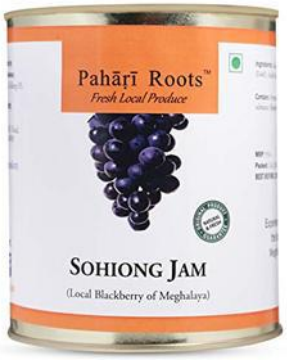

Fig. 6 (b): Sohiong Jam

7. Myrica farquhariana Wall

This fruit crop belongs to family Myricaceae which is commonly known as Box Myrtle (Fig. 7) as general, Soh-phie-nam in Khasi and Saphai in Jaintia Hills. The fruits are very common among the 'Hynniewtrep' and is the state fruit of Uttarakhand. The fruit have many medicinal properties and the edible part of the fruit pulp consist of 75% of the fruit and are eaten fresh at all stages of its growth. It is one of the tastiest and preferred wild fruits of the community. It has several commercial importance as the fruits are used for making refreshing drink and pickle (Fig. 7 (a)) giving attractive sparkling red colour.

Fig. 7: Box Myrtle

Fig. 7 (a): Box Myrtle pickle

8. Assam Lemon

The most common and abundant citrus fruit found in North East state of Assam is the Assam Lemon (Fig. 8) locally known as 'Kazi Nemu'. It is found growing in the backyards of almost every Assamese household without productive measures taken for it. The lemon is generally oval and green in color with a standard size of 85gm to 125gm which is comparatively larger and

contain more juice than rough lemon. The Assam Lemon is the proud beholder of a number of other useful characteristics like aroma, medicinal value, so on so forth. The juice content per lemon is 36% to 44% of the total volume of the fruit. This citrus fruit is grown all-round the year and is mainly use in pickle (Fig. 8 (a)) for their own households and sold commercially online.

Fig. 8: Assam lemon Pickle

Fig. 8 (a): Assam lemon pickle

9. Carambola (*Averrhoea Carambola L*)

Carambola is locally known as 'Soh Pyrshong' in Khasi (Meghalaya) and Heinoujom in Manipur belonging to family Oxalidaceae. It is grown all over northeastern region of India and known as star fruit as the fruit are elongate and angular which is composed of 5 carpels giving a star-shaped cross section resembling a star. The skin is thin, pale to deep yellow and smooth with a waxy cuticle while the flesh is pale yellow-to- golden yellow, translucent, crispy, very juicy, and fibreless. The fruits are more or less oxalic acid in odour and very sour to mildly sweet in flavour. Ripen fruits (Fig. 9) are eaten raw as well as produced processed products like squash, candy (Fig. 9 (a)), pickle (Fig. 9 (b)) and refreshing drink.

Fig. 9: Carambola

Fig.9 (a): Carambola candy

Fig. 9(b): Carambola pickle

10. Ceylon olive (*Elaeocarpus serratus*)

Ceylon olive (*Elaeocarpus serratus* L.) belongs to family Elaeocarpaceae is one of the under-utilised edible fruit tree. The fruit pulp of *E. serratus* is rich in minerals, fibre, vitamins, and phenolic compounds, most of which are antioxidants with medicinal

properties. Fresh and ripened fruit (Fig. 10) are edible and used for preparation of value-added products such as squash, jam, candy (Fig. 10 (a)) and pickles.

Fig. 10: Ceylon olive

Fig. 10 (a): Ceylon olive candy

IV. IMPACT AND APPLICATIONS: POTENTIAL ECONOMIC, NUTRITIONAL, AND SOCIAL IMPACTS OF COMMERCIALIZING UNDERUTILIZED FRUITS

The commercialization of underutilized fruits in Northeast India holds significant potential for economic, nutritional, and social impacts. This section discusses these potential impacts in detail, supported by relevant references.

1. Economic Impact

Commercializing underutilized fruits can lead to substantial economic benefits for local communities. By developing value-added products such as jams, jellies, candies, pickles, and beverages, local farmers and entrepreneurs can access new markets and improve their income levels. The processing of these fruits can create employment opportunities, especially for women and youth, thereby reducing migration to urban areas in search of jobs. This can also help in mitigating the problem of underemployment during the off-season in the agricultural sector. The increased market demand for these products can stimulate local economies and encourage the development of small and medium-sized enterprises (SMEs). As these fruits are indigenous to the region, they can be marketed as unique and exotic products, attracting both domestic and international consumers. The establishment of supply chains for these fruits can also promote infrastructural development, such as better transportation and storage facilities. For example, the commercial production of products like Heimang powder, Heimang tea, and passion fruit squash in Manipur has demonstrated the viability and profitability of such ventures (Koley & Kaur, 2019; Mahapatra et al., 2012).

2. Nutritional Impact

Underutilized fruits are often rich in essential nutrients, vitamins, minerals, and antioxidants, which are crucial for combating malnutrition and micronutrient deficiencies. These fruits can serve as a significant source of nutrition for local populations, improving overall health outcomes. For instance, fruits like wild olive, elephant apple, and Ceylon olive are high in vitamins A, C, and E, and flavonoids, which have numerous health benefits, including boosting the immune system and reducing the risk of chronic diseases (Arora & Nayar, 1984; De Caluwe et al., 2010).

Integrating these fruits into the diet can help address "hidden hunger," a form of malnutrition caused by a lack of essential micronutrients. This is particularly important in rural and tribal areas where access to a diverse diet is limited. The promotion of these fruits can also encourage dietary diversity, leading to better health outcomes.

3. Social Impact

The commercialization of underutilized fruits can have profound social impacts, particularly in empowering women and marginalized communities. Women often play a key role in the collection, processing, and marketing of these fruits. By formalizing and commercializing these activities, women can gain financial independence and contribute to their household income, thereby improving their social status and reducing gender inequalities (Mishra et al., 2015; Uprety et al., 2012).

Additionally, preserving and promoting the use of indigenous fruits can help maintain cultural Sheritage and traditional knowledge associated with these crops. This can foster a sense of pride and identity among local communities, encouraging the younger generation to value and continue these traditions.

The collaboration between researchers, entrepreneurs, and local communities can also strengthen social cohesion and foster a spirit of innovation and entrepreneurship. For example, initiatives to produce and market wild apple pickle, salted dried wild apple, and candied wild apple in Meghalaya and Sikkim have brought communities together,

creating a sense of shared purpose and mutual support (Roy & Rao, 2006; Jamir & Takatemjen, 2012).

Case Studies and Examples

1. **Rhus chinensis Mill (Heimang)**

- **Economic Impact**: Development of Heimang powder, tea, and candy has created a niche market in Manipur, boosting local incomes.
- **Nutritional Impact**: Rich in antioxidants like tannin and gallic acid, these products help in addressing health issues such as kidney stones and gastrointestinal disturbances.
- **Social Impact**: Traditional knowledge of Heimang's medicinal properties is preserved and propagated, enhancing community pride.

2. **Wild Apple (Docynia Indica)**

- **Economic Impact**: Wild Apple products like pickles, salted dried fruits, and candies have commercial potential in Sikkim and Meghalaya.
- **Nutritional Impact**: High polyphenol content contributes to anti-obesity and blood glucose regulation.
- **Social Impact**: Commercialization supports local farmers and entrepreneurs, promoting sustainable livelihoods.

3. **Passion Fruit (Passiflora edulis Sims)**

- **Economic Impact**: Processing into juice, jams, and squashes has opened new market avenues in Mizoram, Manipur, Nagaland, and Sikkim.
- **Nutritional Impact**: Excellent source of vitamins A and C, beneficial for immune health and skin care.
- **Social Impact**: Encourages the cultivation of passion fruit, involving community members in value-added production.

4. **Wild Olive (Elaegnus spp)**

- **Economic Impact**: Pickle production has provided a stable income for communities in Assam and Nagaland.
- **Nutritional Impact**: High in vitamins A, C, E, and essential fatty acids, contributing to cancer prevention and overall health.
- **Social Impact**: Enhances food security by making nutritious food available throughout the year.

5. **Elephant Apple (Dillenia Indica L)**

- **Economic Impact**: Commercially available pickles have generated additional income for Assamese households.
- **Nutritional Impact**: Acidic pulp is used in traditional medicine, aiding in digestion and overall health.
- **Social Impact**: Promotes the use of traditional fruits in modern cuisine, preserving culinary heritage.

6. **Prunus Nepalensis (Sohiong)**

- **Economic Impact**: Sohiong products like squash and jam are commercially viable, boosting local economies in Meghalaya.
- **Nutritional Impact**: Rich in vitamins and antioxidants, supporting overall health and well-being.
- **Social Impact**: Encourages sustainable harvesting and processing practices, benefiting the environment and community.

7. **Assam Lemon**

- **Economic Impact**: Pickle production has become a lucrative business in Assam, supporting many households.
- **Nutritional Impact**: High juice content rich in vitamin C, enhancing immunity.
- **Social Impact**: Promotes the cultivation of indigenous crops, preserving agricultural diversity.

8. **Carambola (Averrhoa Carambola L)**

- **Economic Impact**: Processing into candy and pickle has created new market opportunities.
- **Nutritional Impact**: Provides essential vitamins and minerals, supporting health.
- **Social Impact**: Encourages the use of traditional fruits in contemporary food products.

9. **Ceylon Olive (Elaeocarpus serratus)**

- **Economic Impact**: Value-added products like squash and candy have commercial potential.
- **Nutritional Impact**: Rich in antioxidants and bioactive compounds, beneficial for health.
- **Social Impact**: Supports local entrepreneurship, preserving traditional knowledge.

By highlighting the economic, nutritional, and social impacts of commercializing underutilized fruits, this paper emphasizes the multifaceted benefits of promoting these crops. This approach not only addresses food security and

nutrition but also supports sustainable development and cultural preservation, making it a compelling subject for high-rated journals.

V. NOBILITY AND FUTURE ASPECTS

The exploration and commercialization of underutilized fruits in Northeast India embody a noble endeavor with profound implications for sustainable development. This section highlights the noble aspects of this work and outlines future research directions, supported by relevant references.

a. Nobility of the Endeavor

The pursuit of commercializing underutilized fruits in Northeast India is noble for several reasons. Firstly, it addresses the pressing issue of food security by utilizing indigenous fruit varieties that are often neglected despite their rich nutritional profiles. This can play a vital role in combating malnutrition and improving public health in rural and tribal areas where dietary diversity is limited (Kumar & Bharadwaj, 2005).

Secondly, this endeavor respects and preserves traditional knowledge and cultural heritage. The indigenous communities in Northeast India have a deep understanding of their local biodiversity, which has been passed down through generations. By promoting the use of these underutilized fruits, this project helps safeguard this invaluable knowledge and ensures its transmission to future generations (Uprety et al., 2012).

Thirdly, the project promotes environmental sustainability. Underutilized fruits are often well-adapted to local climatic conditions and require fewer inputs, such as water and fertilizers, compared to commercial crops. This makes them ideal for sustainable agriculture practices that minimize environmental impact and support biodiversity conservation (Sharma et al., 2013).

b. Future Aspects

The commercialization of underutilized fruits in Northeast India holds significant potential for future research and development. Some key areas for future exploration include:

i. Nutritional Profiling and Health Benefits:

- Comprehensive nutritional profiling of underutilized fruits to identify their bioactive compounds and health benefits. This could include studies on their antioxidant, anti-inflammatory, and anti-cancer properties (Kumar & Bharadwaj, 2005).
- Development of functional foods and nutraceuticals from these fruits to address specific health issues such as diabetes, cardiovascular diseases, and gastrointestinal disorders (Mahapatra et al., 2012).

ii. Value-Addition and Product Development:

- Research on innovative processing techniques to develop a wide range of value-added products from these fruits. This could include the use of modern technologies like freeze-drying, encapsulation, and fermentation to enhance the shelf life and nutritional quality of the products (Koley & Kaur, 2019).
- Market research to identify consumer preferences and potential markets for these products, both domestically and internationally (Roy & Rao, 2006).

iii.Sustainable Agriculture Practices:

- Investigation into the cultivation practices of underutilized fruits to improve their yield and quality. This could include studies on organic farming, intercropping, and agroforestry systems that integrate these fruits with other crops (Bhatt & Tomar, 2002).
- Development of sustainable supply chains that minimize post-harvest losses and ensure fair trade practices. This could involve training and capacity-building programs for local farmers and entrepreneurs (Sharma et al., 2013).

iv.Socio-Economic Impact Assessment:

- Longitudinal studies to assess the socio-economic impacts of commercializing underutilized fruits on local communities. This could include evaluating changes in income levels, employment opportunities, and social empowerment (Mishra et al., 2015).
- Policy research to identify the regulatory frameworks and incentives needed to support the commercialization of these fruits. This could involve collaboration with government agencies, non-governmental organizations, and international bodies (Uprety et al., 2012).

VI. CONCLUSION

Since underutilized fruit crops are reservoirs of minerals, vitamins, carbohydrates, proteins, antioxidants, they can be easily processed and converted to value added products in order to increase the livelihood of the farmers, help to reduce hunger, gives nutritional security and also provide food during off season. However, with rapid land transformation, growing connectivity, deforestation due to

uncontrolled Jhum, wood felling, etc. regrettably, resulted in the decline and loss of these species, henceforth facing rarity. The standardization of a scientific crop production, characterization of species, preservation technique, storage conditions, packaging and marketing channel needs to be encouraged and should be the prime strategies which need to be approached to farmers at the earliest. It is high time that the communities, researchers and the entrepreneurs all work together to make these minor fruit crops a commercially viable fruit crop of future. The co-existence of these wild fruit plants along with the commercial exotic crops will definitely help in achieving food security and eco-sustainability in the future.

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