Unveiling the Rich Tapestry of Minor Fruit Crops: Cultivation Practices, Market Strategies, and Contributions to Agricultural Diversity and Sustainability

ABSTRACT

Cultivating minor fruit crops constitutesa vital component of diversified agriculture, contributing to local economies, dietary variety, and niche markets. This explores the intricacies of minor fruit crop production, emphasizing the importance of suitable variety selection, meticulous cultivation practices, and effective pest management. Key considerations include water and nutrient management, pruning techniques, and post-harvest handling. Market strategies~~,~~ such as exploring local markets and value addition~~,~~ are discussed, highlighting growth opportunities. The cultivation of minor fruit crops not only enhances agricultural biodiversity but also foster~~s~~ resilient and sustainable food systems. This encapsulates the essence of cultivating minor fruit crops, shedding light on their significance in the broader agricultural landscape.Value addition through processing, such as making jams, jellies, or juices, ~~is~~ aredискussed as a means of enhancing market appeal and economic viability for growers.The role of minor fruit crops in promoting agricultural sustainability and resilience. By fostering biodiversity and offering alternatives to globally dominant fruit varieties, these crops contribute to the creation of dynamic and resilient food systems.

Keywords: Minor fruit crops, Agricultural diversity, Cultivation Practices, Pest Management, Market Strategies, Sustainability, Biodiversity, Resilient Food Systems.

1.INTRODUCTION

The cultivation of minor fruit crops play~~s~~ a pivotal role in diversifying agricultural landscapes, offering a spectrum of unique and often regionally distinctive fruits that contribute to local economies, dietary variety, and niche markets. Unlike major fruit crops that dominate global agricultural landscapes, these minor fruits encompass a diverse array of species, each possessing distinct flavours, textures, and adaptability to specific climates. The production of minor fruit crops involve~~s~~ a careful selection of suitable varieties tailored to local conditions, meticulous site preparation, and an understanding of optimal planting, irrigation, and fertilization practices. Successful cultivation also requires vigilant pest and disease management, employing integrated approaches to minimize environmental impact. Pruning, training, and appropriate harvesting techniques are essential for maximizing yield and quality. The marketing of

Comment [OF1]: 1 constitute

Comment [OF2]:

Comment [OF3]: what are these minior fruit crops?

Comment [OF4]: 2 paper/study????

Comment [OF5]: sentence is hanging

Comment [OF6]: mention these fruits

minor fruit crops often involves tapping into local markets, farmers' markets, and speciality stores~~,~~ with the potential for value addition through processing. Continuous learning and staying abreast of the latest agricultural research are critical for growers engaged in the production of minor fruit crops, ensuring adaptability to evolving agricultural practices and market trends. This sector not only promotes biodiversity but also contributes to the resilience and sustainability of agriculture by fostering a dynamic and varied cultivation landscape.Some examples of minor fruit crops include elderberries, gooseberries, pawpaws, persimmons, jujubes, and currants. Success in the production of minor fruit crops often involves a combination of good agricultural practices, market awareness, and adaptability to changing conditions.

The production of minor fruit crops involves the cultivation and management of fruits that are not as widely grown or commercially significant as major fruit crops like apples, oranges, or bananas. Minor fruit crops often include a diverse range of fruits that vary in size, flavour, and adaptability to different climates. These crops can be important for local economies, niche markets, and diverse diets.

Here are some key considerations for the production of minor fruit crops:

Comment [OF7]: which sector?

Comment [OF8]: there should be sort methods/methology before presenting the discoveries

Comment [OF9]: these are important piece information but the sentences need to be arranged as follows: Cultivation Practices, Market Strategies, and Contributions. its better to break each componenet into paragraphs

Comment [OF10]: Methodology is not clear. Is this a review orathors recommended cultivation practices? If so,how did you come up with these recommended practices? in Otherwise, provide methodology/methods used to generate theserecommended practices.

Comment [OF11]: provide source

1.Selection of Suitable Varieties:

i. Choose varieties that are well-suited to the local climate and soil conditions.

ii. Consider factors such as disease resistance, pest tolerance, and fruit quality.

2.Site Selection and Soil Preparation:

i. Identify suitable locations with the right soil composition, drainage, and sunlight for each crop.

ii. Prepare the soil by incorporating organic matter and addressing any nutrient deficiencies.

3.Planting and Propagation:

i. Use appropriate propagation methods, such as seeds, cuttings, grafting, or tissue culture, depending on the crop.

ii. Follow recommended planting distances and spacing for optimal growth.

4.Water Management:

i. Implement efficient irrigation systems based on the water requirements of each crop.

ii. Monitor soil moisture levels to prevent under- or over-watering.

5.Nutrient Management:

i. Conduct soil tests to determine nutrient levels and adjust fertilization practices accordingly.

ii. Provide necessary nutrients through organic or synthetic fertilizers.

6.Pest and Disease Control:

i. Implement integrated pest management (IPM) practices to control pests while minimizing environmental impact.

ii. Monitor crops regularly for signs of diseases, and use appropriate measures, including cultural, biological, or chemical control.

7.Pruning and Training:

i. Prune plants to promote better air circulation, sunlight penetration, and fruit production.

ii. Use appropriate training methods to shape plants and optimize space utilization.

8. Harvesting and Post-Harvest Handling:

Comment [OF12]: use numbering different from main section

Comment [OF13]: mention some of the suitable biophyical conditions with repect to varieties/species

Comment [OF14]: which pests and diseases ae of importance?

i.Harvest fruits at the right maturity to ensure optimal flavor and quality. ii.Handle fruits carefully to minimize bruising and damage during harvesting and transportation.

Comment [OF15]: Be specific to some of the conditions that a farmer should pay attension to while carrying out these activities with reference to fruit type

9. Marketing and Value-Adding:

i. Explore local markets, farmers' markets, and specialty stores to sell minor fruit crops.

ii. Consider value-adding processes such as making jams, jellies, or juices to increase product diversity.

10. Continuous Learning:

i. Stay informed about the latest research and advancements in cultivation practices for minor fruit crops.

ii. Network with other growers, extension services, and agricultural organizations for knowledge exchange.

Comment [OF16]: This should move to the next section (Cultivation Practices).

2.THE PRODUCTION OF MINOR FRUIT CROPS IS WELL-STRUCTURED AND COVERS ESSENTIAL ASPECTS FOR SUCCESSFUL CULTIVATION i.

Biodiversity and Ecosystem Services

- Encourage biodiversity on your farm by incorporating companion planting, hedgerows, or cover crops to attract beneficial insects and natural predators.
- Recognize the ecosystem services provided by diverse crops, such as soil improvement, water conservation, and pest control.

2.**Climate Resilience**

- Consider climate-resilient varieties to adapt to changing weather patterns and reduce the risk of crop failure due to extreme conditions.
- Implement climate-smart practices, such as rainwater harvesting or agroforestry, to enhance the overall resilience of your farming system.

3.Organic and Sustainable Practices

- Emphasize organic farming methods to meet the growing demand for organic produce.
- Implement sustainable practices that minimize environmental impact, such as reduced chemical inputs and conservation tillage.

4.Community Engagement

- Foster community engagement by organizing events, workshops, or farm tours to create awareness about minor fruit crops.
- Collaborate with local communities, chefs, and food enthusiasts to build a market for unique and locally grown fruits.

5.Diversification and Crop Rotation

- Explore diversification by growing a mix of minor fruit crops to spread risks and tap into various markets.
- Practice crop rotation to manage soil health, break pest cycles, and improve overall crop productivity.

6.Adoption of Technology

- Stay updated on technology adoption in agriculture, such as precision farming, sensor-based irrigation, or data-driven decision-making for efficient resource use.
- Utilize online platforms for marketing, selling, and staying connected with customers or other farmers.

7.**Government Support and Grants**

•Explore government programs and grants that support the cultivation of minor fruit crops. This could include financial assistance, training programs, or subsidies.

8.**Record Keeping and Analysis**

- Maintain detailed records of cultivation practices, yields, and any issues faced during the growing season. This information can be valuable for future planning and improvement.
- Analyze data regularly to identify trends, successes, and areas for optimization in your farming practices.

2.MINOR TROPICAL FRUITS

Minor tropical fruits are not as widely grown as those found in the big markets, and their consumption and trade are typically more constrained both geographically and numerically: Mangosteen, durian, and carambola are a few prominent examples. These fruits are widely consumed throughout Southeast Asia, with the durian being especially

popular in Malaysia. The following crops can also be included in this group: guava, litchi, passion fruit, some species of Annona, longan, rambutan, and pitaya – not only one but a group of species of the genus Hylocereus and Selenicereus, sweet pepino (*Solanummuricatum* Ait.) and some Sapotaceae, like the mamey (*Calocarpumsapota* (Jacq.) Merr.) or the sapodilla (*Manilkarazapota* (L.) P. Royen), and to a lesser degree others like jaboticaba (*Myrciariacauliflora* Berg), jack- and bread-fruit. Menini (1992) highlighted the substantial export potential of these lesser-known tropical fruits years ago, but only if horticulture research efforts were made to address the pre- and post-harvest horticultural restrictions. Even if many of these lesser fruits are no longer subject to these restrictions after about 25 years, they haven't yet realized their full potential.

EASE OF CULTIVATION

This will involve a lot of hard-to-evaluate issues, such as the possibility of high-density plants, the need for training and pruning, the need for uniform ripening and harvesting, etc.

Due to its larger canopy, durian, jack and breadfruit, and to a lesser extent carambola, do not fit well in the category of easily cultivated trees. The opposite is true for guava, which is easier to grow in high-density plantings because of the availability of dwarf cultivars and its rapid rate of production development. The use of trellises is necessary for passion fruit, pitaya, and sweet pepino crops. These crops demand some initial investment and training, but the high yields and high market prices are the only ways to make up for these costs.

WIDE ADAPTABILITY

Out of all the minor fruits that are taken into consideration here, the ones that adapt to tropical and subtropical conditions the best are guava, sapodilla, pitaya, passion fruit, and sweet Pepino; carambola, which is highly wind-sensitive, longan, and litchi are less adaptable. On the other hand, authentic tropical fruits such as durian, breadfruit, rambutan, and mangosteen have remained largely restricted to their birthplace in Southeast Asia because they require a high degree of climatic adaptation, especially the latter because of its limited genetic variability (GalánSaúco, 2003). The most intriguing plant in the Sapotaceae family in terms of flavour, Pouteriasapota, is difficult to propagate widely since it is extremely sensitive to dry spells (Azurdia, 2006). The guava's high sensitivity to fruit flies and other pests and diseases could also be viewed as an adaptive feature that poses a significant barrier to the fruit's further commercial development.

ORGANOLEPTIC QUALITIES

Almost all of the smaller fruits are of high quality, as shown by the fact that they are widely consumed in their local markets. The exception might be some fruits like guava, jackfruit, sweet pepino, and especially durian, which has a strong smell that turns off a lot of new potential customers and is undoubtedly a major barrier to worldwide trade.

NUTRITIONAL AND MEDICINAL VALUES

A person could incorporate the majority of these small tropical fruits in their daily diet from anywhere in the world because they have long been recognized for their good

nutritional and therapeutic qualities. The global market for nutraceutical products is predicted to reach $500 billion by 2007 (Gosselin *et al.*, 1999), with horticulture products accounting for a large portion of this growth. These projections are about to be tested. One notable example of a small fruit is the mangosteen, whose skin (which makes up about 70% of the fruit's weight) contains xanthones, a class of compounds with strong antioxidant potential that are very desirable as nutraceutical goods and which enable the fruits to be used whole. Longan flesh has been used as an antidote to poison and is reputed to possess febrifuge and vermifuge qualities. Since 1920, various items made from durian flesh, which is said to have aphrodisiac qualities, have been sold all over the world. An infusion of passion fruit leaves high in the glycoside "passiflorine" is said to produce sedative effects (GalánSaúco, 2003).

VERSATILITY OF USE AND EASY CONSUMPTION

Although many various derivative products (such as jam, powder, juice, and others) can be created from most of the fruits considered here, all of them are consumed as fresh fruits. Compared to larger fruits like breadfruits or jackfruits, small, easily peelable fruits like those in the Sapindaceae family, litchi, longan, or rambutan have a higher potential for prolonged consumption. Although the market for processed fruits is sadly much smaller than that for fresh fruits-with the well-known exceptions of pineapple and citrus-the ability to be marketed either fresh or processed, as in the case of litchi or longan, and the versatility of the passion fruit, which can be enjoyed either fresh or in juices, liqueurs, or jams, or the various uses of the carambola (vegetable or fruit salads, cocktails ornament, etc.) can also be a great advantage.

EASE OF PROPAGATION AND DISTRIBUTION OF PLANTING MATERIAL

All of the tiny fruits that are taken into consideration here, primarily the guava and the sapodilla to a lesser extent, are easily propagated by seeds and spread rapidly around the globe (GalánSaúco, 2003). The majority of minor fruits are easily propagated, but certain members of the Sapindaceae family, such as longans and litchis, are typically propagated by air layering. This has made it challenging to disperse specific plant material to parts of the world that are not their native habitat. The presence of latex in the wood skin of plants in the Sapotaceae family, especially Pouteriasapota, makes grafting—the typical method

of vegetative propagation—difficult. This has detrimental effects on the broad distribution of particular plant material. (Azurdia, 2006). Due to its limited seed viability, lack of quick propagation techniques, and sluggish grafted plant growth, the mangosteen presents more challenges for extensive plantings (Bin Osman and Rahman Milan, 2006). When assessing a fruit's potential for additional commercial growth, market factors must also be considered.

TABLE 1 : METHODS OF PROPAGATION IN SITU FRUIT CROPS

CROP	METHODS	COMMERCIAL METHOD	TIME
Aonla	Budding	Patch budding	June-August
Bael	Root cutting, budding, layering	Patch budding	June- July
Custard apple	Soft wood grafting, seed, budding	Budding and grafting	June-July
Date palm	Seed	Seed	Feb.-March and August-September
Fig	Cutting, budding, air layering	Air layering	Dec.-Feb. and June-July
Jackfruit	Inarching, air layering, epicotyl grafting, budding,	Cutting and side veneer grafting	June-July
Jamun	Seed, budding, Softwood grafting	Softwood grafting and patch budding	June-July
Phalsa	Seed, cutting	Seed	March-April
Tamarind	Seed, soft wood grafting, budding	Air layering and patch budding	June-July
Wood apple	Root cutting, budding, seed	Seed and bud grafting	Feb.-March and June-July

VALUE ADDITION IN MINOR FRUIT CROPS

Value addition is the process of changing or transforming a product from its original state to a more valuable state (Sharma *et al.*, 2014). Value addition to agricultural products is the process of increasing the economic value and consumer appeal of an agricultural commodity. Various value-adding technologies such as processing and preservation techniques, dehydration and drying technology, freezing technology, packing, labelling, etc. can be applied to agricultural produce to increase its value. The total value of any agricultural produce is increased by performing certain post-harvest processing operations rather than selling it as such after harvest (APO, 2009). Fruit is a perishable commodity and due to this, they are wasted in large quantities owing to the absence of facilities and know-how for proper handling, distribution, marketing and storage. Furthermore, huge amounts of the perishable fruits produced during a particular season result in a glut in the market and become scarce during other seasons. Food preservation has an important role in the conservation and better utilization of fruits to avoid the glut and utilize the surplus during the off-season. Many types of value-added products are being produced at both household and commercial levels with different popular fruits

cultivated the world over. It is necessary to employ modern methods to extend storage life for better distribution and also processing techniques to preserve them for utilization in the offseason in both large and small scale (Bhattacharyya and Bhattacharjee, 2007; Jena, 2013).

COMPETITION WITH OTHER FRUITS

The largest markets in the world are typically packed with a broad range of fruits, both imported and locally produced, throughout the entire year, making it difficult for them to include new fruits. Immigrants' dietary preferences are the primary source of potential new fruits in these markets, as they will increase consumer demand for exotic fruits. An excellent illustration of this in recent years is the rise in plantain consumption in Spain, France, and the UK, where populations of African, Indian, or Latin American and Caribbean descent have increased significantly, in contrast to Germany or Italy, where immigrants come from a variety of backgrounds. This may also apply to some fruits with exceptional qualities, such as mangosteen, rambutan, litchi, and longan. An exceptional example would be passion fruit, which produces excellent-quality juice that is drunk by 585 people globally. However, direct competition from orange juice is a significant obstacle to any significant rise in the consumption of passion fruit juice.

PACKING AND TRANSPORT FACILITIES

Round fruits, including longans, sapodillas, and litchi, are more readily and affordably packaged and transported than irregularly shaped fruits, like carambola, which are more

likely to be damaged during manipulation. Larger fruits such as mamey, jackfruit, and breadfruit are not only problematic for individual eating but also costly and challenging to transport in their fresh form. Nevertheless, jackfruit is increasingly being used to make value-added goods. (Mitra*et al.,* 2008).

STORAGE AND SHELF LIFE

If new fruits are to succeed commercially, they need to have a longer shelf life and less strict storage requirements. If regulated atmospheres are needed, for example, the cost of transportation goes up significantly. The ability to store food by basic refrigeration in home refrigerators and along the commercial chain, like with sapodilla, litchi, longan, or pitaya, is a huge benefit. On the other hand, fruits with a relatively limited shelf life, such as cherimoya and other Annona species, have the opposite effect (Pinto *et al.,* 2005).

QUARANTINE BARRIERS

Despite trade liberalization, globalization, and the removal of unsound scientific sanitary and phytosanitary barriers globally, crops that need to be disinfected or treated specifically to get rid of fruit flies or other insects continue to pose a serious threat to their widespread distribution in major global markets like the United States and Japan. For example, this applies to small fruits like guavas and carambolas, but not to fruits in the Sapindaceae family, which are less vulnerable to damage by fruit insects.

ABILITY TO PROMOTE

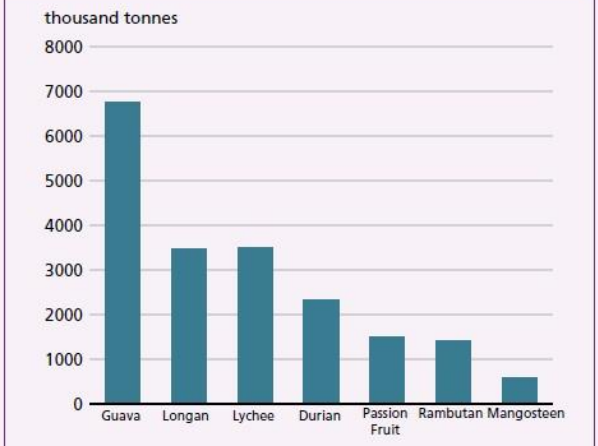
If properly promoted, any distinctive characteristic that makes a fruit or a specific cultivar stand out and be appealing in the market—such as the kiwifruit's unusual brown skin and green interior or the distinctive Golden Pineapple's recent boom (FAO, 2004)—will contribute to a rise in demand for the fruit. When compared to other small tropical fruits, the carambola, with its typical star form, and the pitaya, with its beautiful colour and shape, show distinct advantages. These two fruits could be excellent examples of fruit differentiation. In the same vein are Israel's attempts to segment the market by introducing premium litchi fruits including seedless cultivars and sweet-flavoured green varieties (Gerbaud, 2008). Even though the sapodilla is a well-known fruit in many Asian and Latin American countries, its dull appearance and brown exterior colour, along with the fact that it is practically unknown in Western markets (like the European Union),

make it difficult to forecast a major commercial development shortly. Its distinct flavour and taste, which some have described as a sweet blend of brown sugar and root beer, will necessitate a program of carefully regulated cultivar introduction and market promotion before it becomes a significant fruit.

CONSUMER PERCEPTION

According to Hewett (2008), consumer demand is unquestionably the primary factor that transforms any fruit into a substantial and mainstream commercial crop (major fruit). These days, a product's marketability is mostly determined by the preferences of the individual consumer. Consumer acceptability is also primarily influenced by factors related to health. The remarkable success of an underappreciated fruit with a unique quality, such as the noni or Indian mulberry (*Morindacitrifolia*), which is traditionally thought to make a very healthful beverage in Polynesia, can serve as an example of this. In June 2003, the European Union Scientific Committee approved the fruit as a novel food (IPGRI, 2005). The need for organic fruits is also being given special attention these days. All minor fruits are, in theory, excellent candidates for organic farming, especially when grown close to their native region. However, some fruits—like guava—are more vulnerable to pests like fruit flies and will need to incur additional expenses for bagging in order to compete in international markets. Fruit consumption may rise in the future due to a variety of factors, including the fruit's physical qualities (color, size, taste, aroma, and ease of eating) and its ability to market a well-known brand with added value (healthy) while meeting safety requirements (zero pesticide residues, environmentally sustainable production systems, fair product, and/or organic cultivation). International markets now need certifications such as EUREPGAP, which cover the majority of these safety rules.

Figure 1. Annual average production by type (2015-2017): Guava dominates the minor tropical fruit landscape



Source: Official and unofficial sources including author's estimates

POSSIBILITIES FOR COMMERCIAL CROP DEVELOPMENT

Previously Collins (1992) stated clearly that to develop a new tropical or subtropical fruit industry the following forces should occur together:

A) Impetus should be provided from scientific research that produces cultivars adapted to the new environment and develops suitable cultural practices both pre-and post-harvest, and

B) Signals should be shown in the marketplace about the opportunities for marketing this new fruit. Minor fruits certainly cannot be considered new fruits in their area of production but still, the same principles apply.

Many little fruits are unlikely to close the large gap between the world per capita fruit consumption (78.8 kg/year in 2005) and the expected consumption saturation (=100– 120 kg/year) (Janssen and Subramaniam, 2000). Fruit consumption in all forms has decreased in both the USA (114.1 kg per capita in 2001; Anon., 2003) and the EU (27 markets); in fact, the gross supply per capita in 2007 was 107 kg, down from an average of 108 kg over the preceding six years (Anon., 2008c). However, there's no doubt that imports of minor tropical fruits from their production regions or neighbouring nations will continue to rise in Asia's regional markets. Long-distance shipping costs are rising as a result of rising fuel prices and worries about carbon footprints. In some countries, labels on all food products, including fruits, will soon be required to list the greenhouse gas emissions produced during production, transportation, and disposal (much like the caloric information typically found in food packaging). For highly perishable fruits-which is the situation for the majority of the minor fruits taken into consideration here-that must be transported by air, this could be an issue. Fruit that is transported by boat with excellent

refrigeration systems and large storage capacities, where environmental effects are minimal, is not as problematic in this regard. The current trend of globalization, along with the accompanying surge of important ethnic minorities becoming established in developed countries, will help to open the market for some of the better-quality minor fruits already present in the local markets of certain parts of the world, even though these trends may encourage consumers to consume traditional foods that are produced close to their local markets. This trend may also be aided by the increased interest in "exotic" cuisine among large retailers and customers, as well as by advancements in postharvest management technologies. Horticultural research has solved or is solving a number of these crops' technical issues with cultivation and commercialization, giving them a high possibility of becoming well-known, widely produced (where conditions allow), and important commodities in markets outside of their original regions. With regard to the litchi, longan, and pitaya, this may be the case. It's this final crop that possesses the majority of the qualities needed to be a huge success—much like the kiwifruit has been in recent years— and so establish itself as a big fruit in the world. The contrary can be applied to cherimoya, guava, durian, and rambutan and mangosteen because of their unique odour characteristics. Alternatively, cultivars adapted to subtropical conditions may be found for rambutan and mangosteen, which is highly unlikely given their strict climate requirements and minimal variability, or specific breeding may be done for the first two crops to eliminate odour. In order to support significant commercial development, a viable method of extending postharvest life for the cherimoya (as well as another Annona variety such as the atemoya or sour soup) must be discovered through breeding or relevant research. These days, there are few opportunities to allocate public research money for these reasons because even in the horticultural sector, public monies are being diverted toward more pertinent goals like the creation of biofuel crops. Furthermore, private research funders are unlikely to invest in crops lacking a robust sector to support them and with questionable potential returns.

3.CONCLUSION

The cultivation of minor fruit crops stands as a testament to the richness and diversity within agriculture. Beyond the mainstream and globally dominant fruit varieties, minor fruit crops offer a wealth of flavours and nutritional benefits while contributing to the resilience of local economies. The success of cultivating these lesser-known fruits relies on a holistic approach that encompasses thoughtful variety selection, sustainable agricultural practices, and strategic marketing. By embracing the challenges and opportunities associated with minor fruit crop production, growers not only broaden the agricultural landscape but also address the growing demand for unique, locally sourced, and healthconscious food options. As we continue to navigate a dynamic agricultural future, the cultivation of minor fruit crops emerges not only as a means of preserving agricultural diversity but also as a pathway towards sustainable and resilient food systems.

REFERENCES: -

1. 3rd Session of the Intergovernmental Group on Banana and Tropical Fruits. Puerto de and development. *Acta Hort*. 321:36-41.
2. Anon. 2008b. Environmental Cost of Shipping Groceries Around the World. The New
3. Anon. 2008c Freshfel Europe releases the 2007 edition of its consumption. S and G
4. APO (Asian Productivity Organization). (2009). Value addition to agricultural products, APO News. Available from http://www.apotokyo.org/publications/wpcontent/ uploads/sites/5/2009_Sep_p5.pdf as accessed on 02/05/2017.
5. Azurdia, C. 2006. TresEspecies de ZapoteenAmérica Tropical. 2006. Southampton Centre for Underutilised Crops, Universidad de Southampton, Southampton, UK.
6. Bhattacharyya, B.K. and Bhattacharjee, D. (2007). Bactriocin: A biological food preservative. J. Food Sci. Technol., 44(5): 459-464.

7. Bin Osman, M. and Rahman Milan, A. 2006. Mangosteen – *Garcinia mangostana* –Cline, V. and Carter, R. (2016). "Growing Huckleberries in the Inland Northwest." Washington State University Extension.
8. Collins, R.J. 1992. Developing new tropical and subtropical fruit industries. Theory
9. Conner, P.J. (2002). "Hardy Kiwifruit (*Actinidiaarguta*) Production in North America." *Fruit Varieties Journal*, 56(3), 155-165. crops. Acta Hort. 770:95-102.
10. Das, A. (2022). Post-harvest operation in minor fruits of temperate and subtropical type.
11. de Camargo, A.C. and Shahidi, F. (2020). Phenolic compounds and antioxidant capacity of Brazilian-grownfeijoa (*Accasellowiana*). *Food Chemistry*, 315, 126277.
12. Dirr, T.L. (2004). "Elderberry: Botany, Horticulture, Potential." Timber Press.
13. FAO. 2004. The World Pineapple Market: When growth goes hand in hand with diversity.
14. Ferguson, L. (2017). "Loquat (*Eriobotrya japonica*): A New Fruit Crop for California." University of California Cooperative Extension.
15. Fernández, F. F. (2008). Minor crops: An alternative for the UK fruit industry?. Nuffield Farming Scholarships Trust.
16. Feugang, J.M., (2006). Polyphenolic compounds in Prickly pear [*Opuntiaficusindica* (L.) Mill.]. *Journal of Agricultural and Food Chemistry*, 54(23), 8569-8574.
17. Firdaus, M. (2021). Chemical composition, antioxidant, and anti-inflammatory activities of the fruit peel essential oil of rambutan (*Nepheliumlappaceum* L.). *Industrial Crops and Products*, 169, 113662.
18. fruits of Asia. *Acta Hort*. 770:67-75.
19. GalánSaúco, V. (2008). The potential of minor tropical fruits to become important fruit crops. In IV International Symposium on Tropical and Subtropical Fruits 975 (pp. 581-591).

20. GalánSaúco, V. 2003. Fruit. Tropical and Subtropical. In: S.H. Katz and W.W. Weaver
21. Gerbaud, P. 2008. Close-up: Litchi. FRuiTROP 156:9-30.
22. Gohain, S., &Neog, M. Dietary Contribution of Underutilized Minor Fruit Crops of Assam in Nutritional Security-A Review.
23. Gosselyn, A., Yelle, S. and Dansereau, B. 1999. Policy issues in University Horticultural
24. Grace, M.H. (2018). Blueberry and cranberry fruit composition during development. *Journal of Berry Research*, 8(4), 309-329.
25. Gündoğdu, M. (2021). A comprehensive study on antioxidant properties, chemical composition, and fruit quality attributes of *Mespilusgermanica* L. Fruits. *Food Chemistry*, 357, 129754.
26. Hawkins, J., Powers, M. and Prasain, J.K. (2020). Elderberry flavonoids bind to and prevent H1N1 infection in vitro. Phytochemistry, 172, 112293.
27. Hewett, E. 2008. Post harvest requirements for underutilized tropical and subtropical fruit
28. Inglese, P. (2017). "Cactus Pear." CRC Press.
29. International Plant Genetic Resources Institute (IPGRI). 2005. EU approves novel 30.Jangchud, K. (2003). "Physical and Mechanical Properties of Rambutan (*Nepheliumlappaceum* L.)." *Journal of Food Engineering*, 60(3), 289-296.
31. Janssens, M.J.J. and Subramaniam, B. 2000. Long-term perspectives of fruit and other
32. Jayaprakasha, G.K. (2011). "Chemistry and Biological Activities of *Morindacitrifolia* (Noni)." In "Functional Foods of the East" (pp. 221-234). CRC Press.
33. Jena, S. (2013). Development of a preserved product from underutilized passion fruit and evaluation of consumer acceptance. J. Food Res. Technol., 1(1): 11-19.
34. Kellogg, J., Wang, J. and Flint, C. (2018). Physicochemical properties, polyphenolic content, and antioxidant capacity of Oregon native blackberries. *Journal of Food Composition and Analysis*, 71, 87-95.

35. Kumar, G. K., Sudha Vani, V., Dorajee Rao, A. V. D., &Viji, C. P. (2016). Value addition of some underutilized fruit crops. Progressive Research–An Int J, 11(3), 1890-1892.
36. la Cruz. Spain. 22-26 March 2004.
37. Lee, J. (2016). Phytochemicals and antioxidant capacity of serviceberry (*Amelanchieralnifolia*) leaves. *Food Chemistry*, 194, 609-614.
38. Lutz, R.J. and Peterson, E.B. (2021). Pawpaw (*Asiminatriloba*): A comprehensive review of a native North American fruit. *Hort. Science*, 56(6), 763-770.
39. Määttä-Riihinen, K.R. (2004). Quantities of phenolic compounds and their impacts on the perceived flavor attributes of black currant (*Ribesnigrum* L.) cultivars. *Journal of Agricultural and Food Chemistry*, 52(24), 7539-7546.
40. Mattila, P., Hellström, J., &Törrönen, R. (2018). Phenolic acids in berries, fruits, and beverages. *Journal of Agricultural and Food Chemistry*, 66(26), 6877-6884.
41. Mazumdar, B. C. (2004). Minor fruit crops of India: Tropical and subtropical. Daya Books.
42. Menini, U.G. 1992. Potential and issues for collaborative action on tropical fruit research
43. Miean, K.H. and Mohamed, S. (2009). Flavonoid (myricetin, quercetin, kaempferol, luteolin, and apigenin) content of edible tropical plants. *Journal of Agricultural and Food Chemistry*, 47(6), 2934-2939.
44. Mitra, S.K., Pathak, P.K. and Chakraborty, I. 2008. Underutilized tropical and subtropical
45. Mondal, S. and Rai, V.R. (2020). Persimmon (*Diospyros kaki*Thunb.): A comprehensive review of its phytochemistry, pharmacology, and food applications.
    Food Research International, 137, 109442.
46. New York, p.70-78.
47. nonijuice. News from IPGRI and elsewhere. Press release. www. ipgri.org

48. Nwankwo, C.I. (2018). "Physicochemical and Antioxidant Properties of Ground Cherry (Physalispubescens L.) Fruits." *Food Science & Nutrition*, 6(8), 2219–2228.

49. Panda, D., Panda, S., Pramanik, K., &Mondal, S. (2014). Karonda (*Carissa spp*.): an underutilized minor fruit crop with therapeutic and medicinal use. *International Journal of Economic Plants*, 1(1), 36-41.

50. Pathak, N., Das, R. P., Kotoky, U., &Behera, S. D. (2018). Floral Biology of Some Minor Fruits of Assam. *Int. J. Curr. Microbiol. App. Sci*, 7(7), 1069-1075.

51. Pattanayak, S., & Das, S. (2020). A perspective on Integrated Disease Management

Strategies in Minor Tropical Fruit Crops of India. *Advanced Agriculture* by S. Maitra and B. Pramanick (Editors)© New Delhi Publishers, New Delhi, 142-163.

52. Peña-Estévez, M.E. and Vázquez-Odériz, L. (2020). Volatile composition of quince fruit (Cydonia oblonga Miller) from different geographical origin. *Food Research International*, 129, 108814.

53. Peppers Today (04/08/08). http://www.pepperstoday.com.

54. Pinto, A.C. de Q., Cordeiro, M.C.R., De Andrade, S.R.M., Ferreira, F.R., Filgueiras, H.A.

55. practice. Acta Hort. 321:825-830.

56. Ratti, C. and Serrano, L.A. (2021). Phenolic composition and antioxidant activity of gooseberry (*Ribesuva-crispa* L.) fruit extract. Antioxidants, 10(4), 505.

57. Research. Acta Hort. 495:511-515.

58. Roy, T. N. (2014). Minor (Under-utilized) Fruits in Coochbehar District of West Bengal, India–an Analysis on Marketing Status for Economic Viability. International Journal of Bio-resource and Stress Management, 5(Mar, 1), 122-127.

59. Sánchez, I.A. (2020). "Influence of Storage Conditions on Quality Parameters of Medlar Fruit (Mespilusgermanica L.)." *Horticulturae*, 6(4), 89.

60. Sharma, J. P.; Upadhyay, S.; Chaturvedi, V. K. and Bharadwaj, T. (2014). Enhancing Farm Profitability through Food Processing and Value Addition. In: Shukla, J. P. (Ed.). Technologies for Sustainable Rural Development: Having

Potential of Socioeconomic Upliftment (TSRD-2014), published by Allied Publisher Pvt. Ltd., India. p. 88.

61. Singh, S.R., Phurailatpam, A. K., Wangchu, L., Ngangbam, P., &Chanu, T. M. (2014). Traditional medicinal knowledge of underutilized minor fruits as medicine in Manipur. International Journal of Agricultural Science, 4(8), 241-247.
62. Singh, V., Deen, B., & Singh, S. (2023). Micropropagation of minor fruit crops of India: *A review*. *Agricultural Reviews*, 44(2), 259-263.
63. Son, M.K., Kim, M.K. and Kim, W.K. (2019). Antioxidant and anti-inflammatory effects of physalin E from Physalisangulata. *Journal of Natural Products*, 82(10), 2811-2820.
64. Southampton Centre for Underutilised Crops. University of Southampton. Southampton,
65. Srivastava, A., Bishnoi, S. K., & Sarkar, P. K. (2017). Value addition in minor fruits of eastern India: an opportunity to generate rural employment. Fruits for Livelihood: Production Technology and Management Practices. Agrobios (India), Jodhpur, India, 395-417.
66. Stevens, L. (2017). "Growing Feijoa Pineapple Guava in the Home Garden." University of California Agriculture and Natural Resources.
67. Thomas, A.L. (2016). "Aronia Berry Production in the Midwest." University of Missouri Extension.
68. tree crops in the new century. *Acta Hort*. 531:23-27.
69. Tripathi, P. C. (2021). Medicinal and theraptic properties of minor fruits-A Review. *Int J Minor Fruits Med Aromat Plants*, 7, 01-28.
70. Tripathi, P.C., Yogeesha, H.S., &Shetti, D.L. (2022). standardization of propagation methods in minor wild fruit crops. *Current Horticulture*, 10(1), 32-36.
71. UK. 170p.
72. Underutilised Crops. University of Southampton. Southampton, UK.
73. University of Maryland Extension. "Integrated Pest Management for Elderberries."

74. University of Vermont Extension. "Elderberry Postharvest Handling and Processing."
75. Vargas-Madriz, H. and Esteve, M.J. (2018). "Processing Elderberry (*Sambucusnigra* L.) into Functional Beverages: A Case Study for an Alternative Application." Foods, 7(9), 140.
76. Wang, Y., & Xu, Z. (2019). Comparative analysis of volatile compounds in jujube fruits by different drying methods using HS-SPME-GC/MS and e-nose. *Food Chemistry*, 288, 303-310.
77. Williams, J. and Smith, B.J. (2014). "Elderberry Production in the Midwest and Beyond." Midwest Elderberry Cooperative.
78. Xu, H. X., & Qin, G. W. (2008). Structure, bioactivity and synthesis of methylated flavonoids occurring in the genus Eriobotrya. *Current Organic Chemistry*, 12(16), 1381-1401.
79. York Times. World Business. (26/04/08) http://www.nytimes.com.
80. Zhao, Y. and Wang, J. (2020). Bioactive compounds and antioxidant activity in different types of berries. *International Journal of Food Properties*, 23(1), 15431557.