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The potential for underutilized fruits of northern India to enhance food security and their role in climate resilience

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INTRODUCTION

The underutilized crops are a diverse group of species that are largely ignored by researchers and funding organizations. These crops' potential to provide nourishment and nutritional stability, as well as providing enhanced earning opportunities for low-income farmers, many of whom are women, is gaining popularity. Globally, deficiency in essential vitamins and minerals poses a serious threat to human health and economic progress. Today, consumers are increasingly cognizant of the health and nutritional aspects of their food baskets. The underutilized fruits such as aonla, bael, jamun, karonda, passion fruit, phalsa, pomegranate, tamarind, and wood apple are the primary sources of sustenance for the impoverished and play a significant role in overcoming the issue of malnutrition. These fruits have been utilized by the local tribes to treat various ailments and have also been utilized in the Indian system of medicine since ancient times. Fruits that have been underutilized are abundant in carbohydrates, lipids, proteins, calories, vitamins, minerals (Ca, P, Fe), and dietary fibers. Because of this, they are able to prevent and cure diseases like anemia, cancer, diabetes, hidden hunger, hypertension, kwashiorkor, marasmus, and night blindness.

India has a great variety of naturally grown fruits. Major fruits such as mango, banana, guava, apple, and citrus fruits are abundantly available due to their distinct flavour and taste. However, underutilized fruits are often overlooked, but they are inexpensive, locally grown, and easily available across the country. They also require less care. These fruit plants exhibit inherent disease tolerance and are well-suited to hot and resilient climate conditions. Seabuckthorn is a current domesticated crop that frequently produces on marginal soils and climates in India.

In India, the most underutilized fruits are found in the dry regions of Rajasthan, Madhya Pradesh, Gujarat, Maharashtra, Chhattisgarh, Karnataka, Orissa, and Tamil Nadu. Furthermore, some fruits have outstanding flavour and taste and are employed in the preparation of delicacies at home. The promotion of the cultivation of underutilized fruits and their conservation is very essential. These fruits have the potential to provide significant genes for crop enhancement due to their resistance to both biotic and abiotic factors. A lot of information is known about the excellence of the underutilized fruits of India, but sadly very few of these fruit crops have ended up in farmer's orchards. There is a need for crop improvement and the development of ideal propagation methods and agricultural techniques. It is imperative to encourage the establishment of processing industries for the preparation of jams, jellies, fermented products, and industries for the production of resins and gums as there exists a deficiency in processing in these crops. In the present popular article, certain significant underutilized fruits of Northern India, namely Aonla, Bael, Ber and Jharber, Jamun, Karonda, Lasora, Phalsa, Pomegranate, Loquat, and Fig, have been discussed with regards to climate change and nutritional significance (Vitamins and minerals as protective foods) as observed in the Covid-19 pandemic situation worldwide.

Impact of climate change on horticulture

Climate change is advancing faster than expected, creating new environmental conditions for growing horticultural crops, mainly fruit crops. Currently, extreme heat waves or frost are beginning to manifest their effects in certain regions, while extended drought periods are emerging as a significant threat elsewhere. The impact of climate change could be positive or negative, but it directly affects the quality of produce and total production. Fruit crops are usually affected by climate change because they are perennial. There is a shifting of temperate fruits towards higher altitudes. According to a study, higher altitude orchards in the Shimla district of Himachal Pradesh have been converted from high-chilling apple cultivars to low-chilling apple cultivars, along with other fruit crops such as pear, peach, plum, and kiwi. Whereas, the mid hills of Shimla district are shifted totally from apple to potato cultivation. This occurred as a result of the decreasing trend in snowfall.

However, climate change has brought the opportunity to grow tropical fruits at higher elevations, where the temperate fruits were grown previously. The negative impact of climate change has also been observed in tropical fruits. Temperature is reported to have an influence on flowering in perennial crops such as mango and guava. The increase in greenhouse gas emissions is primarily linked to climate change. Carbon sequestration mitigation techniques aid in mitigating the detrimental impacts of climate change.

Climate change and underutilized fruits

The current issue of climate change and its impact on agricultural productivity has a global impact. Fruit crops such as ber, karonda, lasora, and khejri have the capacity to flourish in arid and semi-arid environments when grown rainfed or with supplemental irrigation using captured rainwater during the establishment and other crucial. Fruit crops possess extended life cycles in comparison to other crops, rendering them more challenging to cultivate under stress and less able to adapt to altering environmental conditions. The inherent potential of underutilized fruits stemming from environmental issues supports a sustainable production chain that encompasses diverse strategies for plant management, including plant breeding operations that capitalize on variances. Numerous neglected fruit crops possess the capability to endure adverse agroclimatic conditions. Several fruit species, including the aonla custard apple, the ber, and the tamarind, are widely known for their drought tolerance

and capacity to flourish in low soils and marginal lands.

Scope of underutilized fruit production

Utilization of neglected land: In India, the total area under horticultural crop is very small, and it is approximately 9% of the total cropped area. Fruit occupy 29% of total horticultural area. Large area is under fallow land. In such area there is a huge scope of minor fruit cultivation. These untapped fallow and degraded lands could be utilized for the cultivation of minor fruit crops and contribute to rural income.

Hardy nature of plants: Fruit crops exhibit resilience to various diseases and pests due to their hardiness and underutilization. They occur in numerous agricultural ecosystems and are often found in marginal areas.

Tolerance to adverse soil and climate: Fruit crops such as ber, phalsa, date palm, bael, and wood apple possess the ability to thrive in areas where other crops are unable to grow. Therefore, fruit cultivation holds significant potential in areas of waste land. In view of increasing population pressure, declining per capita land availability, and escalating input cost, it is essential to diversify Indian horticulture with hardy and high value indigenous fruit crops for boosting fruit production.

Minor fruit as ecological security and ecosystem stability: Most of the underutilized/minor fruits can tolerate adverse ecological conditions (drought, shallowness of profile, cold and wet soil). They can be grown in wasteland. These crops possess significant potential to withstand challenging environments, such as climate changes, soil degradation, and limited water resources. Dragon fruit is a small fruit that is popular in South India because it has many useful nutrients, looks pretty (red or pink), and is cheap. It also has lots of antioxidants, vitamin C, and fiber. Because of this, it is a "healthy fruit." It is a perennial fruit that is frequently called red Pitaya.

Reasons for unpopularity of underutilized fruit crops

- Farmers are unaware of the nutritional or medicinal value of these fruits.
- Most of the underutilized fruits are small in size and have several seeds.
- Lack of improved cultivars and desirable planting material.
- Due to the substantial quantities of tannins and glycosides present in these fruits, a significant number of individuals fail to acknowledge their significance, opting instead for fruits with a pleasant flavour.
- There is a lack of transportation, storage and processing facilities, inadequate marketing support, and poor recognition of these crops in horticulture promotion programs.

Strategies for the development of underutilized fruit crops

- In order to prevent over-exploitation from natural sources, it is important to use homestead farming to domesticate potential wild species. It is imperative to provide assistance to researchers in the expansion of planting materials and their distribution, as well as providing market access through a marketing network for perishables.
- Due to their nutritional value, intensifying research and development efforts in these underutilized horticultural crops would significantly enhance food security and nutrition.
- National level programs are required to be initiated with a restricted number of species for comprehensive research, development, and conservation. Both species and crops that are essential for subsistence farming and those with the potential to become cash crops require greater attention in research.
- The most underutilized horticulture crops are grown in local areas that possess traditional farming expertise. Therefore, it is imperative to document this indigenous

knowledge regarding these crops. It is essential to undertake a systematic local specific crop planning according to their agro-climatic conditions. Proper transport and marketing systems should be developed.

- It is essential to develop criteria for commercial exploitation of underutilized crops in order to overcome the yield and quality issues. Therefore, specialized research efforts are required to develop a location-specific set of strategies for diverse horticultural crops, encompassing the development of superior varieties and the preservation of genetic resources.
- It is essential to make the farming community aware of the nutritional value of underutilized fruit crops from the beginning by arranging various awareness camps/campaigns, exhibitions, at the macro and micro levels, all with the theme of underutilized horticulture crops.

Research and development issues

- The underutilized fruits of the arid region have been neglected. The genetic resources of these crops are still accessible on farmers' fields.
- The germplasm of these crops should be collected, documented, and stored in field gene banks. There should also be an exchange of information between researchers working on these fruit crops.
- There is a necessity to establish ex-situ genetic conservation parks in the diversity rich regions as a backup for future research and development needs.
- Genetic improvement and the development of new varieties are necessary.