Celebrating Biodiversity
Conservation and Sustainable Use of Diversity in Fruits[1]

Ramanatha Rao V[2]

Introduction

Different people enjoy different things in life. For me (and I believe for many others), the most wonderful thing on Earth is undoubtedly its biodiversity. Imagine a green forest made up of many different plant species and teaming with a variety of animals and birds. Even a well-maintained mango orchard, with ripe fruits hanging low on the branches, is equally inviting. Besides the aesthetic value, biodiversity, especially agricultural biodiversity, is fundamental to human life and other living beings of planet Earth maybe next only to air and water. Biodiversity must thus be given its primary importance in all ideas, plans, programmes, and projects. In fact, biodiversity must be central to all celebration of life. "Celebrate Biodiversity" is the theme of the World Environment Day 2020 being observed on June 5. Come to think of it, we have been celebrating biodiversity, i.e., all forms of life since ages. Several cultures in the country consider forests, rivers, hills, etc, as sacred and worship them. However, I that this celebration should go beyond festivities, and become full-pledged action plan to protect and nourish the biodiversity that we have. We have to outgrow our cultural practices of valuing symbols and get to scaling up our actions.

India, along with the rest of Asia, and the Pacific and Oceania region, is very rich in genetic diversity of fruits. Although fruits have always been important agricultural (including horticultural) species, it is only in recent years that there is an increasing awareness of the potential of native tropical fruit species as good sources of dietary vitamins, minerals, and energy. Cultivation of native tropical fruits has an advantage over the import of exotic fruits in terms of increased sustainability and a smaller carbon footprint. They are better adapted to local conditions and consumer preferences than exotic fruits. They also play a very significant role in the well-being of people through enhancing household income, in employment in rural areas, particularly for women, and in environmental protection. At the same time, their bio and genetic diversity are threatened due to various human interventions; therefore, concerted efforts are required to take corrective measures. This is what I call celebrating the biodiversity of fruit species.

The overall goal of our efforts must be to strengthen sustainable livelihoods through improved management and utilization of the biodiversity of tropical fruits. The aims or sub-goals could be many, but the overarching need is to conserve and use tropical fruit genetic diversity in strengthening the capability of farmers, local communities, and institutions. We need to bring together local and scientific knowledge about the diversity of key tropical fruit trees to identify, develop, and test

---

[1] Based on a presentation made at the WEBINAR on "Conserve & Celebrate Biodiversity," 5 June 2020, organised by the ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lake Post, Bengaluru 560089, on World Environment Day 2020.

[2]Formerly Senior Scientist, Bioversity International and currently, Co-Founder, GRSV Consulting Services, Bengaluru. Can be reached at vramanatharao@gmail.com

good practices, which will contribute to the conservation of this diversity and associated ecosystems services while improving the livelihoods of farmers and users. The capability of researchers, extension workers, and farmers should be enhanced to carry out the processes of identification, development, dissemination, and adoption of these good practices, leading to improved livelihoods and food security of the target beneficiaries through the conservation and use of fruit tree genetic resources.

The fruit biodiversity of India is very large. Over 300 species of fruits— including temperate, subtropical, and tropical— are grown in the country. The most important fruit crops grown commercially in India are mango, banana, citrus, guava, grape, pineapple, papaya, sapota, litchi, and apple, which together comprise more than 75% of the total area under fruit cultivation. Also, India is blessed with several indigenous fruits, which are underutilized. They are rich in vitamins, minerals, and other nutrients, which have medicinal potential; they include fruit species like aonla/amalaki/amla (*Emblica officinalis*), bael/stone apple/Bengal quince/bel/siriphal (*Aegle marmelos*), pomegranate/anar (*Punica granatum* L.), jackfruit (*Artocarpus heterophyllus*), wood apple/kath bel (*Feronia limonia*), jamun (*Syzygium cumini*), ber/Indian jujube (*Ziziphus mauritiana*), fig (*Ficus carica*), karonda (*Carissa carandas*), pummelo/jambura (*Citrus grandis*), tamarind (*Tamarindus indica*), etc. All these species, along with many of their wild relatives, constitute a wealth of biodiversity that all Indians should benefit from, especially the rural poor who are highly vulnerable and have very few livelihood options.

Lessons Learnt from Past Work

I wish to highlight important lessons learnt over a decade while working on various issues related to conservation and utilization of fruit genetic resources in several countries in Asia, with particular reference to situations in India. This work was funded by various participating country governments, in addition to the Global Environmental Facility (GEF) through the United Nations Environment Programme (UNEP).

Methods and practices to conserve: We must build on methodologies and practices proven effective for the conservation of crop genetic diversity, adapt their use for tropical fruit tree species, and test their relevance with farmers, local communities, and user groups. At the same time, we must realize that all methods are context and crop/variety specific and that one size does not fit all. Domestication of economically important fruit diversity from the forests, or using some of the wild relatives for rootstock, and sharing such knowledge and skills with the local community adds value to conservation and utilization efforts.

Role in natural ecosystems: While attempting to enhance our efforts on the conservation and utilization of fruit biodiversity, we should also understand their role in natural ecosystems. However, there has been little research on the occurrence and role of wild relatives and related species of fruits in natural ecosystems. We need information on geographic distribution and population sizes of such fruit species, their functions in the natural ecosystems, and community uses of the uncultivated fruit species.

On-farm and *in situ* conservation: The dependence of rural communities on both cultivated and wild tropical fruit biodiversity highlights the importance of management strategies that address on-farm production in tandem with *in situ* conservation of related wild species in natural habitats. However, the importance of integrated on-farm and *in situ* conservation and sustainable use is not limited to optimizing the production potential of tropical fruit species. The complex interdependence of tropical fruit biodiversity in home gardens and farms, on the one hand, and community forests and natural areas, on the other, requires that these elements are viewed as components that help to preserve the function and resilience of a larger agro-ecosystem, including the long-term viability of the wild fruit species. Because wild species frequently are transferred to home gardens when their natural habitat is threatened, the domestication of wild species of tropical fruit is proving an effective way to give farmers continued access to resources—fruit, timber, fodder, dyes, resins, oils, and medicines—that are disappearing from natural forests. These are provisioning services of ecosystems, including the provision of plant genetic resources and pollinating services.

Food and shelter to other living beings and other services: In addition to being a source of starting material for domestication by humans, certain wild fruit trees provide critical food resources for animals during periods of food scarcity. The loss of tropical fruit populations in an area can lead to the extinction, at least at the local level, of those animal species that depend on them. Reduced food resources may impact the animal abundance and foraging behaviour, which, in turn, can have negative effects on forest regeneration.

Custodian farmers: Another important way to celebrate our wealth of fruit biodiversity is to identify and recognize custodian farmers—"those farmers (men and women) who actively maintain, adapt and disseminate agricultural biodiversity and related knowledge, over time and space, at farm and community levels and are recognized by community members for it". For example, in an international tropical fruit tree project in which India was a participant, 52 custodian farmers were identified and their contribution to fruit diversity conservation was recognized by the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA).

Contribution to environmental health: Tropical fruit species are also known to contribute to ecosystem services such as carbon sequestration, protection from soil erosion, soil formation, nutrient cycling, and hydrologic regimes. It is widely accepted today that the elimination of tropical fruit and plantation crops—such as coconut, cashew, and mangroves along the coastline of Southeast Asia—has significantly increased, together with other factors, the level of destruction caused by the tsunami that devastated the region in December 2004. The adoption of good practices in terms of the *in situ* conservation of fruit tree diversity will serve to promote these ecosystem services, as well as to protect habitats in forested areas against degradation and, ultimately, preserve the resilience of larger ecosystems.

Marketing diversity: Marketing the diverse types of fruits and fruit varieties is an important way to recognize the biodiversity of fruits. Linkage to marketing programmes was developed with Growers Associations, Krishi Vigyan Kendras (KVKs),

and State line departments. Sale of the product to market directly, without involving middlemen, should be promoted. Establishing fruit producer associations/self-help groups can help greatly in these efforts, along with the development of value-added fruit products.

Protecting heritage trees: Another way of celebrating biodiversity is taking care of heritage trees, perennial fruit trees that live for many years. For example, cutting of mango trees has been legally banned at Malihabad, Uttar Pradesh. This can help in conserving the mother trees. In other sites, the custodian farmers are being honoured and are being requested to maintain the mother trees. For example, at Sirsi, Karnataka, a list of the Mother trees of best Local Varieties were provided to the State Biodiversity Board, to identify them as heritage trees and provide protection to such trees.

Mainstreaming of fruit tree biodiversity conservation: Mainstreaming is done through regular meetings with KVKs, State Horticultural Departments, and State Agricultural Universities. Diversity fairs are being attended by the officials of these departments, wherein the farmers interact with these officials. Since much of the work involves working closely with farmers and learning from traditional knowledge about good practices, researchers and extension workers need to change their attitudes and learn participatory methods of doing research. Also, it needs the 3-M approach—multisectoral, multi-institutional, and multidisciplinary—as well as considerable policy and funding support.

Promoting stakeholder participation: Usually, most of the initiatives by public agencies tend to be top-down in their approach to problem resolution. However, it has been shown that involving all stakeholder from the beginning of the planning and decision-making process would greatly enhance the effectiveness of any intervention. Methods used in participatory agricultural research need to be used to involve farmers, users, community agricultural workers, and researchers across all stages of an intervention. Sustained involvement enables better identification of the components of the complex interventions needed for a community-based effort. This is the core of participatory agricultural research. Since the conservation and use of biodiversity of fruit species involves different agencies such as agriculture, horticulture, environment, forests, etc., we need to employ a 3M approach, i.e., multisectoral, multi-institutional, and multidisciplinary.

T

Public Awareness and Training: In addition to the scientific and technical aspects considered and discussed above, biodiversity conservation includes a human dimension. Plans for the conservation of biodiversity (including fruits) in any country are set by the felt needs, understanding of issues, and the attitude of people involved and the policymakers. All those that are involved should understand foremost the benefit that farmers and consumers derive from any intervention. Capability in decision making has to be enhanced. Scientific and technical staff vested with the responsibilities of conservation and should be well versed in the scientific and management aspects of conservation and use. Attitudinal changes will be necessary to successfully carry out participatory methods, interacting with farmers and learning from them. The policymakers need to be well aware of the significance of biodiversity

conservation and its role in attaining sustainable agri-horticultural development and production, and in reduction of poverty. Without appropriate and strong policy support, no conservation and use activities can be sustained for any period of time.

Final Words

There has been some significant work globally and in India on various issues related to conservation and use of fruit genetic resources. However, these have been isolated and demonstrative, rather than being part of the mainstream. Such efforts need to be promoted on a large scale and more and more people (farmers, communities, researchers, and policymakers) need to be involved; the work should be done in a more integrated fashion than it has been so far. Developing management systems & processes; emphasize decentralization, fairness & equity in use

Let this wonderful world flourish with bursting biodiversity, with our endeavours focused on promoting biodiversity for the present and conserving it for the future. The survival of humans and other living beings depends on how well we can do this important job. When we do so with fruit species, we celebrate and quite literally enjoy the **fruits** of our labour. Let us celebrate this day by conserving and sustainably using the biodiversity that surrounds us (albeit with expanding gaps in it), including fruit biodiversity. Let us move towards not just food security, but nutrition security as well.

Further Reading

1. Bhuwon Sthapit, Hugo Lamers, and V Ramanatha Rao 2012. Community Based Approach to On-farm Conservation and Sustainable Use of Agricultural Biodiversity in Asia. Indian Journal of Plant Genetic Resources. 25(1): 97-110.

2. Indian Journal of Plant Genetic Resources 28(1). Special issue that carries 19 articles, based on the result of the work done in 4 countries on fruit genetic resources.

3. Sthapit BR, Hugo AH Lamers, V Ramanatha Rao, and Arwen Bailey (eds). 2016. Tropical Fruit Tree Diversity: Good Practices for In Situ and On-Farm Conservation. Routledge, New York. 458 p.

4. Bhuwon Sthapit, V Ramanatha Rao, and Hugo AH. Lamers. 2019. Feasibility of conservation of horticultural genetic resources in in situ/on farm Pp. 49-76 in PE Rajasekharan and V Ramanatha Rao (Editors). Conservation and Utilization of Horticultural Genetic Resources. Springer Nature, Singapore.