



Importance of Preserving Landraces in Modern Crop Breeding

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In the quest for increased agricultural productivity, modern crop breeding has often focused on developing high-yielding, pest-resistant, and climate-resilient crop varieties. However, this emphasis has led to the erosion of genetic diversity, particularly the neglect of landraces—locally adapted traditional crop varieties. Landraces hold immense value in modern crop breeding as they are reservoirs of unique genetic traits essential for addressing global food security and environmental challenges.

Understanding Landraces

Landraces are traditional crop varieties that have evolved over centuries through natural selection and farmer practices. Unlike modern hybrids, landraces are genetically diverse and adapted to specific local environmental conditions. They exhibit a high degree of resilience to biotic and abiotic stresses, making them invaluable for sustainable agriculture.

For instance, in India, landraces such as the aromatic rice variety 'Kalanamak' from Uttar Pradesh and drought-tolerant millets like 'Bajra' from Rajasthan are examples of crops uniquely suited to their environments. These landraces not only provide a direct source of food but also preserve the cultural heritage of local communities.

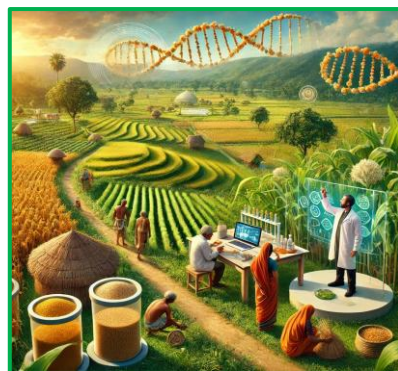
The Role of Landraces in Modern Crop Breeding

- Genetic Diversity** Landraces are a treasure trove of genetic diversity, offering traits that can improve disease resistance, climate adaptability, and nutritional quality in modern crops. For example, the Nagina 22 (N22) rice variety in India possesses high heat tolerance, a critical trait as global temperatures rise.
- Resilience to Climate Change** Landraces are naturally adapted to harsh climatic conditions. Breeding programs can use these traits to develop crops capable of thriving in extreme environments. A study by the Indian Agricultural Research Institute (IARI) found that traditional wheat varieties in India have higher tolerance to drought and salinity compared to modern cultivars.
- Nutritional Benefits** Many landraces are rich in nutrients and bioactive compounds. For example, 'Indrayani' rice from Maharashtra and 'Katarni' rice from Bihar are known for their superior aroma and nutritional qualities. These traits can be harnessed to combat malnutrition through biofortification.
- Sustainability in Farming** Landraces often require fewer inputs, such as synthetic fertilizers and pesticides, making them more sustainable than high-input modern varieties. Traditional practices associated with cultivating landraces also promote soil health and biodiversity.

Challenges in Preserving Landraces

- Replacement by High-Yielding Varieties** The Green Revolution, while increasing food production, led to the widespread adoption of high-yielding varieties at the expense of traditional crops. As a result, many landraces have become extinct or are on the brink of extinction.

2. **Market Dynamics** Farmers often prefer modern hybrids due to their market demand and assured yields. Landraces, being lower-yielding in comparison, face reduced cultivation.
3. **Loss of Indigenous Knowledge** The traditional knowledge associated with cultivating landraces is disappearing as younger generations move away from farming.
4. **Climate Change** While landraces are resilient, extreme climatic events and changing weather patterns can threaten their survival.



Efforts to Preserve Landraces

India has made significant strides in conserving landraces through various initiatives:

1. **Gene Banks** The National Bureau of Plant Genetic Resources (NBPGR) in New Delhi houses over 4.5 lakh accessions of plant genetic resources, including landraces. These gene banks ensure the long-term conservation of genetic diversity.
2. **Community Seed Banks** Local seed banks managed by farmers and NGOs play a vital role in conserving and exchanging landrace seeds. For instance, the Navdanya movement has successfully preserved traditional seeds across India.
3. **Government Policies** The Protection of Plant Varieties and Farmers' Rights Act (PPV&FRA) recognizes farmers' contributions to conserving genetic resources and incentivizes their efforts.
4. **Research and Breeding Programs** Institutions like the Indian Council of Agricultural Research (ICAR) actively incorporate landrace traits into modern breeding programs to enhance crop resilience and sustainability.

Success Stories from India

1. **Scented Rice Varieties** The restoration of traditional aromatic rice varieties, such as 'Katarni' in Bihar and 'Jeeraphool' in Chhattisgarh, has gained national and international recognition, showcasing the economic and cultural value of landraces.
2. **Millets Revival** The 'National Year of Millets' in 2018 and the 'International Year of Millets' in 2023 have brought attention to traditional millet varieties like 'Ragi' and 'Jowar,' promoting their conservation and cultivation.
3. **Farmer-Led Conservation** In Kerala, the 'Save Our Rice' campaign has successfully conserved and revived several indigenous rice varieties, demonstrating the power of community-led initiatives.

Expanding the Framework for Conservation

1. **Collaborative Research** Collaboration between international and local research institutes can pool resources and expertise to identify and conserve valuable landraces.
2. **Digital Cataloging** Advanced technologies, such as GIS mapping and blockchain, can be used to catalog and monitor landrace cultivation, ensuring traceability and fair access.
3. **Educational Initiatives** Integrating landrace conservation topics into educational curricula can raise awareness among young farmers and researchers about the importance of genetic diversity.
4. **Role of the Private Sector** Agri-businesses can contribute by funding landrace conservation projects and developing niche markets for traditional crop products, incentivizing farmers to grow these varieties.

Future Directions

1. **Enhancing Policy Frameworks:** Governments must strengthen intellectual property rights for landrace cultivation and encourage public-private partnerships to finance conservation efforts.

2. **Promoting Agrobiodiversity:** Programs that encourage intercropping and mixed farming can help maintain biodiversity on farms, directly supporting landrace cultivation.
3. **Global Collaboration:** Initiatives like the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) can foster global sharing of genetic resources and knowledge.

Conclusion

Preserving landraces is not just about maintaining biodiversity; it is about securing the future of agriculture. As the foundation of genetic resources, landraces hold the key to developing crops that can withstand the challenges of climate change, ensure food security, and promote sustainable farming practices. India, with its rich heritage of agricultural diversity, has a unique opportunity to lead the world in this endeavour. By integrating traditional knowledge with modern science, we can create a resilient agricultural system that benefits farmers, consumers, and the environment alike.

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