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OUTSTANDING RICE LANDRACES IN INDIA AND COMMUNITY-MANAGED SEED SYSTEMS

Rice landraces hold immense value, not only for their genetic diversity but also for their profound connections to local cultures. As we face the dual challenges of feeding an expanding population and adapting to climate change, reviving these traditional varieties is essential for sustainable agriculture and food security, argues Swati, Anirban, and Subhasmita in this Good Practice Note.

CONTEXT

Rice landraces are indigenous varieties that have evolved naturally over time, shaped by both natural processes and human intervention. These traditional varieties represent more than mere crops; they possess genetic diversity, adaptability, and a deep connection to local cultures and traditions. Significantly, they contain unique genes that offer resistance to diseases and pests, tolerance to climate stresses, and high nutrient levels, making them valuable for nutraceutical products. Due to their rich nutritional profiles, they can also help combat hidden hunger.

Over recent decades, high-yielding varieties (HYVs) have largely replaced traditional landraces. Although HYVs have played a key role in increasing productivity and raising farmer incomes, this success has come at a cost. Indigenous varieties have been displaced, resulting in genetic erosion that leaves us vulnerable to future challenges. While gene bank conservation efforts are critical, they alone cannot ensure the survival of these varieties. True preservation requires that they be reintroduced into farmers' fields.

Kalanamak accessions characterized in GI areas of Uttar Pradesh

Today, we are under increasing pressure to produce more rice to feed a growing population while also contending with climate-related challenges like droughts, floods, and soil salinity. Therefore, the new agricultural revolution must focus on reviving these heirloom varieties. Despite their value, traditional rice varieties face several challenges (Box 1).

Box 1: Challenges in Landrace Scaling and Marketization

As traditional landraces disappear, many heirlooms and indigenous varieties have lost desirable traits like aroma and grain quality due to selection pressure and genetic drift. Farmers often rely on farm saved seeds that are of poor quality because of a lack of genetic purity, vigor, and viability. This problem is largely caused by the unavailability of quality seeds, as many landraces are not integrated into the larger seed value chain.

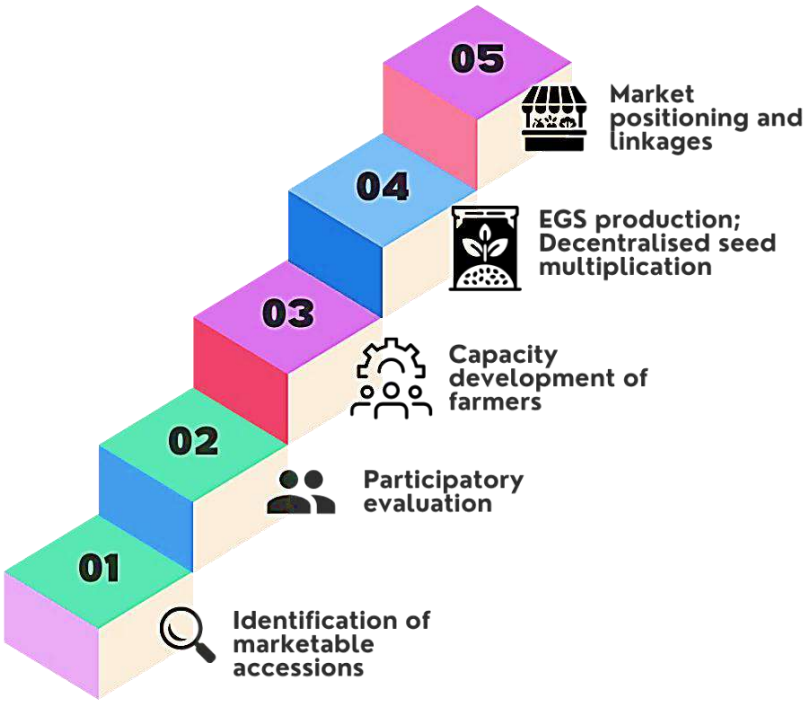
Compounding the challenge, farmers often struggle to access quality seeds of traditional varieties due to limited availability in the seed chain. In some communities, such as the Kutia Kondhs in Odisha, access to these indigenous seeds is ensured through annual or biannual local fairs. These fairs allow farmers to exchange seeds and continue cultivating crops integral to their diets and cultural practices. While these local seed exchanges help preserve traditional varieties on a small scale, they often fail to expand the supply beyond the immediate region. A more robust and scalable system is essential for wider adoption and sustained use.

Another major challenge is the lack of reliable markets for indigenous rice varieties. While a few, like Govind Bhog, have achieved market success, many remain unrecognized, lacking proper positioning and business models. By improving access to quality seeds and creating sustainable markets for these indigenous varieties, we can help preserve their genetic diversity, cultural heritage, and resilience to climate change.

In recent years, the International Rice Research Institute (IRRI) has undertaken systematic steps to strengthen the seed system for these valuable landraces, while developing multidimensional approaches to unlock their full potential and ensure their ongoing use.

IRRI's LANDRACE IMPROVEMENT AND SEED SYSTEM MODEL

Over time, IRRI has developed a comprehensive model for the characterization, improvement, dissemination, and scaling of landraces aimed at reviving economically and culturally significant varieties.



Identification of Marketable Accessions

In the first phase, IRRI collaborates with universities, state agencies, conservators, ethnobotanists, and farmers to identify and collect diverse traditional landraces. These landraces undergo phenotypic and genotypic characterization, with molecular and biochemical assays, such as DNA fingerprinting and nutritional profiling, to evaluate their genetic diversity and nutritional potential.

Superior landrace accessions with marketable traits are identified and integrated into landrace improvement programs. These programs focus on pure line selection and purification, resulting in high-quality, marketable accessions. This model ensures that valuable landraces, vital for local economies and cultures, can be revived and promoted for broader use, sustaining agricultural diversity and resilience.

Participatory Evaluation of Landraces

Once marketable accessions are identified, IRRI collaborates with government and non-government stakeholders to work with farmer clusters, including Farmer Producer Organizations (FPOs), Farmer Producer Companies (FPCs), and Women's Self-Help Groups (WSHGs). These groups are usually located in areas where landraces are popular or in regions with Geographical Indication (GI) tags for specific heirloom varieties.

To identify the best-fit varieties, multi-environment evaluations are conducted, focusing on yield and other key traits. The process of testing and popularizing these accessions includes:

- **On-Farm Trials**: Accessions are planted in strip plots, and farmers participate in evaluating them. Phenotypic screening is analyzed using Mixed Linear Models (MLM).
- **Crop Cafeteria**: Multiple accessions are planted in two to three replicates at sites like Krishi Vigyan Kendras (KVKs) and State Agricultural Universities (SAUs), where varieties are screened through participatory selection.
- **Head-to-Head (H2H) Trials**: Minikits containing 5 kg of new accessions are distributed for comparative evaluation alongside traditional varieties, allowing farmers to assess performance firsthand.

These steps ensure that the best landrace varieties are rigorously tested and effectively introduced to the farming community, helping to scale their production and market presence. Dealer-led demonstrations and frontline cluster demonstrations on 2 to 3 hectares are also carried out to increase awareness.

Kalanamak rice varietal cafeteria jointly managed by ICAR-KVK Gorakhpur and IRRI

Capacity Development of Farmers in Early Generation Seed (EGS) Production

Farmer groups in GI-tagged areas, such as those cultivating Kalanamak in Siddharth Nagar and Adamchini in Chandauli districts of Uttar Pradesh, play a crucial role in EGS production of these prized landraces. These farmers are trained in Quality Seed Production (QSP) techniques, including best practices in seedbed preparation, proper spacing, isolation, timely roguing, and effective disease and pest management.

In addition to production, farmers receive training on optimal post-harvest management, packaging, and marketing to meet market standards. Gender-inclusive training modules ensure that both men and women farmers are equipped with the skills needed for high-quality seed production, contributing to the sustainability of these valuable landraces while enhancing their economic potential.

Decentralized Seed Multiplication

The modern seed system for high-volume crops like rice often focuses on large-scale production of a few dominant varieties. This approach, managed by major seed enterprises and regulatory bodies, has led to the widespread use of varieties like MTU7029 (Swarna) and BPT5204 (Samba Mahsuri). However, it often fails to meet the specific needs of local farmers, resulting in stagnating profits and reduced market agency.

Quality seed production of Kalanamak accessions by farmers

Decentralization offers a compelling alternative. IRRI supports local-level seed systems through partnerships with local NGOs and trained farmer producer companies (FPCs), Self-Help Groups (SHGs), and Women SHGs. By adapting seed production to local conditions, this approach reduces reliance on large commercial entities and strengthens local seed systems. Decentralization preserves valuable landraces, enhances farmer autonomy, creates rural employment, and fosters community resilience.

Market Positioning and Linkages

In addition to training and capacity building, IRRI supports farmer collectives by offering essential market intelligence and helping them establish last-mile linkages. By facilitating buy-back agreements with state and national seed corporations, as well as private sector entities, IRRI ensures reliable market access for farmer collectives.

Advantages of community-managed seed production of landraces

IRRI collaborates with the Government of Odisha to promote specialty rice varieties with nutritional benefits and develop ready-to-cook products. Supported by a tripartite agreement involving IRRI, the Department of Agriculture & Farmers' Empowerment (DA&FE), and the Department of Mission Shakti, Odisha, this approach not only empowers farmers but also strengthens their position in the agricultural value chain, fostering an inclusive and resilient seed system.

IMPACT

IRRI's Kalanamak Model: A Success Story from Uttar Pradesh

Kalanamak, known as Buddha's Prasad, is a prized rice variety with export potential in Southeast Asia. Currently sold at INR 250 per kg on e-commerce platforms, with certified products fetching even higher prices, IRRI's work with Kalanamak in Uttar Pradesh exemplifies success in specialty rice cultivation and commercialization.

IRRI's efforts have led to the identification and purification of ten superior Kalanamak accessions (K1 to K10), setting a benchmark in specialty rice development. Through decentralized seed production and collaboration with NGOs like SHDA and Aparajita Samajik Samiti, IRRI ensures community-driven quality seed production and marketing.

This model not only highlights the potential for specialty crops to drive economic development but also demonstrates the power of community-based approaches in achieving sustainable agricultural success.

Ten superior accessions designated as K1 to K10

Kalanamak rice variety has been chosen by the Siddharthnagar district in Uttar Pradesh, India, for the "One District, One Product" scheme under the Atmanirbhar Bharat Abhiyan campaign. IRRI participated in the Kalanamak Mahotsav program in Uttar Pradesh to feature its new accessions and rice-based products.

IRRI at Kalanamak Mahotsav

SUSTAINABLITY OF THE MODEL

To sustain these initiatives, there is a need to create a robust seed system and a value chain for landraces. One approach is to screen, characterize, and propose landraces through state-based varietal release systems and provisions, leveraging the policies and guidelines established by the PPVRF (Protection of Plant Varieties and Farmers' Rights Authority). This would mainstream these products or germplasms into seed systems and develop a profit-sharing model between the state, commercializing institutions, and the farmers registered for those varieties.

Another parallel effort could involve leveraging and building upon community institutions and farmer collectives to engage in purification, seed production, and the development of comprehensive value chain activities centred around landraces. The trade-off for compensating the lower yield compared to many high-yielding varieties and the reduced incentive for producers can be addressed by positioning many of these products as premium-quality rice. Community institutions can act as aggregators and be linked to various retailers or direct commercial platforms active in the healthier, organic, and nature-based product sectors.

Such an integrated effort—enabling supportive policies, science-based characterization, value-added product development, seed maintenance and multiplication, and community-driven initiatives—is essential to ensure the success of these models.

END NOTE: FUTURE PROSPECTS IN THE LANDRACE VALUE CHAIN PROGRAM

Reviving diminishing indigenous rice genotypes can significantly improve production systems and increase farmers' financial returns (Box 2). Promoting these landraces requires appropriate market positioning, popularization, and farmer capacity-building.

Box 2: Hidden Treasures – Economically Vital Rice Landraces of Eastern India

For generations, communities across India have cherished indigenous rice varieties for their unique benefits. In eastern India, for instance, Govind Bhog rice holds significance in Hindu rituals, while Kalanamak rice from Uttar Pradesh is revered as Buddha's Prasad. Beyond their cultural importance, these varieties are nutritionally rich, providing essential vitamins and minerals.

Some landraces are particularly valued for their health benefits. Kabiraj Sal rice from West Bengal, for example, is traditionally used to support recovery from prolonged illness, while black rice varieties like

Chak Khao are rich in anthocyanins, known for their antioxidant and potential chemotherapeutic properties. Other landraces, such as Kalamalli, Kanakchudi, Tikichudi, and Muktabali from Odisha, have high iron content, which addresses critical micronutrient deficiencies.

These indigenous rice varieties are also well-adapted to diverse climate conditions. For instance, Kalajeera and Machhakanta varieties are drought-tolerant, while FR13A and Ganga Siuli can withstand submergence during flash floods. Nona Bokra and Pokkali are highly resilient to coastal saline conditions. Many of these landraces have been utilized in breeding programs to develop stress-tolerant rice varieties (STRVs), equipping them to better withstand the challenges posed by climate change.

IRRI is currently working to screen and market promising traditional landraces from the Balasore, Balangir, and Sambalpur districts in Odisha, in collaboration with the State Seed Testing Laboratory (SSTL) and the Odisha University of Agriculture and Technology (OUAT). This initiative includes evaluating new accessions alongside well-known landraces from the state, such as Kalavati, Kalajeera, Dhusara, and Chinikamini. Efforts are also underway to develop the seed system and value chain for the Adamchini and Mahachinawar varieties in Uttar Pradesh.

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