
Seed Sovereignty - Safeguarding Seeds for Sustainable Agriculture

**Vanishree G^{1*}, Gopalareddy K², Mamrutha H.M³, Anjitha George⁴,
Ramya P¹, Gayatri K R⁵, Theertha C P⁶, Hemavati Ranebennur⁷,
Manjanagouda S Sannagoudar⁸**

¹Senior Scientist (Genetics & Plant Breeding), ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

²Senior Scientist (Seed Science & Technology), ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

³Senior Scientist (Plant Physiology), ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

⁴Senior Scientist (Entomology), ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

⁵Student, University of Agricultural Sciences, GKVK Campus, Karnataka, India.

⁶Young Professional-1, ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

⁷Senior Scientist (Plant Pathology), ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

⁸Scientist (Agronomy), ICAR-National institute of Seed Science and Technology, Regional station, GKVK Campus, Karnataka, India.

*Corresponding author's e-mail: vanishreeg@gmail.com

Published on: April 30, 2026

ABSTRACT

Seeds form the biological foundation of agriculture and are central to global food and nutritional security. For centuries, farming communities conserved, selected, and exchanged seeds, creating a vast diversity of locally adapted crop varieties. However, the

rapid commercialization of the seed sector, expansion of hybrid technologies, and increasing intellectual property protections have gradually shifted control of seeds away from farmers toward corporate entities. This transformation has raised concerns about declining agrobiodiversity, farmer dependence on commercial inputs, and erosion of traditional seed knowledge. The concept of seed sovereignty emphasizes the rights of farmers and communities to save, use, exchange, and improve seeds, thereby sustaining decentralized and resilient seed systems. In India, initiatives such as community seed banks and policy frameworks like the Protection of Plant Varieties and Farmers' Rights Act (PPV&FRA), 2001 provide important mechanisms to safeguard farmers' rights while promoting innovation in plant breeding. Strengthening farmer-managed seed systems alongside formal research institutions is essential for conserving crop diversity, enhancing climate resilience, and ensuring sustainable agricultural development.

INTRODUCTION

Seeds are the foundation of agriculture and the basis of global food security. They carry the genetic information that determines crop productivity, resilience to pests and diseases, and adaptability to diverse agro-climatic conditions. For thousands of years, farmers have carefully selected and conserved seeds, gradually developing a wide diversity of crop varieties with different colors, tastes, nutritional qualities, and resistance to environmental stresses. In traditional farming systems, seeds were freely exchanged among farming communities. This practice not only helped maintain crop diversity but also strengthened social networks and preserved valuable indigenous knowledge related to farming practices. However, during the last century, the global seed system has undergone major transformations due to technological innovations, commercialization, and changes in agricultural policies.

EVOLUTION OF THE MODERN SEED SYSTEM

Until the mid-twentieth century, seeds were primarily overseen by farmers and public agricultural institutions. Farmers saved seeds from their harvest and exchanged them within local communities. Public-sector plant breeders also played an important role in developing improved crop varieties. However, in the last hundred years, the global seed system has experienced significant changes. The authority over seeds has progressively transitioned from farmers and public entities to a limited number of multinational chemical corporations. This transition was propelled by technological innovations such as hybridization and genetic modification, coupled with enhanced legal protections for intellectual property. The introduction of hybrid seeds in the 1930s established the groundwork for a robust private seed industry with considerable financial resources. Subsequently, in the 1980s, patents were issued for genetically engineered traits, restricting farmers and breeders from utilizing protected varieties without incurring licensing fees. These concepts were further solidified through international agreements associated with the World Trade Organization under the TRIPS agreement concerning intellectual property rights. The commercialization of patent-protected transgenic seeds further expedited consolidation within the seed market. Over time, many multinational corporations acquired smaller seed companies, leading to increased consolidation in the global seed market. A few large corporations now dominate a significant share of the proprietary seed sector. By 2007, as reported by ETC Group, three leading companies, including Monsanto, DuPont, and Syngenta, dominated nearly half of the global proprietary seed market.

SEED GOVERNANCE AND AGRICULTURAL BIODIVERSITY

The merging of the seed industry has greatly influenced seed sovereignty. Numerous companies advocate for seeds that need to be bought every year, which discourages farmers from saving and reusing their own seeds. Technology fees often permit use for just one harvest, leading to ongoing reliance on commercial suppliers. Simultaneously, both public and private research is increasingly directed towards highly profitable proprietary crops, rather than enhancing open-pollinated varieties that farmers can freely replant. As companies phase out less profitable seed lines, genetic diversity diminishes. Cultural knowledge related to seed saving and selection is also at risk of vanishing if these practices are not upheld.

Many modern seed varieties are designed for uniformity and high productivity under specific conditions. However, traditional varieties developed by farmers over generations often possess unique traits such as drought tolerance, pest resistance, and adaptability to local environments. The decline in the cultivation of traditional varieties can lead to erosion of genetic diversity, which is essential for maintaining resilient agricultural systems.

SEED SOVEREIGNTY - CONCEPT AND IMPORTANCE

Seed sovereignty refers to the right of farmers and communities to save, use, exchange, and sell seeds without restrictive regulations. It promotes decentralized and farmer-managed seed systems that prioritize biodiversity, sustainability, and local food security. Seed sovereignty is vital for maintaining long-term food and nutrition security in a world affected by climate change. Community seed banks are key in preserving traditional, locally adapted seeds and protecting crop diversity from privatization. They should enhance local knowledge, encourage collective farmer ownership, and share seeds openly while opposing efforts to commercialize and monopolize genetic resources. Traditional seeds are priceless as they have developed over centuries in local agro-climatic conditions. Through ongoing selection by farmers and plant breeders, these seeds have acquired stable and recognizable traits like drought resistance, pest resilience, varied flavors, colors, and nutritional benefits. For thousands of years, agriculture in India depended on these self-saved, chemical-free, locally adapted seeds, supporting large populations even before the Green Revolution.

SEED SOVEREIGNTY IN THE INDIAN CONTEXT

India possesses immense agricultural biodiversity and has historically been home to thousands of crop varieties. For example, traditional farming communities have developed numerous landraces of rice, millets, pulses, and vegetables adapted to diverse climatic conditions. Before the Green Revolution, Indian agriculture largely depended on locally saved seeds and mixed cropping systems. These systems supported soil fertility, reduced pest problems, and ensured stable food production.

Policy changes during the Green Revolution period (mid-1960s) focused on a limited number of cereal crops and introduced semi-dwarf varieties that relied on chemical inputs. This resulted in monocultures, loss of biodiversity, and a decline in traditional mixed-cropping systems. The Green Revolution introduced high-yielding varieties that required irrigation, chemical fertilizers, and pesticides. While these technologies significantly increased food production, they also encouraged monocropping and reduced the cultivation of traditional crop varieties.

In recent years, several farmer-led initiatives have attempted to revive traditional seed systems. Indigenous polyculture systems like the Barah Anaj system revived by the Beej Bachao Andolan still show resilience. Mixing millets, pulses, vegetables, and other local crops helps reduce pest

problems, enhances soil health, and ensures reliable harvests even with unpredictable rainfall and climate challenges. These decentralized, open-pollinated, organic seed systems are more appropriate for rainfed and resource-limited areas. India's vast biodiversity, which includes thousands of edible plant species, is a vital resource for the future. However, today only a small number of these species are actively cultivated.

POLICY FRAMEWORK SUPPORTING FARMERS' RIGHTS

India has adopted a balanced legal framework that aims to protect both plant breeders and farmers. One of the most significant legislations in this regard is the Protection of Plant Varieties and Farmers' Rights Act (PPV&FRA), 2001. This Act is unique in the world because it simultaneously recognizes the rights of plant breeders, researchers, and farmers. The primary objective of the Act is to encourage the development of new plant varieties while ensuring that farmers who have traditionally conserved and developed crop diversity continue to enjoy their customary rights over seeds.

The Protection of Plant Varieties and Farmers' Rights Act (PPV&FRA), 2001 was enacted to provide an effective system for the protection of plant varieties and to recognize the contributions of farmers in conserving, improving, and making available plant genetic resources for crop improvement. Unlike many international plant variety protection laws that primarily focus on breeders' rights, the Indian law also gives legal recognition to farmers as cultivators, conservers, and breeders.

FARMERS' RIGHTS UNDER PPV&FRA

- **Right to Save and Use Seeds:** Farmers are allowed to save, use, sow, re-sow, exchange, share, or sell farm produce, including seed of a protected variety. However, farmers cannot sell branded seeds of protected varieties.
- **Right to Register Farmers' Varieties:** Traditional varieties developed and maintained by farmers can be registered under the Act as "farmers' varieties." This helps in recognizing and protecting indigenous crop varieties.
- **Benefit Sharing:** If a breeder develops a new variety using genetic material conserved by farmers, the farming community may receive a share of the benefits through the National Gene Fund.
- **Compensation for Crop Failure:** If a registered variety fails to perform as claimed by the breeder under given conditions, farmers are entitled to seek compensation.
- **Recognition and Reward:** Farmers and communities who have conserved valuable plant genetic resources can receive recognition and financial rewards.

INSTITUTIONAL MECHANISMS: The implementation of the PPV&FRA is carried out by the Protection of Plant Varieties and Farmers' Rights Authority, established under the Ministry of Agriculture and Farmers Welfare.

The Authority performs several important functions, including:

- Registration of new plant varieties.
- Protection of farmers' varieties.
- Promotion of awareness about farmers' rights.
- Support for conservation of plant genetic resources.
- Management of the National Gene Fund.

The Act also promotes the establishment of community seed banks and participatory plant breeding programs, encouraging collaboration between farmers and scientists.

SIGNIFICANCE FOR SEED SOVEREIGNTY

The PPV&FRA represents a unique model that balances innovation with farmers’ rights. By allowing farmers to save, exchange, and sell seeds while also protecting plant breeders’ innovations, the Act supports both agricultural development and seed sovereignty. In the context of growing commercialization of the seed sector, such policies are crucial for ensuring that farmers remain active participants in seed conservation and crop improvement.

FARMER-MANAGED AND CORPORATE SEED SYSTEMS

Today, agriculture operates between two major seed systems. Comparison of Farmer-Managed and Corporate Seed Systems for key aspects is given in Table 1.

Farmer-Managed Seed System: In this system, farmers save, exchange, and reproduce seeds within local communities. These seeds are usually open-pollinated varieties that can be replanted year after year.

Advantages include:

- Preservation of biodiversity.
- Adaptation to local climatic conditions.
- Reduced dependence on external inputs.
- Greater farmer autonomy.

Corporate Seed System

The corporate seed system relies mainly on hybrid or proprietary varieties developed by private companies. These seeds are protected by intellectual property rights and are usually purchased every season.

Advantages include:

- High productivity under controlled conditions.
- Uniform crop quality.
- Large-scale commercial production.

However, reliance on purchased seeds may increase farmers’ dependency on commercial suppliers.

Table 1. Comparison of Farmer-Managed and Corporate Seed Systems

Aspect	Farmer-Managed Seed System	Corporate Seed System
Seed type	Mostly open-pollinated and traditional varieties	Hybrid and proprietary varieties
Seed source	Saved and exchanged among farmers	Purchased from seed companies
Reusability	Seeds can be saved and replanted for several seasons	Often cannot be reused effectively
Biodiversity	High crop diversity and local adaptation	Limited number of uniform varieties
Cost to farmers	Low cost	Higher cost due to repeated purchases
Control over seeds	Farmers and communities control seeds	Seed companies control seed supply
Suitability	Well-suited for smallholder and rainfed farming	Suitable for intensive commercial agriculture

COMMUNITY SEED BANKS

Community seed banks play a crucial role in conserving traditional crop varieties and strengthening seed sovereignty. These locally managed institutions collect, store, and distribute seeds of indigenous crops within farming communities.

Functions of community seed banks include:

- Conservation of traditional varieties.
- Exchange of seeds among farmers.
- Preservation of local agricultural knowledge.
- Promotion of climate-resilient crops.

Several states in India have successfully implemented community seed bank initiatives, particularly in tribal and rainfed regions.

KEY THREATS TO SEED SOVEREIGNTY

Technological Dependency: Hybrid seeds and specific modern varieties do not preserve their performance in the following generations. As a result, farmers are required to purchase seeds every season, leading to economic dependency and a decline in traditional self-reliance.

Restrictive Seed Laws: International agreements such as UPOV, especially UPOV-91, reinforce Plant Variety Protection systems that grant intellectual property rights over seeds. These regulations can limit the ability to save and exchange seeds and may obligate farmers to pay royalties. Certification standards like DUS (Distinctness, Uniformity, and Stability) disadvantage traditional landraces due to their genetic diversity not meeting strict uniformity requirements. A well-known example is Iraq's Order 81 (2004), which limited the saving of protected seed varieties. Large agrochemical firms such as Bayer, Syngenta, and Corteva wield significant power over seed markets, research priorities, and agricultural policies. This synergy between corporate interests and institutional frameworks often pushes traditional farmer-managed seed systems to the periphery.

GLOBAL EFFORTS TO PROTECT SEED SOVEREIGNTY

In the face of global challenges, various countries have taken proactive measures to uphold farmers' rights. India has passed the Protection of Plant Varieties and Farmers' Rights Act, which affirms farmers' rights to save, use, exchange, and sell seeds. Mexico has imposed restrictions on GM corn imports to protect its native maize diversity. Tanzania and Ethiopia have resisted the complete adoption of UPOV-91, while Algeria maintains stringent regulations on GM crops to safeguard traditional landraces. These cases demonstrate that policy decisions can promote both innovation and the rights of farmers.

WHY SEED SOVEREIGNTY MATTERS FOR THE FUTURE

The issues of climate change, water scarcity, soil degradation, and escalating input costs call for resilient agricultural systems. Traditional and diverse seed systems provide a broader genetic base for adaptation, lessen vulnerability to pests and diseases, and decrease dependence on chemical inputs. They also enhance the independence of smallholder farmers.⁸¹ (2004), which restricted the saving of protected seed varieties.

CONCLUSION: OUR FUTURE IS EMBEDDED IN SEEDS

Seed sovereignty plays a crucial role in food justice, the conservation of biodiversity, and sustainable development. The shift from diverse landraces to uniform hybrids controlled by corporations endangers ecological stability and the autonomy of farmers.

Safeguarding seed sovereignty involves enhancing community seed banks, securing legal acknowledgment of farmers' rights, encouraging open-source seed sharing, and opposing excessive privatization of seeds. The direction of agriculture hinges on whether communities opt for centralized corporate dominance or decentralized resilience grounded in farmer expertise and biodiversity.