

Barriers to Innovation and Trade

The Impact of Seed Intellectual Property Laws on Global Food Security

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Introduction

The global food system faces unprecedented challenges, exacerbated by climate change, population growth, and geopolitical tensions. Climate change, in particular, has resulted in extreme weather patterns that have significantly affected crop yields. At the same time, the global population is expected to increase food demand by 60 percent by 2050.¹ Furthermore, trade disputes and conflicts disrupt global food supply chains, compounding the problem. In this context, the need for resilient crop varieties is critical, and seed diversity plays a pivotal role in ensuring food security. Diverse seed varieties offer resilience against pests, diseases, and climate variations, making them essential for maintaining food production under adverse conditions.

However, access to these diverse and resilient seeds is limited in many developing regions, primarily due to restrictive seed intellectual property (IP) laws. Recognizing that challenges facing smallholder farmers are multifaceted, involving not only IP restrictions but also variables such as infrastructure, landholding patterns, and regional policy dynamics, the following addresses the narrow consideration of IP reform as a crucial step toward improving access to resilient seeds and mitigating food insecurity in regions facing significant barriers. This paper explores the complex relationship between seed IP protection and global food security, emphasizing the need for legal reforms that balance innovation incentives with equitable access to seeds. It offers strategic policy recommendations aimed at fostering a more sustainable and inclusive global food system.

Overview of Seed Intellectual Property Laws

The protection of seed varieties through intellectual property laws has evolved significantly over the past century.² Initially, seeds were considered communal resources, freely exchanged among farmers and researchers. However, the advent of modern biotechnology and genetic engineering led to the commercialization of seeds, prompting the introduction of legal frameworks to protect breeders' rights.

Two major international agreements have shaped global seed IP law: the International Union for the Protection of New Varieties of Plants (UPOV) Convention, International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA), and the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement.³ These agreements established guidelines for protecting breeders' rights while promoting innovation. Despite their objectives, these legal frameworks have raised concerns about equitable access to seeds, particularly for smallholder farmers in developing countries.⁴ For instance, while the U.S. has stringent protections under the Plant Variety Protection Act (PVPA), other regions like the European Union adopt a more flexible approach, allowing exceptions for farmer-saved seeds. These discrepancies create challenges for international seed trade and innovation.

Impact of Seed IP Laws on Innovation

On one hand, seed IP laws provide incentives for research and development by granting breeders exclusive rights to their innovations. This has led to the development of high-yield, disease-resistant crops, driving agricultural productivity. For example, the commercialization of genetically modified organisms (GMOs) in the 1990s spurred

innovation in crop varieties that could withstand pests and harsh environmental conditions.^{5, 6} On the other hand, these laws can create monopolies, reducing competition and limiting access to seeds for researchers and farmers. In some cases, the high cost of patented seeds has driven farmers into debt, further widening the gap between developed and developing regions, large corporations with vast resources, and smaller localized farming efforts. This dynamic has been especially damaging to smallholder farmers, which often lack the resources to purchase expensive seeds. For example, in India, the introduction of Bt cotton initially boosted yields, but over time, the high costs of patented seeds, coupled with evolving pest resistance, led to a crisis where thousands of indebted farmers faced crop failure.⁷ In contrast, farmers in the U.S. benefit from government subsidies that make advanced seeds affordable, increasing productivity and profits. According to the World Bank, 80 percent of Africa's food is produced by smallholder farmers, yet they lack access to the most advanced seeds due to cost and legal barriers.⁸

To date, seed IP laws have had a mixed impact on breeding programs.^{9, 10} While they encourage investment in private sector breeding initiatives, they often stifle public sector research, particularly in developing countries. Public research institutions face restrictions on conducting trials with proprietary seeds.¹¹ This limits their ability to develop new varieties tailored to local conditions where they are most needed. In contrast, the private sector has played a dominant role in seed innovation, with major multinational companies controlling a significant share of the global seed market. While these companies have made important contributions, their focus on profit has sometimes come at the expense of accessibility and equity, which has further marginalized farmers in developing regions. Public-private partnerships offer a promising solution, combining the resources of the private sector with the public sector's commitment to social good.

Barriers to Seed Trade and Dissemination

International and regional trade regulations create significant barriers to the movement of seeds across borders. Stringent phytosanitary standards and jurisdictionally varying IP laws complicate the ability of farmers and breeders to access and export seeds. This lack of seed mobility undermines global efforts to improve food security by limiting the spread of resilient crop varieties. In Ethiopia, a successful community-based seed system overcame legal barriers and enabled farmers to access improved varieties without infringing on IP rights.^{12, 13, 14}

Smallholder farmers, who make up the majority of food producers in developing countries, are disproportionately affected by these barriers. High licensing fees, limited market access, and complex legal requirements prevent them from obtaining improved seeds. For instance, in Malawi, smallholder farmers struggle to afford patented seeds, which are up to five times more expensive than traditional varieties. Without access to improved seeds, these farmers face diminished yields and reduced incomes, further entrenching poverty and food insecurity in their communities. While we emphasize IP laws as a central barrier, we recognize that they operate within a broader set of challenges that shape agricultural productivity. For instance, limited infrastructure in regions like India and small landholdings compound the challenges of accessing and utilizing improved seed varieties. Similarly, in West African cotton production, external factors such as subsidies and regulatory frameworks also impact local farmers' access to competitive markets. These examples underscore the fact that IP restrictions, while significant, are just one aspect of a broader set of challenges impacting seed access and adoption. By recognizing and addressing these multiple layers of influence, policymakers can work toward creating a more supportive environment for smallholder farmers, enhancing their ability to access and utilize advanced seed varieties. Efforts to harmonize IP and trade policies with local realities can bridge some of these gaps, fostering a more resilient global food system.

Legal Perspectives on Seed IP and Trade

The judiciary and legal provisions have played a pivotal role in shaping seed IP laws, setting key precedents that influence the global seed market. Within Article 27.3(b) of the TRIPS Agreement, which sets out that World Trade Organization member states may exclude from patentability plants and animals as well as essentially biological processes for the production of plants or animals, but that they shall provide for the protection of plant varieties either by patents, an effective sui generis system (a system of its own kind), or a combination thereof. Notable court cases, such as *Bowman v. Monsanto Co.*, 569 U.S. 278 (2013), underscore the delicate balance between safeguarding breeders' rights and ensuring equitable access to seeds for smallholder farmers.¹⁵

A comparative analysis of seed IP enforcement across various jurisdictions reveals stark contrasts. While developed nations have established robust frameworks to protect breeders' rights, many developing countries face challenges due to weak legal infrastructures, making it difficult to enforce IP laws.¹⁶ This imbalance in enforcement exacerbates disparities in the global seed trade, placing farmers in developing regions at a significant disadvantage.

Key legal challenges in seed trade litigation include patent infringement, disputes over breeders' rights, and conflicts between national and international laws. These legal battles not only stifle innovation but also strain international relations and disrupt the flow of trade, ultimately hindering global agricultural development.

Policy Recommendations

- **Balancing IP Protection with Innovation and Access.** To promote both innovation and access, policymakers should consider flexible IP frameworks that protect breeders' rights while ensuring that farmers and researchers have access to seeds. Exceptions for farmer-saved seeds, reduced licensing fees, and the promotion of open-source seed initiatives can achieve this balance. For example, the Open Source Seed Initiative (OSSI) provides an innovative model that allows farmers and researchers to breed, use, and share seeds without legal restrictions.
- **International Cooperation and Harmonization.** Greater international cooperation is needed to harmonize seed IP laws and reduce disparities between national regulations. Strengthening global agreements, such as the UPOV Convention and TRIPS Agreement, can promote the equitable dissemination of seeds while protecting breeders' rights. The African Union, for example, could play a leading role in aligning and harmonizing seed regulations across its member states, improving cross-border seed trade and access. The World Food Programme and similar institutions could create a division specialized in facilitating public-private partnerships for developing economies that could qualify for an exception to IP enforcement.
- **Supporting Smallholder Farmers and Developing Countries.** Policymakers should prioritize financial and technical support for smallholder farmers and developing countries. This could include funding for seed research, subsidies for purchasing improved seeds, and capacity-building initiatives to help farmers navigate the complexities of seed IP laws. In Brazil, for instance, public-private partnerships have successfully fostered seed innovation, ensuring that smallholder farmers can access improved crop varieties.¹⁷
- **Public-Private Partnerships.** Public-private partnerships can effectively bridge the gap between the private sector's resources and the public sector's commitment to social good. In Kenya, a collaboration between

local universities, biotech firms, and the government has made drought-resistant maize varieties accessible to smallholder farmers through royalty-free licensing agreements.¹⁸

Conclusion

The current system of seed IP laws presents significant barriers to innovation, trade, and global food security. While these laws incentivize research and development, they also limit farmers' and researchers' access to seeds, particularly in developing countries. To create a more equitable and sustainable global food system, policymakers, researchers, and stakeholders must work together to reform the seed IP laws. We recognize that seed IP restrictions are part of a complex set of factors affecting agricultural productivity and food security. Addressing IP reform in isolation may not fully resolve these issues but is an essential step in the broader effort to support resilient food systems. By adopting flexible IP frameworks, promoting international cooperation, and establishing an advocacy role within organizations like the World Food Programme, we can foster a system where innovative seed varieties are accessible to all.

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1 How to Feed the World in 2050: High-level Expert Forum, Food and Agricultural Organization of the United Nations, Rome, Italy, October 12-13, 2009.

2 Organic Seed Alliance, "A Guide to Seed Intellectual Property Rights," June 30, 2023, <https://seedalliance.org/publications/a-guide-to-seed-intellectual-property-rights/>.

3 To benefit from the protections and frameworks provided by UPOV, countries must become members and will benefit from greater plant breeding varieties developed in other member countries and IP protections for plant breeders developing varieties suited to local conditions.

4 For purposes of this paper, the definition of emerging and developing economies and developing countries follows that proposed by the World Economic Outlook by the International Monetary Fund, which classifies countries according to factors like per capita income, exports of diversified goods and services, and integration into the global financial systems. In general, developing countries have lower access to safe drinking water, sanitation, and hygiene; energy poverty; higher levels of pollution; and generally poorer quality infrastructure than more developed countries.

Further, the World Trade Organization recognizes "developing countries" and "least developed countries" according to set criteria, which member countries announce for themselves to avail themselves of certain rights and unilateral preference schemes. Acknowledging the "us vs. them" debate that emerges from such classification methods, this paper utilizes the term as a descriptor of a country's ability to inject significant capital into focalized infrastructure dealing with seed-specific policies.

5 Ruchir Raman, "The impact of Genetically Modified (GM) crops in modern agriculture: A review." *GM Crops & Food* 8, no. 4 (2017): 195–208.

6 US Food and Drug Administration, "Science and History of GMOs and Other Food Modification Processes," 2022.

7 Andrew Paul Gutierrez, Peter E. Kenmore, and Luigi Ponti, "Hybrid Bt Cotton Is Failing in India: Cautions for Africa," *Environmental Sciences Europe* 35, no. 1 (2023): 93.

8 David Suttie and Rui S. Benfica, "Fostering Inclusive Outcomes in African Agriculture: Improving Agricultural Productivity and Expanding Agribusiness Opportunities through Better Policies and Investments," 2016, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3305053.

9 La Vía Campesina, "Seed Laws that Criminalise Farmers: Resistance and Fight Back," GRAIN, April 8, 2015, <https://grain.org/en/article/5142-seed-laws-that-criminalise-farmers-resistance-and-fightback>.

10 Keith Fuglie and James M. MacDonald, "Expanded Intellectual Property Protections for Crop Seeds Increase Innovation and Market Power for Companies," Amber Waves: The Economics of Food, Farming, Natural Resources, and Rural America, August 2023.

11 Niels Louwaars, "Seeds of Confusion: The Impact of Policies on Seed Systems," Wageningen University and Research, 2007.

12 Teshome H. Mulesa and Ola T. Westengen, "Against The Grain? A Historical Institutional Analysis of Access Governance of Plant Genetic Resources for Food and Agriculture in Ethiopia," *The Journal of World Intellectual Property* 23, no. 12 (2020): 82–120.

13 Republic of Ethiopia, "Federal Negarit Gazeta," 1998.

14 Ethiopia's PVP law was first adopted in 2006 and revised in 2017. Similar to India's PPVFR Act, the 2006 law conferred extensive rights to farmers to save, use, multiply, exchange, and sell farm-saved seeds or propagating material from protected varieties, with the only limitation that they could not sell them in the seed industry as certified seed (Article 28). When the PVP law was revised in 2017, the farmers' rights provision was amended. Under the revised law, smallholder farmers and pastoral communities (as opposed to "farmers" previously) "shall have the right to save, use, exchange and sell farm saved seed of any variety on the non commercial [market]." Proclamation No. 1068/2017, Art. Art.

7.1. “Smallholder farmers or pastoral communities” are defined as those whose livelihoods depend predominantly on agriculture, who use family labor, and own 10 ha of land or less (Art. 2.15).

15 In *Bowman v. Monsanto*, plaintiff Monsanto sued Bowman, a farmer to whom use of patented seeds had been licensed, for patent infringement. Bowman argued that the planting of a patented seed fulfills the right to use and resell under the Patent Exhaustion Doctrine and Monsanto wrongfully interfered with farmers’ practices. The U.S. Supreme Court affirmed the decision of the U.S. Court of Appeals for the Federal Circuit in favor of Monsanto on the basis that the patent exhaustion doctrine—an affirmative defense stating that once a product is sold by a patent owner, the patent owner cannot sue the purchaser for having an authorized copy of the patented product—does not permit a farmer to plant and grow saved, patented seeds without the patent owner's permission. The result of the Supreme Court’s decision is an illustration of how challenging the legal system is for smaller farmers to navigate complex statutory landscapes.

16 Organizations such as the French private organization SEMAE (formerly GNIS, “l’interprofession de toutes les semences et de tous leurs usages”) is an interprofessional organization that is legally recognized in France and Europe, which endeavors to promote dialogue of the various players who benefit and participate in the seed industry. The role of such organizations is to provide a platform and space for dialogue among French seed farmers and interest holders and to provide such actors with standardizing controls and norms to comply with the standards imposed by the OECD, EU, or ISTA (International Seed Testing Association).

17 OECD, “The Brazilian Agricultural Innovation System,” in *Innovation, Agricultural Productivity and Sustainability in Brazil* (OECD Publishing, 2015).

18 Daniel Otunge, Nancy Muchiri, Grace Wachoro, James Gethi, and Grace Agili, “Reducing Maize Insecurity in Kenya: The WEMA project,” African Agricultural Technology Foundation and Kenya Agricultural Research Institute, November 2010.