12 When Public Goods Go Private
The CGIAR Approach to Intellectual Property, 1990–2020

David J. Jefferson

For most of the twentieth century, intellectual property was of little relevance for public agricultural research. When the Consultative Group on International Agricultural Research (CGIAR) was established in 1971, its centers considered the privatization of research products to be antithetical to the network's mission, which endeavored to promote food security in developing countries through sustainable agriculture. To realize this mission, CGIAR scientists distributed the products of their research, such as new crop varieties, directly to farmers, free of charge, through extension services provided in collaboration with public national agricultural research systems. In contrast, private agricultural firms generally focused on commercializing products in high-income countries where industrialized agriculture was common and intellectual property operated to secure market exclusivity for new products.

Beginning in the 1980s, several changes unsettled the public–private balance in agricultural science and provoked a reimagination of the role of intellectual property in the research and development process. Various factors help to explain these shifts, including developments in science (e.g., advent of new genetic transformation techniques), the law (e.g., expansion of intellectual property systems), and politics (e.g., decrease in governmental support for research). The ability to claim a broader range of agrarian inventions as property, coupled with the rethinking of how public institutions should leverage exclusive rights, have raised the stakes of agricultural science and ignited tensions that affect the work of many institutions worldwide, including CGIAR.

In the 1990s, agricultural experts – including agronomists, plant scientists, economists, lawyers, and development policy specialists,

Acknowledgments: I am grateful for feedback that members of the Harnessing Intellectual Property to Build Food Security research group at the University of Queensland provided on early drafts of this chapter, as well as for the support of Helen Anne Curry and Timothy W. Lorek as editors of this volume.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

but notably not farmers – working within or as consultants for CGIAR developed at least three approaches to how the network and its centers should respond to the global expansion of intellectual property in agriculture. I describe the first approach as maximalist, based on an understanding that formalized intellectual property ownership could provide an important means for centers to augment the impact of their technologies for target beneficiaries. In contrast, I characterize the second approach as adaptationist. Adherents expressed skepticism about the appropriateness of claiming intellectual property rights, but they also recognized that sooner or later CGIAR would need to modify its existing practices to accommodate a reality in which many products of science were regarded as proprietary objects. Finally, I portray the third approach as rejectionist. Proponents claimed that intellectual property was antithetical to CGIAR's mission and its historical focus on small-scale, sustainable agriculture. In this chapter, I argue that over the thirty years from 1990 to 2020, the adaptationist approach crystallized as the overarching approach to intellectual property within CGIAR, as internal debates stabilized and internal governance structures developed and matured.

When intellectual property first emerged as a matter of concern for CGIAR, activists and researchers aligned with organizations that rejected privatization under any circumstance – including Via Campesina, Third World Network, and Genetic Resources Action International (GRAIN) – clashed with industry representatives who thought the centers should maximize the benefits of a capitalist approach to technology dissemination – such as those from the International Association of Plant Breeders for the Protection of Plant Varieties (ASSINSEL) and the International Seed Trade Federation. Over time, CGIAR found ways to accommodate both perspectives to some extent, with each center still able to exercise autonomy over technology management and private-sector partnerships. As of 2020, the centers operated along a continuum, such that some regularly engaged with intellectual property systems while others rarely sought patents, plant variety protection, or other forms of exclusive ownership for their inventions. However, and although CGIAR formally retained its focus on the production of "global public goods,"[1] by the end of the second decade of the new millennium it was clear that across the

[1] In the CGIAR context, global public goods (now officially termed "international public goods") are products of scientific research whose social returns on investment exceed any potential private returns. In theory, global public goods are freely available to all (nonexcludable) and not diminished by use (nonrivalrous). However, according to the current CGIAR conceptualization, intellectual property may be justified to render certain technologies not freely available to all (excludable), where doing so increases value for society

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

global research partnership that CGIAR represents[2] ignoring the influence of intellectual property was no longer tenable. The ascendancy of the adaptationist approach was evident in the fact that responses to the growth of proprietary science had been thoroughly woven into the research and technology development practices of all the centers and CGIAR itself.

Although the need to respond to the expansion of intellectual property led to the alteration of certain CGIAR activities, doing so did not produce the effects that many experts initially expected. Throughout the 1990s and early 2000s, while opponents of privatization feared that the pursuit of intellectual property rights in the form of patents and plant variety protection would undermine CGIAR's mission, proponents foresaw the potential to incentivize partnerships with commercial entities and to provide an alternative source of revenue in an era of diminished public funding. By 2020, neither of these visions had been actualized. The possibility that centers might obtain intellectual property for their creations did not substantially alter their research agendas, lead to a dramatic increase in proprietary claims for CGIAR technologies, or directly generate significant revenue through the commercialization of protected technologies.

Instead, intellectual property had subtle and diffuse effects on the activities of individual centers, and on how they relate to one another as members of the CGIAR global partnership. The expansion of proprietary science also transformed how some centers interact with private-sector partners, especially agribusiness firms. During the early 2000s, all centers adopted institutional policies to deal with the potential effects of intellectual property, and all hired personnel to resolve questions related to the ownership of research results and the commercialization of CGIAR technologies. Furthermore, intellectual property played a role in the structure and internal governance standards of the CGIAR network as a whole, providing both a justification for centralization (e.g., through juridical harmonization and the consolidation of legal services across the network)

as a whole. See D. G. Dalrymple, "International Agricultural Research as a Global Public Good: Concepts, the Global Experience, and Policy Issues," *Journal of International Development* 20 (2008): 347–379, at 350–351.

[2] In 2019, CGIAR announced a major reform known as "One CGIAR," which was driven by a "need for collaboration to become more systemic to better capture strategic opportunities and synergies across the organization." The aim is to create better integration among CGIAR partners and enhance the impacts of CGIAR research. While this transformation will no doubt result in significant effects, as of the time of writing in 2022, it has not resulted in a dramatic shift in CGIAR's intellectual property policies or practices. "Toward Greater Impact: A CGIAR Engagement Framework for Partnerships & Advocacy," Global Director, Partnerships and Advocacy, 4, March 29, 2022, https://storage.googleapis.com/cgiarorg/2022/03/CGIAR-Engagement-Framework-29-March-2022.pdf.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

and a platform for individuation (e.g., by allowing each center to define its own operational approach to intellectual property).

This chapter focuses on the period of 1990 to 2020, when numerous discussions and concrete changes occurred in reaction to the increasing influence of intellectual property on agricultural research worldwide. Over the course of these three decades, CGIAR leaders and consultants engaged in debates, produced reports, and drafted, adopted, and harmonized policies, leading to a systematized approach to intellectual property governance that is now shared across the global partnership. The chapter draws on internal documents and consultants' reports to recount the history of the consolidation of a coordinated CGIAR approach to intellectual property. It shows that the debates sustained between different experts mirrored discussions about agricultural science and the commercialization of research products that were ongoing in other institutions, including universities and national government agencies, during the same period. Notwithstanding the ambitions and concerns of proponents and opponents of privatization and commercialization, a radical shift away from the global public goods model did not occur. Instead, the formal endorsement of the adaptationist approach to intellectual property precipitated subtler transformations to CGIAR research administration.

Historical and Institutional Context

A series of scientific, economic, and legal developments that occurred in the latter part of the twentieth century led to the expansion of formal intellectual property norms into many domains of agricultural research and plant breeding. As national and international laws were created or expanded, researchers in fields such as molecular biology, genetics, and plant sciences could more easily claim proprietary rights in their creations. In parallel, the locus of plant varietal improvement shifted from the public to the private sector in many countries, while firms trading in seeds, fertilizers, and other farming inputs consolidated through a multitude of mergers and acquisitions.[3] As agricultural science and technology development became increasingly intertwined with intellectual property laws and with globalized capitalism, debates surged about the privatization of seeds and other plant materials, which international legal systems historically had treated as the common heritage of humankind.[4]

[3] S. C. Price, "Public and Private Plant Breeding," *Nature Biotechnology* 17, no. 10 (1999): 938; R. Tripp and D. Byerlee, "Plant Breeding in an Era of Privatisation," *Natural Resource Perspectives* 57 (2000): 1–4; P. H. Howard, "Visualizing Consolidation in the Global Seed Industry: 1996–2008," *Sustainability* 1, no. 4 (2009): 1266–1287.

[4] J. R. Kloppenburg, Jr. and D. L. Kleinman, "Property versus Common Heritage," in J. R. Kloppenburg, Jr., ed., *Seeds and Sovereignty: Debate over the Use and Control of Plant*

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

Many of these discussions were characterized by certain assumptions. These included the idea that the availability of the exclusive rights provided by intellectual property regimes should incentivize innovation in agricultural science and plant breeding, which in turn was expected to benefit farmers, for example by making the seeds of improved crop varieties more broadly available.[5] However, a competing assumption held that some farmers – including smallholders and Indigenous cultivators, especially in the Global South – would be harmed by the expansion of intellectual property in agriculture. The assumption was that the increased privatization of public research products and the corresponding prioritization of maximizing economic returns would lead to a neglect of crop species and varieties for which large markets do not exist, while proscribing customary cultivation practices such as the saving, exchange, and local sale of farm-saved seeds.[6]

It was inevitable that as the largest public agricultural research system in the world, CGIAR would need to contend with intellectual property issues. While debates over the use of proprietary legal vehicles to claim agricultural technologies became common in research institutions worldwide in the 1980s and 1990s, such discussions had unique features within CGIAR. This may be partially explained by the complex character of the network. At the time when intellectual property became a matter of concern for agricultural science, CGIAR operated simultaneously as a loose affiliation of individual research centers – each with their own missions, governance models, and scientific orientations – and as a centralized institution in its own right. The variegated nature of CGIAR meant that it had to both accommodate centers' diverse responses to intellectual property, and harmonize local approaches to create a coherent, system-wide strategy. In this way, CGIAR needed to transcend the dichotomous thinking that characterized many late twentieth-century debates about the global expansion of intellectual property in agriculture.

The formation of CGIAR in 1971 forged a formal link between institutions that had emerged independently from post–World War II, country-specific agricultural programs. In part because certain centers predated CGIAR, tension between centralization and autonomy imbued the network from the time of its establishment. Competing

Genetic Resources (Durham, NC: Duke University Press, 1998), pp. 173–203. Here "common heritage" is defined as when plants and seeds are viewed as a common good for which no payment is necessary or appropriate.

[5] L. R. Helfer, *Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments*, FAO Legislative Study No. 85 (Rome: FAO, 2004).

[6] N. P. Louwaars, R. Tripp, D. Eaton et al., *Impacts of Strengthened Intellectual Property Rights Regimes on the Plant Breeding Industry in Developing Countries* (Wageningen, Netherlands: World Bank, 2005).

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

interests that alternately advocated for unification or independence contributed to divergent views about the appropriate role of intellectual property throughout the 1990s and early 2000s. For example, there was tension between efforts to establish universal policies, performance standards, and decision-making protocols for resource allocation, and the need to safeguard individual centers' capacities to innovate and set appropriate internal governance standards.[7]

Economic factors also underpinned the intellectual property debates that emerged in the 1990s. In CGIAR's early years, the centers were mainly funded through donations from national and international governmental agencies. More recently, however, financial support from governments became increasingly scarce. While private philanthropy stepped in to fill some gaps, the number of "public–private partnerships" with for-profit firms also grew.[8] Reliance on associations with profit-driven entities required that CGIAR reconcile its nonproprietary global public goods model with the commercialization strategies of multinational agribusinesses, which typically were grounded in the protection of research products as intellectual property for the purpose of securing market exclusivity. This dynamic was further compounded by scientific developments, such as the emergence of new agricultural biotechnologies (e.g., transgenic plants), and the global expansion of patent and plant variety protection laws. Thus, at the dawn of the 1990s, a series of international scientific, economic, and legal developments brought intellectual property to the fore within CGIAR.

Intellectual Property Becomes a Matter of Concern, 1990 to 1996

The first formal review of the implications that intellectual property could have for CGIAR was initiated in 1982, but by then certain centers, most notably the International Rice Research Institute (IRRI), had already obtained patents for their inventions.[9] As the 1990s commenced, all

[7] D. Byerlee and J. K. Lynam, "The Development of the International Center Model for Agricultural Research: A Prehistory of the CGIAR," *World Development* 135 (2020): 105080.

[8] From 2011 to 2022, the Bill & Melinda Gates Foundation contributed the second-highest amount to the CGIAR Trust Fund ($990.6 million), behind only the United States Agency for International Development (USAID) (US$1,474.1 million); see CGIAR, "CGIAR Trust Fund Contributions," www.cgiar.org/funders/trust-fund/trust-fund-contributions-dashboard. On public–private partnerships, see D. J. Spielman, F. Hartwich, and K. von Grebmer, *Sharing Science, Building Bridges, and Enhancing Impact: Public–Private Partnerships in the CGIAR*, IFPRI Discussion Paper 00708 (Washington, DC: IFPRI, 2007).

[9] W. E. Siebeck, D. L. Plucknett, and K. Wright-Platais, "Privatization of Research through Intellectual Property Protection and Its Potential Effects on Research at the International

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

CGIAR center directors "accepted that the legal protection of inventions and intellectual property" had become standard practice in modern agricultural science, particularly for research involving the use of novel biotechnologies.[10] Although the directors expressed confidence that the growth of intellectual property could be accommodated without abandoning the global public goods model, they also acknowledged the "clear need" for expert guidance on patent and plant variety protection issues. They argued that CGIAR centers should be shielded from any detrimental effects associated with the increased utilization of intellectual property in agricultural research but should also be able to "take advantage of potential benefits," including "the promotion of collaborative arrangements" and "the facilitation of access to technologies."[11]

The directors presented a draft paper on intellectual property at a 1990 meeting of the CGIAR leadership, where their proposals generated "considerable discussion."[12] Shortly afterward, the CGIAR chairman convened a consultation that brought together twenty-eight experts from national governmental agencies, universities, and nongovernmental development organizations (NGOs) to "think creatively about a CGIAR strategy for the 1990s."[13] Consultation participants represented the United Nations Food and Agriculture Organization (FAO), United Nations Development Programme (UNDP), World Bank, Rockefeller Foundation, and several European and North American government agencies and universities. Industry representatives were not invited. Nevertheless, and notwithstanding their public-sector affiliations, some consultants favored greater engagement with businesses, highlighting that the private sector encompassed "a wider universe … than just the multinational companies" and that the centers could play an important role in supporting small industries in rural areas in the countries where they were located.[14] However, others were skeptical of partnering with industry, querying, "Could the CGIAR hurt

Centers," in D. R. Buxton et al., eds., *International Crop Science I* (Madison: Crop Science Society of America), pp. 499–504. Early IRRI patents covered inventions including extracts from rice plants used as insecticides (PH 12554) and herbicides (PH 13021), a seed plate planter (PH 13473), a process of rice seedling production (PH 13550), a reaper (PH 14108), and a chemical compound used for flavoring foods (US 4522838).

[10] CGIAR Center Directors Committee, "Biotechnology in the International Agricultural Research Centers of the Consultative Group on International Agricultural Research: A Statement by Center Directors," CGIAR Mid-Term Meeting, the Hague, the Netherlands, May 21–25, 1990, 5, https://hdl.handle.net/10947/201.

[11] Ibid. [12] Ibid.

[13] CGIAR Ad Hoc Strategy Consultation, Synthesis Report, February 1992, encl. in Letter from CGIAR Chairman V. Rajagopalan, letter to Heads of CGIAR Delegations, February 24, 1992, 1, https://hdl.handle.net/10947/718.

[14] Ibid., 30.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

itself in some ways in some countries if its relationship with private companies is too close?"[15]

In summarizing the discussion, economist and Stanford University professor Walter Falcon, who served as moderator, noted that "[s]trong anti-private sector sentiments exist in several circles related to CGIAR."[16] Correspondingly, many stakeholders would likely oppose the future utilization of intellectual property laws to protect CGIAR technologies, because "for some persons and donors, intellectual property rights are a political issue, at least in part, while they are moral or ethical issues for others."[17] Despite this, Falcon concluded that intellectual property issues, particularly in relation to patents, plant variety protection, and material transfer agreements would almost certainly figure more prominently in the centers' work in the future. CGIAR "must learn how to handle these questions effectively."[18]

The conversation continued to gather momentum at a 1992 meeting, where CGIAR leadership debated the recently released "Suggested Principles for a Future CGIAR Policy on Intellectual Property Rights" and a discussion document on "Intellectual Property, Biosafety and Plant Genetic Resources." The latter identified several situations that might justify centers' use of intellectual property, including "to prevent preemptive protection by others, which might restrict the availability of those inventions, especially to ... developing countries."[19] Intellectual property ownership could also give centers leverage in negotiations for the use of third parties' technologies, where a cross-licensing or similar arrangement could be brokered. However, the leadership concluded that centers should not pursue intellectual property for economic reasons, and any financial returns generated from licensing or commercializing technologies that centers owned would need to be used for the direct benefit of developing countries.[20]

Although the discussion document was unanimously adopted at the 1992 meeting, divergent views on intellectual property persisted. One year later, during another leadership conference, some experts rejected the idea that CGIAR should adopt a formal intellectual property policy, while others wanted to unambiguously encourage collaboration with private-sector partners.[21] Further complicating matters, two major shifts in the international legal landscape occurred in the early 1990s that

[15] Ibid. [16] Ibid. [17] Ibid., 31. [18] Ibid., 38.
[19] CGIAR Discussion Document on Intellectual Property, Biosafety, and Plant Genetic Resources, Mid-Term Meeting, May 18–22, 1992, 2, https://hdl.handle.net/10947/648.
[20] Ibid.
[21] W. E. Siebeck, "Intellectual Property Rights and CGIAR Research – Predicament or Challenge?" in *CGIAR Annual Report 1993–1994* (Washington, DC: CGIAR Secretariat, 1994), pp. 17–20.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

created uncertainty about intellectual property governance within CGIAR. The changes were the entry into force of the Convention on Biological Diversity (CBD) in December 1993, and the signing of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO) in April 1994. These international agreements, which in some ways were in tension with one another, led the new CGIAR chairman, the Egyptian scientist and economist Ismail Serageldin, to convene a panel on intellectual property rights in 1994.[22] Given the reforms anticipated in the wake of the CBD and the TRIPS Agreement, the panel urged CGIAR to analyze how changes to national intellectual property laws might affect the dissemination of agricultural technologies in the Global South.[23]

The Indian geneticist and Green Revolution plant breeder M. S. Swaminathan chaired the panel, which comprised center directors and experts from academic, governmental, and philanthropic institutions. For the first time an industry representative joined the conversation: the CEO of the pharmaceutical and agrochemicals company Zeneca (now AstraZeneca). Panel experts agreed on several points, including the circumstances that would justify the use of patents to protect CGIAR inventions and the principle that if a center obtained a patent for one of its inventions, it should provide royalty-free licenses to developing countries.[24] Panelists also agreed that questions such as where to apply for patent protection and how to share intellectual property ownership rights under collaborative research agreements should be determined case by case.[25]

The panel further recommended the establishment of pooled technical and legal services to enable centers to understand intellectual property issues and develop "common operational approaches" to technology management.[26] Finally, and revealing of the longstanding tension between centralization and autonomy, some panelists endorsed the idea that CGIAR should have independent legal personality. This would formalize the ad hoc funder–center partnership structure and enable

[22] C. Lawson and J. Sanderson, "The Evolution of the CBD's Development Agenda That May Influence the Interpretation and Development of TRIPS," in J. Malbon and C. Lawson, eds., *Interpreting and Implementing the TRIPS Agreement: Is It Fair?* (Cheltenham, UK: Edward Elgar, 2008), pp. 131–158.

[23] CGIAR Intellectual Property Rights Panel and M. S. Swaminathan, "Report of the Intellectual Property Rights Panel," September 30, 1994, i, https://hdl.handle.net/10947/1094.

[24] Ibid., ii. Justifiable circumstances included preventing appropriation by third parties, ensuring further product development and delivery to farmers, and negotiating access to other proprietary technologies.

[25] Ibid., ii–iii. [26] Ibid., iii.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

CGIAR to act on behalf of individual centers, for instance when filing for patent protection.[27]

The panel also considered how CGIAR should approach plant variety protection as a form of intellectual property alternative to patents. This was especially relevant considering the 1991 reform of the Convention of the Union for the Protection of New Varieties of Plants (UPOV Convention) and the TRIPS Agreement.[28] The latter treaty required all members of WTO, including developing countries, to enact plant variety protection laws.[29] At the time, activists critical of the TRIPS Agreement interpreted this requirement as an implicit endorsement of the UPOV Convention.[30] In this context, panelists "strongly support-[ed]" the recognition of exceptions to plant variety protection, which would allow farmers to save and exchange seeds, and permit protected varieties to be used for research.[31] Panel experts additionally suggested that CGIAR should co-sponsor the formation of a standardized approach to plant variety protection, in collaboration with the governments of developing countries, which could operate as an alternative to the UPOV Convention.[32]

The CGIAR leadership reviewed the panel's report during a meeting in December 1994 and "broadly accepted" its recommendations, endorsing another round of consultation that aimed to develop a system-wide intellectual property policy.[33] After two years of research and discussions, the "Guiding Principles for the CGIAR Centers on Intellectual Property and Genetic Resources" were released at a 1996 leadership meeting. Like earlier policy statements, these principles emphasized that centers should continue to prioritize the full disclosure of research results and release products into the public domain, except where seeking intellectual property protection "is needed to facilitate technology transfer or otherwise

[27] Ibid., 4.

[28] The 1991 Act of UPOV substantially expanded the scope of intellectual property available to plant breeders. For example, it enabled a broader set of plant materials to be claimed and lengthened the periods of exclusivity, while also limiting certain exemptions that had been previously recognized.

[29] Notably, the TRIPS Agreement exempted "least developed countries" that are WTO members from implementing the agreement until 2006, which was later extended until July 2034 at the earliest. See WTO, "WTO Members Agree to Extend TRIPS Transition Period for LDCs until 1 July 2034," June 29, 2021, www.wto.org/english/news_e/news21_e/trip_30jun21_e.htm.

[30] V. Shiva, "Agricultural Biodiversity, Intellectual Property Rights and Farmers' Rights," *Economic and Political Weekly* 31, no. 25 (1996): 1621–1631, at 1628.

[31] "Report of the Intellectual Property Rights Panel," iii. [32] Ibid.

[33] CGIAR Secretariat, *CGIAR International Centers Week, Washington, DC, October 24–28, 1994: Summary of Proceedings and Decisions* (Washington, DC: CGIAR, December 1994), p. 48, https://hdl.handle.net/10947/273.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

protect the interests of developing nations."[34] Furthermore, CGIAR institutions should not view exclusive rights as a means to secure monetary returns. However, the principles also indicated that if a center did benefit financially from intellectual property commercialization, the center would need to ensure that the funds were used to further its public goods mandate and the overall objectives of CGIAR.[35] These examples demonstrate that by the time the guiding principles were released in 1996, CGIAR had largely consolidated a standardized approach to intellectual property.

A System-Wide Policy Is Consolidated, 1996 to 2012

Although by 1996 it appeared that CGIAR was ready to enact a system-wide intellectual property policy, its leadership decided that the guiding principles should continue to operate as nonbinding working guidelines until ongoing legal questions were resolved.[36] In the meantime, chairman Serageldin formed a panel on proprietary science and technology, which conducted interviews with administrators and scientists from seven centers, in addition to intellectual property managers at five major US land-grant universities and five multinational agricultural companies.[37] Timothy Roberts, a British chemist and former intellectual property manager of ICI Seeds (now AstraZeneca) chaired the panel, reflecting Serageldin's growing belief that the private sector would be an essential part of future CGIAR strategy.

The panel presented its final report at a leadership meeting in 1998. The document was notable for its consideration of issues that had received little attention in prior deliberations. For instance, the report identified risks that could arise if intellectual property were sought for CGIAR inventions, including the substantial expenditures associated with the preparation, filing,

[34] "Guiding Principles for the Consultative Group on International Agricultural Research Centers on Intellectual Property and Genetic Resources," principle 7, published in CGIAR Center Directors Committee and CGIAR Committee of Board Chairs, "CGIAR Center Statements on Genetic Resources, Intellectual Property Rights, and Biotechnology," May 1999, https://hdl.handle.net/10947/253.

[35] Ibid., principle 8.

[36] These questions included the potential impact of the International Treaty on Plant Genetic Resources for Food and Agriculture (then still in negotiation) and likely reforms to national intellectual property laws. See CGIAR Secretariat, *The CGIAR at 25: Into the Future: ICW96 Summary of Proceedings and Decisions*, CGIAR International Centers Week 1996: Summary of Proceedings and Decisions (Washington, DC: CGIAR, January 1997), p. 67, https://hdl.handle.net/10568/119103.

[37] "Mobilizing Science for Global Food Security," Report of the CGIAR Panel on Proprietary Science and Technology, SDR/TAC:IAR/98/7.1, April 20, 1998, www.fao.org/3/w8425e/w8425e00.htm.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

and maintenance of patent and plant variety protection applications.[38] Obtaining proprietary rights could also skew the centers' research agendas. For instance, centers might begin to focus more attention on investigations that could lead to the development of marketable products while neglecting research on questions with limited commercial applications. On the other hand, benefits that could result from intellectual property utilization included the possibility of facilitating technology transfer to target beneficiaries, the ability of centers that partnered with external entities to reserve rights to jointly owned intellectual property for humanitarian use, and the potential to attract local investments and enable "capital formation" in countries where centers operated.[39]

Panel members acknowledged that any revenues derived from licensing a protected technology would constitute a potential benefit for the center that owned it, but they disagreed about the extent to which CGIAR should engage in commercial activities in the first place. While the majority thought that generating income should never be the main reason to seek intellectual property, the minority "strongly" believed that not protecting certain technologies would be tantamount to "wast[ing] useful resources."[40] Although panel members generally concurred that CGIAR should establish a set of mission-driven criteria to guide decision-making, discord permeated the report because participants "disagree[d] markedly as to what an ideal situation should be."[41] The panel was particularly divided over the question of "whether CGIAR should campaign against all intellectual property on life-forms, or whether it should promote extension of [intellectual property] to promote innovation, transfer and adoption of useful technologies."[42]

Deliberations over how CGIAR should practice science in relation to intellectual property were manifested in three approaches or viewpoints. The first approach, which I describe as maximalist, was endorsed by some panel members, who "believe[d] strongly that advanced biotechnology and the development of transgenic crop varieties are central to the goal of increasing food production in developed and developing countries, and that only in the context of strengthened intellectual property regimes will these proceed efficiently."[43] The panel's report overtly referenced a "Statement on Biotechnology and the Agri-Food Industry" by the International Agri-Food Network as representative of this approach.[44] Although the report did not specifically mention which panelists endorsed the viewpoint that I term maximalist, it is likely that they included at least Robert Horsch of Monsanto and Bernard Le Buanec

[38] Ibid., section 3.2. [39] Ibid. [40] Ibid. [41] Ibid., section 6. [42] Ibid.
[43] Ibid., section 6.2.1. [44] Ibid.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

of the International Seed Trade Federation and ASSINSEL, whose institutions had also endorsed the International Agri-Food Network's Statement.[45]

Proponents of maximalism championed the widespread utilization of intellectual property by at least some centers. Maximalists also thought that CGIAR should endorse the ratcheting-up of international intellectual property regimes, including by broadening the scope and reach of the TRIPS Agreement. Adherents to maximalism were "gravely concerned" about the notion that CGIAR should act as a "voice for the poor," believing that enabling aid recipients to express their views would "inevitably polarize the CGIAR's supporters; put at risk its scientific credibility; and undermine its ability to continue its enormously valuable technical contribution to the welfare of the poor."[46] In other words, they maintained that centers should continue to deliver new technologies to poor farmers but that they should not empower farmers politically, because doing so might offend CGIAR donors and partners or make the centers appear unscientific.

Other panel members supported an approach that I characterize as adaptationist, according to which most of CGIAR's core work could proceed without major changes to centers' customary lack of engagement with intellectual property laws. The adaptationist viewpoint recognized that "the increasing use of proprietary property in agricultural research and development is a fact of life, whether regrettable or beneficial," so centers should acclimate while continuing to focus on furthering their missions. In adjusting to this new reality, "the very substantial costs of increasing CGIAR capacity to manage intellectual property must be weighed carefully against potentially competing needs of an arguably underfunded CGIAR system."[47] Likewise, centers should judiciously consider the opportunity costs of using limited resources to enforce their intellectual property rights in the event of infringement. Adaptationists also expressed concern that patents owned by third parties were unreasonably constraining research. Therefore, they recommended that CGIAR advocate for a clearer definition of the "research exemption" to patents, which effectively limits the scope of exclusive rights to commercial uses rather than investigative or experimental activities.[48]

Finally, some panel members embraced an approach that I term rejectionist, resisting the idea that the most "advanced" agricultural science was the kind associated with industrial biotechnology and the development of transgenic plant varieties. Instead, a truly advanced approach would pursue "the better understanding, improvement, and adaptation to various developing country conditions of sustainable, diversity-based

[45] Ibid., appendix B. [46] Ibid., section 6.2.1. [47] Ibid., section 6.2.2. [48] Ibid.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013



Figure 12.1 Protesters in the Philippines, 2010s, take a stand against Golden Rice, genetically modified organisms (GMOs), transnational corporations (TNCS), and the International Rice Research Institute (IRRI). IRRI is represented by the bespectacled, white-coated puppet at back right. By permission of MASIPAG.

agricultural systems, and the related management of genetic, crop, soil, and other agricultural resources."[49] According to the report, examples of this viewpoint could be found in the Thammasat Resolution, a 1997 declaration by representatives of Indigenous, peasant, nongovernmental, academic, and governmental organizations including Via Campesina, the Third World Network, and GRAIN, as well as in a statement issued by the prominent agro-ecologist Miguel Altieri (Figure 12.1).[50]

Rejectionists believed that intellectual property should have little relevance for the centers' work. Instead of becoming involved with commercialization, CGIAR "should only make research investments in technologies that the private sector is not investing in, and for which the only 'market' is the poor."[51] The rejectionist viewpoint argued that CGIAR should actively oppose a proposed expansion of the TRIPS Agreement, which would have required all WTO member countries to recognize patents for inventions based on animals and plants.

[49] Ibid., section 6.2.3. [50] Ibid., appendices D-5 and D-6. [51] Ibid., section 6.2.3.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

Simultaneously, rejectionists advocated for "alternative" intellectual property regimes that would support CGIAR's mission of making plant varieties freely available to poor farmers in developing countries.[52]

Unlike the maximalists and adaptationists who participated in the 1998 panel on proprietary science and technology, rejectionists believed that CGIAR was in a position to actively shape rather than merely passively respond to changes driven by techno-legal developments and the spread of global capitalism. As Altieri argued in an appendix to the panel's report, "[i]t is time for the CGIAR to play a more active role in defining the future [intellectual property rights] scenarios so as to prevent that the free exchange of knowledge and resources does not give way to a monopoly vested in those who control capital and hence the resources for research."[53]

Notwithstanding the discrepancies between the maximalist, adaptationist, and rejectionist approaches, few significant changes were made to the official CGIAR stance on intellectual property after the report was presented. The guiding principles that were first introduced in 1996 continued to provide a system-wide framework until an updated policy, "CGIAR Principles on the Management of Intellectual Assets" (hereafter Intellectual Assets Principles) was finally adopted in 2012. Over this fifteen-year period, the adaptationist approach to intellectual property came to dominate. Meanwhile, certain centers, most notably IRRI and the International Maize and Wheat Improvement Center (CIMMYT), became increasingly maximalist by deepening engagements with private-sector partners and seeking intellectual property for inventions that could prove commercially viable. Other centers continued to avoid making proprietary claims for their technologies, maintaining a rejectionist approach. However, by 2012 it was clear that at the system level, the rejectionist viewpoint, with its advocacy for strengthening local, customary farming systems as an alternative to advanced biotechnologies, had been formally marginalized.

The dismissal of the rejectionist approach and its adherents' advocacy for CGIAR to take a more active role in shaping global agricultural research practices might be partially explained by the fascination with the "gene revolution" that pervaded agriscience discourse in the 1990s. When the 1998 CGIAR system review report highlighted that genetic "breakthroughs" were typically only achieved by the private sector, it also indicated that "CGIAR's challenge is to create a new form of public–private partnership that will protect intellectual property while bringing the benefits of this research to the poorest nations."[54] In his opening

[52] Ibid., section 6.2.3. [53] Ibid., appendix D-5.
[54] CGIAR System Review Secretariat, *The International Research Partnership for Food Security and Sustainable Agriculture*, Third System Review of the Consultative Group on

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

remarks at a 2000 leadership meeting, Chairman Serageldin used even starker language to describe the situation:

> CGIAR now faces a future characterized by make-or-break challenges, and make-or-break opportunities . . . The implicit bargain among the developing countries – the possessors of germplasm – the advanced research organizations, the main producers of new science, and international institutions working with national agricultural research systems . . . is becoming more and more difficult to maintain, as scientific developments become increasingly subject to private control. The private sector is now at the head of most developments in the field of science and, to recoup the billions of dollars it invests on research, is expanding the application of patents and intellectual property rights. We cannot remain indifferent to what goes on beyond the parameters of that bargain.[55]

In 2000, a CGIAR working group on intellectual property rights and the private sector echoed Serageldin, noting that "CGIAR must negotiate from a position of strength. Its leverage is strengthened when its own [intellectual property] is of interest to partners. It must be a trusted and respected player."[56] In other words, the working group insisted that to remain both scientifically relevant and economically viable, at minimum centers would need to speak the language of agribusiness, conceptualizing their own technologies as CGIAR intellectual property.

As the first years of the new millennium unfolded, the CGIAR approach to intellectual property stabilized. Proprietary science issues were debated with far less frequency in internal documents published between 2000 and 2010 in comparison with the previous decade.[57] Simultaneously, the organization's leadership shifted its focus to bolstering CGIAR as a centralized entity, while harmonizing the various centers' internal policy frameworks. For instance, following a series of meetings in 2005, the CGIAR genetic resources policy committee generated a template intellectual property policy statement, which was intended to promote consistency in centers' practices.[58] Despite these efforts, a 2008 independent review found that although some centers had already adopted internal policies and hired professional

International Agricultural Research (Washington, DC: CGIAR), September 1998, p. viii, https://hdl.handle.net/10947/1586.

[55] CGIAR Secretariat, *Charting the CGIAR's Future: A New Vision for 2010*, Summary of Proceedings and Decisions, Mid-Term Meeting 2000, Dresden, Germany, May 21–26, 2000 (Washington, DC: CGIAR, July 2000), p. 16, https://hdl.handle.net/10947/300.

[56] Ibid., 28.

[57] This assessment is based on keyword searches of documents housed in the CGSpace repository in August 2021, https://cgspace.cgiar.org.

[58] CGIAR Genetic Resources Policy Committee, "Summary Report of the Genetic Resources Policy Committee (GRPC) Meetings Held in 2005," appendix 2, https://hdl.handle.net/10947/3935.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

staff to resolve intellectual property questions, the majority had not, and they "tend[ed] to deal with these issues on an ad hoc basis, often reacting to crisis."[59] A frank warning accompanied this assessment: "CGIAR cannot ignore or causally handle issues of intellectual property protection."[60]

Although all fifteen CGIAR centers[61] had already adopted intellectual property policy statements at the time the independent review was conducted, only six had established in-house units or offices dedicated to intellectual property management. Furthermore, while the review found that scientists working at the centers were increasingly aware of the relevance of intellectual property to their research, they lacked an understanding of pertinent international and national legal regimes.[62] Another issue was the fact that most centers did not allocate resources to intellectual property management in their annual budgets.[63]

The recommendations issued by the independent review – and indeed, the initial rationale for its formation – reflected the consolidation of the adaptationist and maximalist approaches. The institutional response to the deficiencies that the review identified was the 2012 adoption of the Intellectual Assets Principles. These principles espoused a commitment to the "sound management" of intellectual property as a means to advance the "CGIAR Vision" of a "world free of poverty, hunger and environmental degradation."[64] The policy formally articulated CGIAR's conceptualization of research results as global public goods and embraced a commitment to the "widespread diffusion and use of these goods to achieve the maximum possible access, scale, scope of impact and sharing of benefits to advantage the poor, especially farmers in developing countries." Simultaneously, the principles outlined CGIAR's commitment to the "prudent and strategic

[59] Elizabeth McAllister, Keith Bezanson, G. K. Chadha et al., *Bringing Together the Best of Science and the Best of Development: Independent Review of the CGIAR System: Technical Report* (Washington, DC: CGIAR, November 2008), p. 5, https://hdl.handle.net/10947/4949.

[60] Ibid., p. 4.

[61] The number of CGIAR centers has fluctuated over time. While there were fifteen centers in 2012, since that time Bioversity International and the International Center for Tropical Agriculture have formed an alliance, reducing the total number of centers to fourteen in 2022.

[62] Ibid., 250. The six centers that as of 2008 had established in-house intellectual property units were the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Livestock Research Institute (ILRI), IRRI, the International Center for Tropical Agriculture (CIAT), Bioversity International, and CIMMYT.

[63] Ibid., 251.

[64] CGIAR System Management Office, "CGIAR Principles on the Management of Intellectual Assets," March 7, 2012, principle 5.1, https://hdl.handle.net/10947/4486.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

use" of intellectual property, including requirements that centers manage their technologies with "integrity, fairness, equity, responsibility, and accountability," and that they engage in due diligence to ensure that they do not infringe third-party proprietary rights.[65]

One year after the Intellectual Assets Principles were adopted, CGIAR issued a set of implementation guidelines that provided additional information and examples to facilitate understanding and ensure coherent intellectual property management across the centers.[66] The implementation guidelines clarified that when centers consider whether to seek formal intellectual property protection, they should follow an internal evaluation procedure to ensure that doing so is necessary. The culmination of this procedure should typically entail the preparation of a written report that describes the strategy for technology development, dissemination, and commercialization, the reasons for filing the application, the benefits expected to result from protection, and the risks that may result from declining to seek protection, among other issues.[67] The standardization of these internal evaluation procedures is but one example[68] of how a culture of intellectual property had permeated CGIAR's operations by the second decade of the 2000s, even as the actual number of applications for patents and plant variety protections that centers filed remained low.

Lessons from the Intellectual Assets Reports

Every year since the adoption of the Intellectual Assets Principles in 2012, CGIAR has published an "intellectual assets report" on centers' technology management activities, including claims made under intellectual property laws. The first report indicated that although CGIAR institutions did not file a single application for patents or plant variety protection in 2012, intellectual property was already shaping their cultures and practices. For instance, by the end of that year, all centers had developed legal and intellectual property expertise in the form of in-house or external personnel, in contrast to what the 2008 independent review had found. Centers had responded to CGIAR's prioritization of intellectual property capacity development by enrolling staff

[65] Ibid., principle 1, principle 6.4.1, principle 5.2, and principle 5.3.
[66] CGIAR System Management Office, "Implementation Guidelines for the CGIAR IA Principles on the Management of Intellectual Assets," June 14, 2013, background, https://hdl.handle.net/10947/4487.
[67] Ibid., IP rights (article 6.4).
[68] Another example can be found in the CGIAR Intellectual Property Community of Practice, a system-wide forum launched in 2013 whose aim is to promote the effective management of intellectual property across all CGIAR institutions. S. Cummings et al., eds., "Open for Business: Pathways to Strengthen CGIAR's Responsible Engagement with the Private Sector," 2022, 32, https://hdl.handle.net/10568/119305.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

in technical seminars, recruiting additional legal experts, organizing workshops and training activities for researchers and administrators, and mobilizing resources to support local intellectual property management units.[69] Furthermore, ten of the fifteen centers had already reviewed and modified their policies to ensure compliance with the Intellectual Assets Principles.[70]

Notwithstanding these activities, even today the privatization of CGIAR technologies remains rare. The intellectual assets reports from 2012 to 2021 indicated that in any given year, few centers sought formal intellectual property protection. Over this ten-year period, a total of fifty-two patent filings were made, while only seven applications for plant variety protection were submitted.[71] Furthermore, the actual number of technologies that these filings represented was lower than the figures suggest. Many of the patent applications were reported multiple times across different years, for example when an application claiming a particular invention converted from a provisional to an international filing made under the Patent Cooperation Treaty, and subsequently progressed to national phase applications in specific countries.[72]

Between 2012 and 2021, nine centers lodged at least one intellectual property application.[73] However, one center accounted for the majority of the filings: IRRI made thirty-eight of the fifty-nine applications (64 percent) lodged during this period. The center with the second-highest number was the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), with six submissions. All other centers submitted a smaller number of applications throughout these ten years, indicating the relative infrequency with which formal intellectual property protection was sought across the CGIAR network. It is also notable that of the fifty-two patent applications that CGIAR institutions submitted between

[69] CGIAR Consortium Legal Counsel, "CGIAR Intellectual Assets (IA) Report for 2012," August 2013, 3–4, https://hdl.handle.net/10947/2887.

[70] Ibid., 8–9.

[71] These data were compiled from the annual intellectual assets reports for 2012–19, available at CGIAR, "Intellectual Assets Reports," www.cgiar.org/food-security-impact/intellectual-assets-reports.

[72] For example, the 2013 intellectual assets report disclosed that IRRI had lodged six provisional patent applications in the United States. The following year, five of these provisional applications were converted into international filings made through the Patent Cooperation Treaty (PCT), while one became the subject of a US utility patent application. Subsequently, in 2015, one of these PCT filings advanced to national phase applications in seven countries (Brazil, China, India, the Philippines, Thailand, the United States, and Vietnam). Therefore, although cumulatively this activity appears as nineteen patent filings, a single invention accounted for nine of the applications lodged.

[73] The centers that made intellectual property filings during this period were IRRI, CIMMYT, the International Center for Agricultural Research in the Dry Areas (ICARDA), the International Institute of Tropical Agriculture (IITA), ICRISAT, ILRI, the International Potato Center (CIP), CIAT, and Bioversity International.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013


US010999986B2

(12) **United States Patent**
Jena et al.

(10) **Patent No.: US 10,999,986 B2**
(45) **Date of Patent: May 11, 2021**

(54) **INCREASING HYBRID SEED PRODUCTION THROUGH HIGHER OUTCROSSING RATE IN CYTOPLASMIC MALE STERILE RICE AND RELATED MATERIALS AND METHODS**

(71) Applicant: **International Rice Research Institute**, Los Baños (PH)

(72) Inventors: **Kshirod K. Jena**, Cuttack (IN); **Balram Marathi**, Hyderabad (IN); **Joie Ramos**, Los Baños (PH); **Reynaldo Diocton, IV**, Samar (PH); **Ricky Vinarao**, Los Baños (PH); **G. D. Prahalada**, Sira (IN); **Sung-Ryul Kim**, Ulsan (KR)

(73) Assignee: **International Rice Research Institute**, Los Baños (PH)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 12 days.

(21) Appl. No.: **15/579,247**

(22) PCT Filed: **Jun. 5, 2016**

(86) PCT No.: **PCT/IB2016/053294**
§ 371 (c)(1),
(2) Date: **Dec. 4, 2017**

(87) PCT Pub. No.: **WO2016/193953**
PCT Pub. Date: **Dec. 8, 2016**

(65) **Prior Publication Data**

US 2018/0160638 A1 Jun. 14, 2018

Related U.S. Application Data

(60) Provisional application No. 62/171,524, filed on Jun. 5, 2015.

(51) **Int. Cl.**

A01H 1/04	(2006.01)
C12Q 1/6895	(2018.01)
A01H 5/10	(2018.01)
A01H 1/02	(2006.01)
A01H 4/00	(2006.01)
C12N 15/82	(2006.01)

(52) **U.S. Cl.**
CPC ***A01H 1/04*** (2013.01); ***A01H 1/02*** (2013.01); ***A01H 4/008*** (2013.01); ***A01H 5/10*** (2013.01); ***C12Q 1/6895*** (2013.01); *C12N 15/8289* (2013.01); *C12Q 2600/13* (2013.01); *C12Q 2600/156* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,764,643 A	8/1988	Calub
2012/0240285 A1	9/2012	Jinushi et al.

FOREIGN PATENT DOCUMENTS

CN	102333439	1/2012
WO	WO 2016/193953	12/2016
WO	WO 2018/224861	12/2018

OTHER PUBLICATIONS

Miles et al (2008, "Quantitative Trait Locus (QTL) Analysis" , Nature Education 1(1):208).*
Taillebois et al (1986, "Improving Outcrossing Rate in Rice (*Oryza sativa* L.)", Proceedings of the International Symposium on Hybrid Rice, pp. 175-180).*
Miles et al (2008, "Quantitative Trait Locus (QTL) Analysis" , Nature Education 1(1):208; p. 4, 2nd paragraph).*
(Taillebois et al 1986, Proceedings of the International Symposium on Hybrid Rice, pp. 175-180).*
Communication Pursuant to Article 94(3) EPC dated Jan. 18, 2019 From the European Patent Office Re. Application No. 16729639.1. (4 Pages).
Examination Report dated Feb. 5, 2018 From the Ministry of Science and Technology of the Socialist Republic of Vietnam Re. Application No. 1-2018-00038 and Its Summary in English. (2 pages).
International Preliminary Report on Patentability dated Dec. 14, 2017 From the International Bureau of WIPO Re. Application No. PCT/IB2016/053294. (7 Pages).
International Search Report and the Written Opinion dated Dec. 1, 2017 From the International Searching Authority Re. Application No. PCT/IB2017/053363. (16 Pages).
International Search Report and the Written Opinion dated Aug. 8, 2016 From the International Searching Authority Re. Application No. PCT/IB2016/053294.
Angeles-Shim et al. "Molecular Analysis of *Oryza latifolia* Desv. (CCDD Genome)-Derived Introgression Lines and Identification of Value-Added Traits for Rice (*O. sativa* L.) Improvement", The Journal of Heredity, 105(5): 676-689, Advance Access Published Jun. 17, 2014.
Causse et al. "Prospective Use of *Oryza longistaminata* for Rice Breeding", Rice Genetics II—Proceedings of the Second International Rice Genetics Symposium, IRRI, Manila, Philippines,May 14-18, 1990, XP002760153, p. 81-89, May 14, 1990. p. 87, Para.2.
Dayun et al. "Preliminary Report on Transfer Traits of Vegetative Propagation From Wild Rice species to *Oryza sativa* Via Distant Hybridization and Embryo Rescue", The Kasetsart Journal Natural Sciences, 34(1): 1-11, Jan.-Mar. 2000.
Endo et al. "Molecular Breeding of A Novel Herbicide-Tolerant Rice by Gene Targeting", The Plant Journal, 52(1): 157-166, Oct. 2007.

(Continued)

Primary Examiner — Stuart F Baum

(57) **ABSTRACT**

Methods for increasing hybrid seed production are provided. Increased hybrid seed production is achieved through higher outcrossing rates in cytoplasmic male sterile (CMS) lines of rice by introgressing the long stigma trait of *Oryza longistaminata*. CMS lines having higher outcrossing rates capable of high hybrid seed set are also provided.

8 Claims, 17 Drawing Sheets
(15 of 17 Drawing Sheet(s) Filed in Color)

Specification includes a Sequence Listing.

Figure 12.2 In 2021, the US government granted a patent to IRRI for a method of increasing the production of hybrid rice seed. US Patent no. 10,999,986 B2, granted May 11, 2021 to the International Rice Research Institute, Los Baños, Philippines.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013



Figure 12.3 A worker cares for a sample of *Oryza longistaminata* at IRRI in 2009. This type of rice was used in the hybrid seed production method outlined in US Patent no. 10,999,986 B2, granted to IRRI in 2021. Photo by Ariel Javellana/IRRI and reprinted by permission of IRRI.

2012 and 2021, by 2022 only three had been approved. One patent, granted in the United States to IRRI, covers methods for increasing seed production in hybrid rice lines, as well as rice plants obtained by employing the claimed methods (Figures 12.2 and 12.3).[74] The other two patents were granted in the United States and Europe for the same ICRISAT invention, a DNA construct comprising a pigeon-pea gene, as well as plants whose genome contains the claimed DNA construct.[75]

[74] IRRI, "Increasing hybrid seed production through higher outcrossing rate in cytoplasmic male sterile rice and related materials and methods," US patent 10,999,986, filed June 5, 2016 and issued May 11, 2021. Patents were also filed for this invention in Australia, China, Brazil, and Europe, but the applications have been discontinued, while an application filed in the Philippines was still pending at the time of writing.

[75] ICRISAT, "Cytoplasmic male sterility gene ORF147 of pigeon pea, and uses thereof," US patent 11,060,106, filed December 1, 2017 and issued July 13, 2021; ICRISAT, "Cytoplasmic male sterility gene ORF147 of pigeon pea, and uses thereof," European patent 3,548,505, filed December 1, 2017 and issued January 27, 2021. Patent applications were also lodged in Canada and Australia for this invention. At the time of writing, the Canadian application was still pending, while the Australian application had been discontinued.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

Notwithstanding the relatively small number of formal intellectual property claims that centers have made in the past decade, in recent years CGIAR institutions have worked to deepen engagement with the commercial sector. One manifestation of this effort is the proliferation of limited exclusivity agreements,[76] the vast majority of which have been executed between centers and private firms.[77] Between 2012 and 2021, a total of 302 of these kinds of contract were signed, amounting to more than five times the number of intellectual property filings made by centers during the same period.[78]

When the Intellectual Assets Principles were enacted, agreements granting limited exclusivity in the use of CGIAR technologies were, like intellectual property claims, seldom pursued. This began to change in 2017. Between 2017 and 2021 alone, 273 limited exclusivity agreements were signed (90 percent of the total). Although most of these contracts were between CIMMYT and seed company partners, the rise of agreements allowing third parties to exclusively use CGIAR technologies indicates the extent to which certain centers have begun to collaborate with commercial entities. In this way, adaptationist policies have accommodated an approach that intellectual property maximalists advocated in the mid 1990s.

By the end of the second decade of the new millennium, all CGIAR centers had enacted their own institutional policies to implement the Intellectual Assets Principles, and all had allocated part of their budgets to salaries for in-house or external intellectual property personnel, while also regularly training staff in intellectual property management. Nevertheless, despite decades of efforts to centralize and harmonize, each center continued to operate with substantial independence. In the future, it is possible that center autonomy in intellectual property management will be curtailed under the One CGIAR strategy, which was

[76] Limited exclusivity agreements are contracts through which CGIAR or the centers grant third parties exclusive rights to commercialize CGIAR "intellectual assets." These exclusive rights must be necessary for the further improvement of the intellectual assets or to enhance the scale or scope of impact on target beneficiaries, and as limited as possible in duration, territory, and/or field of use. Limited exclusivity agreements provide that CGIAR intellectual assets must remain available for noncommercial research by public-sector organizations and in the event of food security emergencies. CGIAR System Management Office, "CGIAR Principles on the Management of Intellectual Assets," principle 6.2.

[77] For example, in 2017 CIMMYT granted twenty-three licenses through limited-exclusivity agreements to partner institutions, 17 percent of which were public-sector institutions and parastatals, and 73 percent of which were private seed companies. CGIAR System Organization, *CGIAR Intellectual Assets Management Report 2017* (Montpellier, France: CGIAR System Organization, 2018), https://hdl.handle.net/10568/102281.

[78] These data were compiled from the annual intellectual assets reports for 2012–21.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

launched in 2019 and aims to achieve unified governance and institutional integration across all centers.[79]

Consistent with the One CGIAR approach, a 2022 special report recommended centralization in intellectual property management, stating that CGIAR should become a "one-stop-shop" for engagement with private-sector enterprises.[80] Recognizing that the absence of transversal mechanisms to deal with intellectual property rights has posed a barrier to engagement with businesses, especially multinational firms, the report recommended that CGIAR should develop system-wide approaches to intellectual property ownership that would enhance partnership with the private sector.[81]

Notwithstanding the ongoing drive towards centralization, there are good reasons for CGIAR centers to retain some flexibility in defining their approaches to intellectual property management. The centers vary significantly in size and scope, and in the extent to which their work is compatible with technoscientific and capitalistic agricultural practices. For instance, it is logical that centers such as IRRI and CIMMYT would be the most prolific users of patents, plant variety protection, and limited exclusivity agreements, given that their research priorities focus on rice, and wheat and corn, respectively. These crops are the three most widely grown in the world, and they also form the core of intellectual property portfolios owned by the largest multinational agricultural corporations. Conversely, pursuing intellectual property claims may be less relevant for centers such as World Agroforestry or WorldFish, given these institutions' emphases on ecological approaches to agriculture and aquaculture. Such methods may be less compatible with privatization and industrialization, making them unlikely targets for corporate investment.

Reflecting the impact of broader scientific, economic, and legal shifts that have occurred over the past three decades, CGIAR policies and practices now formally regard all inventions made by the centers as potentially protectable "intellectual assets." While many CGIAR technologies may still be distributed directly to farmers in the Global South, it is increasingly possible that at least some centers will seek to develop and commercialize their inventions in partnership with agribusinesses.

Given the diversity of the centers' research agendas, geographical locations, budgetary circumstances, and local administrative cultures, the adaptationist approach of the Intellectual Assets Principles appears to operate as a fair compromise. The principles established that CGIAR institutions should generally avoid intellectual property claims, allowing

[79] See discussion of One CGIAR in note 2 above.
[80] Cummings et al., "Open for Business," 10. [81] Ibid., 36.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013

rejectionist centers to continue to focus on nonproprietary forms of technology dissemination. Simultaneously, the policy held that, where appropriate, intellectual property ownership may "lead to the broadest possible impact on target beneficiaries in furtherance of [the] CGIAR Vision,"[82] providing a justification for maximalist centers to embrace entrepreneurial practices. Nevertheless, examining the history of intellectual property debates within CGIAR from 1990 to 2020 reveals that the rejectionist viewpoint was formally marginalized during this period. While some CGIAR administrators and scientists may continue to eschew intellectual property, they must do so in the context of an institutional culture that since 1990 has increasingly internalized a global capitalist approach to agricultural science.

[82] CGIAR System Management Office, "CGIAR Principles on the Management of Intellectual Assets," principle 6.

Downloaded from https://www.cambridge.org/core. UNIVERSIDAD AUTONOMA METROPOLITANA, on 17 Nov 2026 at 03:40:15, subject to the Cambridge Core terms of use, available at https://www.cambridge.org/core/terms. https://doi.org/10.1017/9781009434713.013