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INTRODUCTION

The market for biotechnology products has expanded rapidly in the 1990s and is expected to result in radical changes in agriculture around the world.[1] Investment in research and development of new seed varieties has become a key factor for agricultural development.[2] In the past few decades, the investment in research and development has largely shifted

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1. The market for transgenic crops will continue to grow:

> The [International Service for the Acquisition of Agri-Biotech Applications] ISAAA projects that the global market value of transgenic crops will increase from between $4.5 billion and $4.7 billion in 2003, to $5 billion or more in 2005. In 2002, the global market was estimated at $4 billion, representing 15 percent of the $31 billion global crop protection market and 13 percent of the $30 billion global commercial seed market. The ISAAA says the estimated market value is based on the sale price of transgenic seed plus any technology fees that apply.

Doris de Guzman, *Surge in US Biotech Crops Continues*, CHEM. MARKET REP., Apr. 12, 2004, at 13.

2. The high cost of research and development is a limiting factor in emergence of biotechnology products:

> Biotechnology is an expensive market to break into. Sources estimate that biotechnology research and development (R&D) costs more than $200 million for just one product. . . . [G]etting a biotech drug to market is a difficult and expensive process. After years of laboratory research, hurdles consisting of clinical trials and governmental approval must be crossed before a drug can even make it to market.

Jay P. Kesan, *Intellectual Property Protection and Agricultural Biotechnology: A Multidisciplinary Perspective*, 44 AM. BEHAV. SCIENTIST 464, 465-66 (2000) (citation omitted).

from state-sponsored research to private funding.[3] At the same time, the market became dominated by a few multinational firms that now control most biotechnological research and development around the world.[4] In this new environment of largely private control of an international market, the protection of intellectual property rights and its role in shaping the biotech market have drawn academic attention and been

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3. *See* Philip G. Pardey, Bonwoo Koo & Carol Nottenburg, *Creating, Protecting, and Using Crop Biotechnologies Worldwide in an Era of Intellectual Property*, 6 MINN. J. L. SCI. & TECH. 213, 217 (2004). This shift seems to be the result of robust growth of private research and development (R&D) funding while public funding has remained relatively constant:

> The dramatic increase in private sector plant breeding R&D expenditures came while public expenditure in that area changed very little in real terms. On the whole, private spending on plant breeding has steadily increased since 1960 as the seed industry increased in size and extent of commercialization. Private sector R&D expenditure has shifted over this period, in percentage terms, from farm machinery and food and kindred products to agricultural chemicals and plant breeding research.

JORGE FERNANDEZ-CORNEJO, U.S. DEP'T OF AGRIC., THE SEED INDUSTRY IN U.S. AGRICULTURE: AN EXPLORATION OF DATA AND INFORMATION ON CROP SEED MARKETS, REGULATION, INDUSTRY STRUCTURE, AND RESEARCH AND DEVELOPMENT 42 (2004) (citation omitted).

> Private agricultural research is displacing public research generally and specifically regarding the development of new varieties of crops that have high commercial value. This tendency is especially pronounced in countries like the United States where private agricultural research and development was ninety percent of public spending in 1960, growing to 133 percent by 1996, the latest year for which comparable public-private data are available. Private investments, fueled by agricultural biotechnology research, gravitate to techniques which promise large markets, are protected by intellectual property rights, and are easily transferable across agroecologies.

Pardey, Koo & Nottenburg, *supra*, at 217-18 (footnotes omitted).

4. "The 1990s have witnessed considerable acceleration in the process of consolidation of the seed industry with the emergence of giant life-science companies. Companies such as Novartis, Monsanto, Du Pont, Astra-Zeneca, Dow Agrosciences, and Aventis are major players not only in seeds, but also in agro-chemicals, pharmaceuticals, diagnostics and vaccines." C.S. Srinivasan, *Concentration in Ownership of Plant Variety Rights: Some Implications for Developing Countries*, 28 FOOD POL'Y 519, 522 (2003). "According to RAFI, the top five Gene Giants (AstaZeneca [sic], DuPont, Monsanto, Novartis and Aventis) account for nearly two-thirds of the global pesticide market (60%), almost one-quarter (23%) of the commercial seed market, and virtually 100% of the transgenic (genetically modified) seed market." Press Release, Rural Advancement Found. Int'l, World Seed Conference: Shrinking Club of Industry Giants Gather for Wake or Pep Rally? (Sept. 3, 1999), http://www.etcgroup.org/documents/news_worldseed.pdf.

the focus of many articles and studies.[5] Governments, international organizations, the private sector (firms and farmers), scholars, and scientists are discussing the implications of these changes in the market for seeds and how property rights should be defined and enforced to promote social welfare.[6] Private companies have tried to enforce intellectual property rights over new varieties of seeds in international markets to protect their investments. However, different countries offer different legal protection, and in many cases developing countries have insisted on minimal property rights to favor their farmers and obtain new technologies at the lowest possible cost.[7]

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5. *See, e.g.*, Julian M. Alston & Raymond J. Venner, *The Effects of the US Plant Variety Protection Act on Wheat Genetic Improvement*, 31 RES. POL'Y 527 (2002); M.C.F. Diez, *The Impact of Plant Varieties Rights on Research: The Case of Spain*, 27 FOOD POL'Y 171 (2002); George B. Frisvold, John Sullivan & Anton Raneses, *Genetic Improvements in Major US Crops: The Size and Distribution of Benefits*, 28 AGRIC. ECON.: J. INT'L ASS'N AGRIC. ECONOMISTS 109 (2003); Peter D. Goldsmith, *Innovation, Supply Chain Control, and the Welfare of Farmers*, 44 AM. BEHAV. SCIENTIST 1302 (2001); Gregory D. Graff, Gordon C. Rausser & Arthur A. Small, *Agricultural Biotechnology's Complementary Intellectual Assets*, 85 REV. ECON. & STAT. 349 (2003); Mark D. Janis & Jay P. Kesan, *U.S. Plant Variety Protection: Sound and Fury . . .?*, 39 HOUS. L. REV. 727 (2002) [hereinafter Janis & Kesan, *Sound and Fury*]; Kesan, *supra* note 2; William Lesser, *Intellectual Property Rights and Concentration in Agricultural Biotechnology*, 1 AGBIOFORUM 56 (1998); GianCarlo Moschini & Harvey Lapan, *Intellectual Property Rights and the Welfare Effects of Agricultural R&D*, 79 AM. J. AGRIC. ECON. 1229 (1997); D.D. Rohrbach, I.J. Minde & J. Howard, *Looking Beyond National Boundaries: Regional Harmonization of Seed Policies, Laws and Regulations*, 28 FOOD POL'Y 317 (2003); Timothy Swanson & Timo Göschl, *Property Rights Issues Involving Plant Genetic Resources: Implications of Ownership for Economic Efficiency*, 32 ECOLOGICAL ECON. 75 (2000); GianCarlo Moschini, *Economic Benefits and Costs of Biotechnology Innovations in Agriculture* (Ctr. for Agric. and Rural Dev., Iowa State Univ., Working Paper No. 01-WP 264, 2001), *available at* http://www.econ.iastate.edu/research/webpapers/paper_1924.pdf; Peter Goldsmith, Gabriel Ramos & Carlos Steiger, Intellectual Property Protection and the International Marketing of Agricultural Biotechnology: Firm and Host Country Impacts (2002), http://www.farmfoundation.org/projects/documents/case2_ipr22.pdf; Mark D. Janis & Jay P. Kesan, Weed-Free I.P.: The Supreme Court, Intellectual Property Interfaces, and the Problem of Plants (Nov. 2001), http://papers.ssrn.com/abstract=290634 [hereinafter Janis & Kesan, Weed-Free I.P.].

6. *See, e.g.*, FERNANDEZ-CORNEJO, *supra* note 3; *see also* Pardey, Koo & Nottenburg, *supra* note 3 (describing the role of intellectual property rights in the international context).

7. This seems to reflect a dichotomy between the Northern and Southern Hemispheres:

The argument made by Northern countries is that while prices may

One of the most important issues regarding biotechnology is the legal environment in which seeds are to be produced and traded. A homogeneous legal framework characterizes domestic markets, while different legal regimes can distort or change marketing and production incentives in international markets. This Article analyzes the legal differences between the United States and Argentina, two of the most important exporters of grains in the world. As we show, the evolution of laws and regulations in both countries helps us understand the challenges of generating uniform protection in international markets as well as the incentives for private sector companies under different legal systems. We will highlight the differences in property rights protection as well as the incentives for producers and traders.

ARGENTINA AND THE UNITED STATES IN WORLD MARKETS

Argentina and the United States are important actors in international agricultural markets. In Argentina, the market liberalization during the 1990s gave new impetus to agricultural production, and soybean was one of the crops that benefited the most.[8] An intensified interest in new seed varieties and the introduction of genetically modified seeds in 1996 accompanied the impressive growth in grain exports.[9]

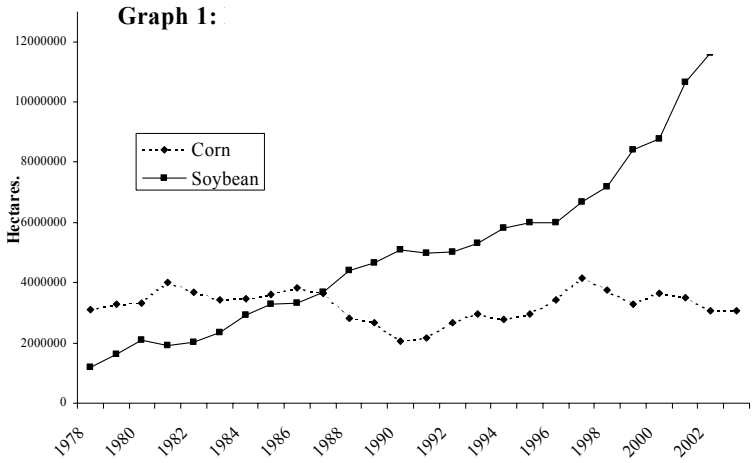
> rise in the short run, new technologies will be available over the long term and will, in turn, raise economic productivity. As the result of protected property rights, the South will gain from new investment. . . . For the net technology using countries (South) the significant short term costs may arise directly from an increase in the cost of the input due to the lack of complete substitutes and indirectly from the administrative and enforcement costs of a Northern style [intellectual property rights] IPR protection system. Adding to the complexity is the fact that welfare impacts are best understood in a dynamic context, as the short-term losses of strengthening the South's IPR regime are believed to be trumped by the long-term gain from economic growth.

Goldsmith, Ramos & Steiger, *supra* note 5, at 4 (citations omitted).

8. *See* RANDALL D. SCHNEPF, ERIK N. DOHLMAN & CHRISTINE BOLLING, U.S. DEP'T OF AGRIC., AGRICULTURE IN BRAZIL AND ARGENTINA: DEVELOPMENTS AND PROSPECTS FOR MAJOR FIELD CROPS 22 (2001).

9. *See id.* at 23.

GRAPH 1. CORN AND SOYBEAN PLANTED IN ARGENTINA[10]



Since the 1978-79 season, the area planted with soybean in Argentina has steadily grown (Graph 1).[11] The total growth from 1978 to 2003 reached 669%, while total production went from 2.5 million metric tons to 35 million in 2003. During the same period the area planted with corn declined 6.5%, but production increased 72.9% due to improvements in yield. The boom in soybean production has propelled Argentina into the spotlight in international markets. Total production of corn represented just 2.6% of total world production for the period 1999-2000 to 2001-02. Nonetheless, total exports of coarse grains were 11.6% of total world exports (Table 2).

Argentina and the United States are among the largest exporters of grain and oilseeds (Tables 1 and 2). In the case of soybeans, the United States and Argentina represent 58.2% of total world exports, while Argentina is the main exporter of soybean oil and meal. The United States and Argentina are the leading exporters of coarse grains (Table 2). The United States also leads the world in wheat exports, and Argentina ranks fifth (Table 2). As a result, both countries play an important role in international agriculture markets. The strength of both countries in international markets is also

10. For graph data, see Secretaria de Agricultura, Ganaderia Pesca y Alimentos (SAGPyA), Estimaciones Agricolas, http://www.sagpya.mecon.gov.ar/new/0-0/agricultura/otros/estimaciones/basestima.php (last visited Mar. 18, 2006).

11. *See id*.

reflected in the market for new seeds (Table 3). In this case, the United States is first in the consumption of new varieties while Argentina is eighth. Finally, Argentina, following the United States, was one of the earliest adopters of genetically modified crops, especially soybean and corn.[12] Since 1996, the Argentine government has approved the use of genetically modified seeds, and farmers have been adopting Roundup Ready soybean and Bt corn intensively.[13] In the case of soybean, the area sown with genetically modified seeds rose from 6% in 1996 to 99.5% in 2002-03, while genetically modified corn increased from 0.25% to 40% during the same period; cotton went from 2.7% to 20%.[14] Despite the impressive increase in new technological advances, there are important gaps in the amount of investment in research and development of new varieties, which are, in part, due to the investment gap between developed and developing countries.[15] Part of this gap also corresponds to the incentives offered by different regulatory regimes in each country.[16]

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12. "In 2002 four countries accounted for 99% of total area sown with genetically modified crops: United States with 39.0 million hectares (66% of total), Argentina with 13.5 million hectares (23%), Canada with 3.5 million hectares (6% of total) and China with 2.1 million hectares (4% of total)." CARMEN VICIEN, TENEDENCIAS EN EL DESARROLLO E INTRODUCCION DE MATERIALES GENETICAMENTE MODIFICADOS EN EL SECTOR AGRICOLA ARGENTINO. ESTUDIO SOBRE EL SECTOR AGROALIMENTARIO. COMPONENTE B: REDES AGROALIMENTARIAS. TRAMAS. OFICINA DE LA CEPAL-ONU – MINISTERIO DE ECONOMIA DE LA NACION 5 (2003) (on file with authors).

13. *See* U.S. GEN. ACCOUNTING OFFICE, BIOTECHNOLOGY: INFORMATION ON PRICES OF GENETICALLY MODIFIED SEEDS IN THE UNITED STATES AND ARGENTINA 7 (2000).

14. *See* OSCAR AGUSTIN DOMINGO, INTELLECTUAL PROPERTY MANAGEMENT IN THE DEVELOPMENT OF A MEDIUM-SIZED ARGENTINIAN SEED COMPANY 8 (2003), http://www.upov.int/en/documents/Symposium2003/wipo_upov_sym_13.pdf.

15. This gap is significant and may be growing:

> In 1995 developed countries spent $5.43 on public and private agricultural research and development for every one hundred dollars of agricultural output, compared with just sixty-six cents per one hundred dollars of output for developing countries. The eightfold difference in total research intensities illustrates the size of the technological gap in agriculture between rich and poor countries. Moreover, the situation is growing worse. The difference in public research intensity ratios was 3.5-fold in the 1970s, compared with 4.3-fold now. An even wider gap would have opened up if private spending was also factored in.

Pardey, Koo & Nottenburg, *supra* note 3, at 218 (footnotes omitted).

16. *See* Jay P. Kesan & Andres A. Gallo, Insecure Property Rights and

Given the important role the United States and Argentina play in international grain markets, an analysis of the differences in property rights legislation is meaningful to understand market behavior and the incentives producers face in each country.

TABLE 1. INTERNATIONAL EXPORTS IN SOYBEAN[17]

Table 1: International Trade: Soybean Exports
(Percentage of Total World Exports)

	Soybean	Soybean Meal	Soybean Oil
Brazil	33.4	32.0	28.5
Argentina	13.7	42.8	50.3
Paraguay	4.4	1.8	1.9
Bolivia	0.5	2.2	2.6
United States	44.5	12.4	5.8
Canada	1.6	0.2	0.2
Asia	0.7	6.7	1.7
China	0.6	1.5	0.4
Rest of World	0.3	1.9	8.8

Plant Varieties: The Effect on the Market for Seeds in Argentina 14-20 (July 25, 2005) (unpublished manuscript), *available at* http://agecon.lib.umn.edu/cgi-bin/pdf_view.pl?paperid=16347&ftype=.pdf (showing how differences in property rights protection between Argentina and the United States has produced a lower amount of investment in Argentina's seed market).

17. For table data, see U.S. Dep't of Agric., Market and Trade Data, http://www.fas.usda.gov/archive/asp (last visited Mar. 18, 2006).

TABLE 2. INTERNATIONAL EXPORTS IN COARSE GRAINS AND WHEAT[18]

Table 2: International Trade: Coarse Grains and Wheat

(Percentage of Total World Exports)

Coarse Grains		Wheat	
Argentina	11.6	Argentina	8.9
Australia	4.8	Australia	13.4
Canada	2.6	Canada	13.0
China	9.4	India	3.5
Brazil	3.6	Kazakhstan	3.9
Russia	2.2	Russia	6.4
South Africa	1.2	Syria	0.7
		Turkey	1.0
Ukraine	4.3	Ukraine	3.8
EU-25	5.9	EU-25	13.4
Others	4.5	Other Europe	1.1
		Others	5.7
United States	49.8	United States	25.1

Note: Coarse Grains include Corn, Barley, Sorghum, Rye and Oats

18. For table data, see U.S. Dep't of Agric., FASonline, http://www.fas.usda.gov/oilseeds/circular/2006/06-02/toc.htm (last visited Mar. 18, 2006).

TABLE 3. INTERNATIONAL SEED MARKETS[19]

Table 3: Estimated Values of Commercial Markets for Seed		
Country	Internal Commercial Market (Million of Dollars)	
United States	5700	23.2%
China	3000	12.2%
Japan	2500	10.2%
Commonwealth of Independent States	2000	8.1%
France	1370	5.6%
Brazil	1200	4.9%
Germany	1000	4.1%
Argentina	930	3.8%
India	900	3.7%
Italy	650	2.6%
United Kingdom	570	2.3%
Canada	550	2.2%
Poland	400	1.6%
Mexico	350	1.4%
Spain	300	1.2%
Netherlands	300	1.2%
Australia	280	1.1%
Hungary	200	0.8%
Denmark	200	0.8%
Sweden	200	0.8%
Other	1967	8.0%
Total	**24567**	

PROPERTY RIGHTS PROTECTION AROUND THE WORLD

Property rights protection for seeds in international markets is far from uniform.[20] Each country has devised its own rules and regulations, and producers have to deal with these differences when trading or doing business with other

19. *See* FERNANDEZ-CORNEJO, *supra* note 3, at 8.

20. *See* W. Lesser, *An Economic Approach to Identifying an "Effective Sui Generis System" for Plant Variety Protection Under TRIPs*, 16 AGRIBUSINESS 96, 109-10 (2000) (explaining some different types of property rights protection in the international arena).

countries. One of the most important initiatives for the homogenization of intellectual property rights is the Trade-Related Aspects of Intellectual Property Rights (TRIPS)[21] established by the World Trade Organization (WTO) for all member countries.[22]

Another important organization seeking uniformity for plant variety protection is the International Union for the Protection of New Varieties of Plants (UPOV).[23] This international organization is comprised of a group of countries that designs rules for the protection of property rights.[24] Even though UPOV is representative of the international community, it lacks any enforcement power, and the guidelines and rules approved must be implemented by member governments.[25] In this regard, UPOV resolutions have to be broad enough to be accepted in each member country. If UPOV recommendations are too specific or strict, many countries, especially developing countries that are consumers of the new technologies, might not comply. On the other hand, if the rules are too broad, there is no meaningful protection of property rights for seed producers. For this reason, United States companies have been very uneasy about UPOV, since UPOV rules provide less stringent property rights protection than the domestic regulatory system. On the other hand, countries like

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21. The aim of TRIPS was to establish a uniform standard for intellectual property protection:

> In 1994 the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) was concluded as part of the Uruguay Round of Multilateral Trade Negotiations establishing the World Trade Organization (WTO). Before TRIPS, the only international framework for intellectual property was the Paris Convention of 1883, but unlike TRIPS, the Paris Convention did not impose any uniform standard of intellectual property protection and countries were free to establish their own intellectual property laws.

Amy Nelson, Note, *Is There an International Solution to Intellectual Property Protection for Plants?,* 37 GEO. WASH. INT'L L. REV. 997, 1008 (2005) (footnotes omitted).

22. "TRIPS thus requires WTO Member States to provide some form of intellectual property protection for plant varieties." *Id.*

23. *See* International Union for the Protection of New Varieties of Plants, http://www.upov.org (last visited Feb. 10, 2006).

24. *See* Members of the International Union for the Protection of New Varieties of Plants, http://www.upov.org/en/about/members/pdf/pub423.pdf (last visited Feb. 10, 2006) (listing the member nations and the date at which they became members).

25. *See* Nelson, *supra* note 21, at 1004.

Argentina find UPOV rules to be too strict for local farmers and, as a result, have failed to pass some of these rules into law.[26]

The first general UPOV proposal was agreed upon in 1978 (UPOV 78),[27] and it recommended that the participant countries establish a system of property rights protection for seeds based on the granting of commercialization rights,[28] a legal instrument similar to the Plan Variety Protection Act (PVPA) certificates in the United States.[29] This system was considered a novelty in many developing countries, and the European Union supported it, yet it was considered insufficient for the United States government and most of the private sector engaged in the production of seeds.[30] Because of pressure from the private sector and the Unites States government, UPOV approved a new set of recommendations in

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26. Concerns about local agriculture and farmers have affected implementation of plant variety protection rights in many developing countries:

> The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), which followed from the international trade negotiations of the Uruguay Round, requires all member-countries of the World Trade Organization (WTO) to provide for an "effective" system of plant variety protection within a specified time frame. This has significantly accelerated the spread of PVP systems across countries. Many developing countries are currently in the process of enacting PVP legislation, even as they face an intense debate about the potential economic impacts of PVP on their agriculture and farmers.

C.S. Srinivasan, *supra* note 4, at 520 (footnote and citation omitted).

27. International Convention for the Protection of New Varieties of Plants, Dec. 2, 1961, 33 U.S.T. 2703 (as revised at Geneva on Oct. 23, 1978) *available at* http://www.upov.org/en/publications/conventions/1978/pdf/act1978.pdf .

28. *See id.* at art. 5.

29. *See* 7 U.S.C. § 2351(a) (2000).

30. Plant variety protection rights may be inherently less valuable than other forms of intellectual property:

> Under plant variety protection schemes, farmers may legally save, reuse, and sometimes sell seeds in following seasons so that seed firms are faced with only the residual demand for their seeds in subsequent seasons. This problem, together with the difficulty of monitoring and enforcing property rights to seed, makes its legal protection less valuable than other forms of protection on other products. Private seed markets have responded to the appropriability problem by developing hybrid varieties or pursuing genetic use restriction technologies (GURTs). These methods prevent seeds from effectively reproducing and serve as a form of "biological" rather than legal property protection.

Pardey, Koo & Nottenburg, *supra* note 3, at 225 (footnote omitted).

1991 (UPOV 91).[31] The recommendations included more robust protection, limiting farmers' rights of use[32] and allowing the coexistence of diverse regulatory regimes for seed production.[33] The last issue was particularly important for the United States, where seed producers have a vast array of legal instruments to protect their varieties, such as a PVPA certificate, a plant patent, or even a utility patent. Despite this effort to bring the United States closer to the international regulatory regime, UPOV 91 has faced opposition in several countries. For example, despite some attempts, Congress in Argentina has not approved UPOV 91,[34] and, as a consequence, foreign seed producers cannot resort to the patent system for their varieties.

Thus, a uniform international regulatory regime for seed producers remains an unrealized goal. Seed producers will face different regulatory frameworks in different countries, and the adaptation to those regimes is important for their economic success. Furthermore, incentives for production and commercialization of new varieties in international markets will be affected by differences in property rights protection. Business strategies will differ from country to country, and

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31. International Convention for the Protection of New Varieties of Plants, Dec. 2, 1961, 33 U.S.T. 2703 (as revised at Geneva on Mar. 19, 1991) [hereinafter UPOV91], *available at* http://www.upov.org/en/publications/conventions/1991/pdf/act1991.pdf.

32. *See id.* at art. 14. Under the 1991 Act countries have implemented farmers' rights differently:

> The 1978 UPOV Act allows a universal farmers' privilege – indirectly by not classifying such use as an infringement. The 1991 Act (Article 15.2), however, makes the farmers' exemption optional at the national level. The US has decided to allow a full Farmers' Exemption, while the EU requires that large farms pay a royalty.

Lesser, *supra* note 20, at 111 (citation omitted).

33. *See* UPOV91, *supra* note 31, at art. 4. The 1991 Act obviated the need for member nations to make an either/or choice of intellectual property forms for plant varieties:

> Whereas the 1961 UPOV Convention stipulated that each member state could recognize the right of the breeder by granting either a special title of protection or a patent, the 1991 UPOV Convention stipulates only that each contracting party shall grant and protect breeders' rights, thereby allowing EPC member states to eliminate the exclusionary provisions for plant varieties from their patent acts.

Nelson, *supra* note 21, at 1005-06 (footnote omitted).

34. *See* Members of the International Union for the Protection of New Varieties of Plants, http://www.upov.org/en/about/members/pdf/pub423.pdf (last visited Feb. 10, 2006).

technology transfers to less developed countries could suffer from this heterogeneity.

SEED PROTECTION IN THE UNITED STATES

Intellectual property protection for seeds in the United States is very well enforced. Seed producers can resort to various legal instruments to protect their inventions and enforce their property rights in the marketplace.[35] As a result, the intellectual property regime in the United States is one of the friendliest in the world for biotechnology inventors. The regimes available for seed producers include the Plant Patent Act of 1930 (PPA),[36] PVPA certificates,[37] and the Patent Act of

35. *See* Janis & Kesan, *Sound and Fury*, *supra* note 5, at 730-45 (describing the protection and incentives provided by the various intellectual property regimes in the United States).

36. *See* 35 U.S.C. § 161 (2000). This was the first U.S. law to specifically address plant breeding:

> The first IPR legislation enacted to specifically address issues of plant breeding was the *Plant Patent Act of 1930 (PPA)*. Administered by the U.S. Patent and Trademark Office (PTO), the PPA provides patent protection over asexually or vegetatively reproduced plant varieties. The PPA also includes patent protection for spores, mutants, hybrids, newly found seedlings, or plants found in an uncultivated state, and extends property rights for a period of 17 years.

FERNANDEZ-CORNEJO, *supra* note 3, at 19. "[I]n the Townsend-Purnell Plant Patent Act of 1930, Congress created a plant patent regime limited to varieties that had been asexually reproduced." Janis & Kesan, *Sound and Fury*, *supra* note 5, at 734-35 (footnote omitted). "Enactment of the PPA was driven largely by an increasing concern that plant breeders should be rewarded like other inventors for their investment in developing new plant varieties, and that the absence of patent rights would undermine the incentive to engage in plant breeding." Nelson, *supra* note 21, at 999 (footnote omitted).

37. *See* 7 U.S.C. §§ 2321-2331, 2351-2357, 2371-2372, 2401-2404, 2421-2427, 2441-2443, 2461-2463, 2481-2486, 2501-2504, 2531-2532, 2541-2545, 2561-2570, 2581-2583 (2000). "The Plant Variety Protection Act (PVPA) grants breeders a Certificate of Protection that gives them exclusive rights to market a new plant variety for 18 years from the date of issuance. These exclusive rights are subject to a research exemption and a farmer's exemption." FERNANDEZ-CORNEJO, *supra* note 3, at 19.

> The *1994 amendment to the PVPA*, which went into effect in April 1995, brought the PVPA into conformity with international standards established by the International Union for the Protection of New Varieties of Plants and allowed the United States to ratify the 1991 International Convention for the Protection of New Varieties. Protection provided by Certificates of Protection extended from 18 to 20 years for most crops.

Id. "Plant variety protection is also now a fixture of U.S. law, the U.S. PVPA having been enacted in 1970 after only the briefest of debate." Janis & Kesan, *Sound and Fury*, *supra* note 5, at 742 (footnote omitted).

1952.[38] The extension of property rights protection for seed producers reached a high point when the U.S. Supreme Court reinforced the role of utility patents for plant varieties. By allowing the use of utility patents for plants in the key case of *Diamond v. Chakrabarty*[39] and in the recent case of *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Breed Int'l, Inc.*,[40] the Supreme Court gave seed producers full protection for their new varieties.[41] In

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> [W]hen the Clinton Administration finally submitted the 1991 text of the UPOV treaty to the Senate for ratification, the Administration emphasized the benefits of the PVPA as a reciprocity vehicle. The United States did eventually join the UPOV, perhaps guaranteeing the continued existence of the U.S. PVPA in some form.

Id. at 745 (footnotes omitted).

> The PVPA provides patent-like coverage for plants not covered by the PPA (that is, sexually-reproduced plants and tuber-propagated plants). . . . Under the PVPA, protection extends to selling, importing, exporting, sexually reproducing, or using the variety to produce another variety. The PVPA, however, contains a save seed exemption and a research exemption.

Nelson, *supra* note 21, at 1002 (footnotes omitted).

38. *See* 35 U.S.C. § 101 (2000). This greatly expanded the subject matter eligible for protection:

> The *Patent Act of 1952 (PA)* extends patent rights to agricultural innovations under a much more general category that includes "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvements thereof." Patent protection under the PA covers agricultural machinery, equipment, chemicals, production processes, and similar inventions, and is termed "utility patent protection." More importantly, the PA's broad definition of what may be entitled to patent protection leaves an important opening for covering innovations in biotechnology and genetic engineering.

FERNANDEZ-CORNEJO, *supra* note 3, at 19.

39. 447 U.S. 303 (1980). "In *Chakrabarty*, decided in 1980, the Court ushered in the age of biotechnology patenting, holding in a 5-4 split that genetically-modified bacteria fell within the scope of patent-eligible subject matter." Janis & Kesan, Weed-Free I.P.*, supra* note 5, at 7.

40. 534 U.S. 124 (2001).

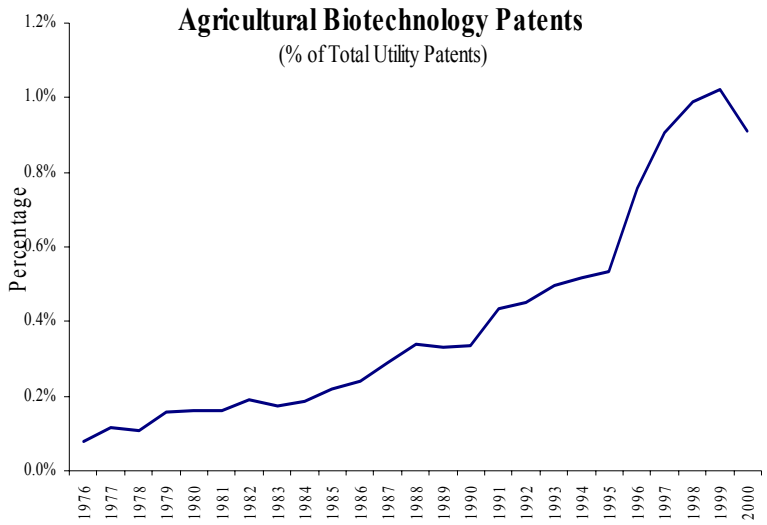
41. *See id.* at 145.

> In a 6-2 decision handed down in December 2001, the US Supreme Court has confirmed that plants are eligible subject matter for protection under the utility patent regime, notwithstanding the existence of limited forms of intellectual property protection for plants under the Plant Patent Act (PPA) and the Plant Variety Protection Act (PVPA). The case, *J.E.M. Ag Supply v. Pioneer Hi-Bred*, endorsed a longstanding practice of the US Patent and Trademark Office (PTO), under which the PTO has issued hundreds of utility patents on plants since 1985.

Mark D. Janis & Jay P. Kesan, *Intellectual Property Protection for Plant Innovation: Unresolved Issues After* J.E.M. v. Pioneer, 20 NATURE

addition, the U.S. government amended the PVPA regime to conform to the new UPOV agreement of 1991.[42] That said, producers consider the PVPA regime, proposed by UPOV to promote regulatory uniformity, to be a weak tool for the protection of property rights when considered alone without a utility patent regime. These legal developments were accompanied by an impressive increase in private sector participation in seed production and a rush to patent new varieties (Tables 4 and 5). We also observed an increase in the number of utility patents devoted to biotechnology patents for plant varieties (Graph 2). Furthermore, these legal changes helped to foster research and development efforts in biotechnology and the creation and adoption of genetically modified seeds. As a result, we have a system in which property rights are well-defined and enforced, and researchers can choose the level of protection they consider sufficient to effectively protect their inventions in the market.

GRAPH 2. AGRICULTURAL BIOTECHNOLOGY PATENTS IN THE UNITED STATES[43]



BIOTECHNOLOGY 1161, 1161 (2002) (footnote omitted).

42 *See* FERNANDEZ-CORNEJO, *supra* note 3, at 20.

43 For graph data, see Econ. Research Serv., U.S. Dep't of Agric., Data: Agricultural Biotechnology Intellectual Property, http://www.ers.usda.gov/Data/AgBiotechIP/Gallery/Graphic1.htm (last visited

TABLE 4. AWARDED AGRICULTURAL BIOTECHNOLOGY PATENTS IN THE UNITED STATES[44]

Table 4: U.S. agricultural biotechnology patent awards by technology classification, 1976-2000 1/

Technology Class	1976-80	1981-85	1986-90	1991-95	1996-2000	Total
Plant Technologies	54	91	244	576	2,011	2,976
Protection, Nutrition, and Biological Control of Plants and Animals	76	154	277	512	865	1,884
Pharmaceuticals	72	89	150	248	718	1,277
Patented organisms, Nonplant	14	76	214	347	795	1,446
Metabolic Pathways and Biological Processes in Animals	39	25	79	166	454	763
Metabolic Pathways and Biological Processes in Plants	156	181	263	255	716	1,571
Metabolic Pathways and Biological Processes, DNA-Scale	0	5	79	199	961	1,244
Genetic Transformation	25	100	364	908	2,732	4,129
Genomics	0	0	10	54	265	329

U.S. agricultural biotechnology patent awards by assignee sector and national origin, 1976-2000

	1976-80	1981-85	1986-90	1991-95	1996-2000	Total
U.S. Firm	167	239	481	893	2,551	4,331
U.S. Nonprofit	49	104	231	526	1,434	2,344
U.S. Government	18	27	54	129	193	421
U.S. Independent	0	2	3	7	15	27
Non-U.S. Firm	107	162	434	660	1,688	3,051
Non-U.S. Nonprofit	5	13	31	103	291	443
Non-U.S. Government	14	24	38	79	214	369
Non-U.S. Independent	1	5	7	14	14	41
Unknown/other	21	26	49	106	233	435

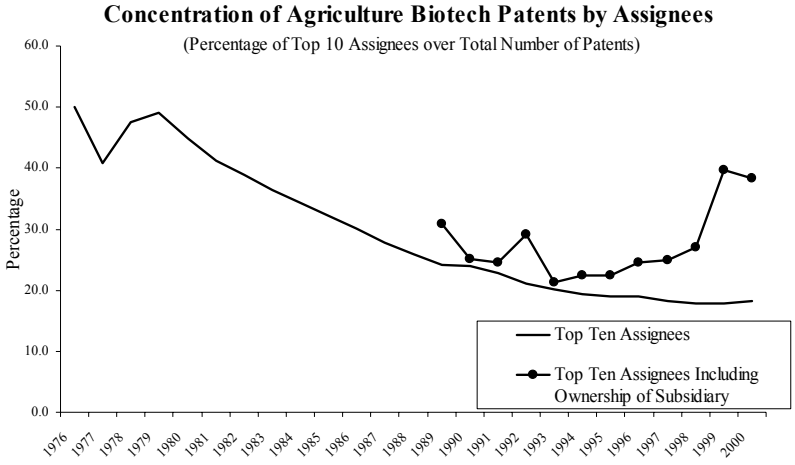
1/ Table entries may not sum to totals because some patents are classified in multiple areas, others in none.

Mar. 18, 2006).

44. For table data, see Econ. Research Serv., U.S. Dep't of Agric., Data: Agricultural Biotechnology Intellectual Property, http://www.ers.usda.gov/Data/AgBiotechIP/Gallery/Graphic2.htm (last visited Mar. 18, 2006).

Despite the success in promoting investment in research and development on new plant varieties and the application of biotechnology in agriculture, the strict protection of property rights has produced some concerns about the recent tendency toward mergers in the industry, which has led to a concentration of patents in fewer companies. Graph 3 shows the ratio of the percentage of patents held by the top ten assignees over the total number of patents. As the graph shows, the concentration of agricultural biotech patents in the top ten assignees has dropped since the 1970s. But if we include the patent ownership of subsidiary organizations, this ratio has increased over the years, indicating the effects of mergers on the ownership of the new technologies (Graph 3). As a result, mergers have increased the number of patents held by the top patent holders in the last decade.

GRAPH 3. CONCENTRATION OF AGRICULTURE BIOTECH PATENTS IN THE UNITED STATES[45]



SEED PROTECTION IN ARGENTINA: EVOLUTION AND DEVOLUTION OF THE LEGAL PROTECTION

The legal framework in Argentina is far from the comprehensive protection provided for seed producers in the

45. For graph data, see Econ. Research Serv., U.S. Dep't of Agric., Data: Agricultural Biotechnology Intellectual Property, http://www.ers.usda.gov/Data/AgBiotechIP/ (last visited Mar. 18, 2006).

United States. Argentinean legislation has evolved over time, providing some timid increases in the protection of seed producers. In 1935, Congress enacted the first law regulating plant varieties.[46] Although this legislation provided for the registration of new seeds and required government approval for new varieties to be introduced in the market, it did not provide any legal protection to intellectual property rights for the new seeds.[47] In the following decades, succeeding governments created diverse agencies in charge of managing the regulatory system.[48] In 1973, the Military Government passed Law No. 20247—the "Law of Seeds."[49] This was the first piece of legislation giving commercialization rights to the inventors of new seed varieties.[50] Although this law was a step forward in protecting intellectual property rights, it was not immediately enacted and had to wait until 1978 for its regimentation.[51] Law No. 20247 provided for the creation of the National Seed Commission (Comision Nacional de Semillas, CONASE), in charge of advising and evaluating government policies regarding the regulatory regime.[52] Second, it created a

46. Law No. 12253, called "Ley de Granos," was passed by Congress in October 1935. *See* Instituto Nacional de la Semilla (INASE), Evolucion del fitomejoramiento y la produccion de semillas en nuestro pais. Estructuras oficiales y su marco regulatorio desde comienzos de siglo (1998) [hereinafter Evolucion], *available at* http://www.dpi.bioetica.org/ovnotas1.htm.

47. *See id.*

48. *See id.*

49. *See* Law No. 20247, Poder Ejecutivo Nacional, Mar. 30, 1973, *available at* www.sagpya.mecon.gov.ar/new/0-0/inase/pdf/Normativa/LEY-20.247.PDF.

50. Article 22 of the law states: "The property right of a variety will be given for a period no less than 10 and no more than 20 years, according to the type of plant and the regulations." *Id.*

51. *See* Decree No. 1995 of 1978, *available at* www.mecon.gov.ar.

52. The law provides:

> The Commission will be formed by ten members designed by the Ministry of Agriculture and Livestock. . . . Five of the members will be State representatives, two from the National Agency of Agriculture Control and Commercialization (Direccion Nacional de Fiscalizacion y Comercializacion), two from the National Institute of Agriculture Technology (Instituto Nacional de Tecnologia Agropecuaria) and one from the National Grain Board (Junta Nacional de Granos). Five other members will represent the private sector, one from the seeders, two from the seed traders and production and two from the seed users. The Ministry of Agriculture and Livestock will name the president and vice-president from the members of the Commission.

national registry and a property registry for new varieties, providing exclusive commercialization rights to the owners for a term between ten and twenty years, depending on the type of seed.[53] This system of varieties registration implied a two-step procedure: the inventor of a new variety should register the variety in the National Variety Registry[54] and then apply for a property certificate to be included in the National Registry of Property of Varieties.[55] Third, the law provided for the recognition of foreign seeds, but it established that the country of origin should provide similar protection for Argentine researchers. Furthermore, the term of the property rights was limited to the number of years left in the original certification of property granted in the country of origin of the variety.[56] Fourth, the Executive Power could declare a new variety to be of "restricted public use," implying that the owner of the variety should be compensated by the state and that the ownership should be transferred to the Ministry of Agriculture.[57] Finally, the law recognized farmers' rights to the use of seeds saved from a previous crop and researchers' rights to use one variety of a seed to develop a new variety.[58] As a result, the first legal

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See Law No. 20247, Poder Ejecutivo Nacional, Mar. 30, 1973, at art. 5, *available at* www.sagpya.mecon.gov.ar/new/0-0/inase/pdf/Normativa/LEY-20.247.PDF.

53. *See id.*

54. Chapter IV of Law No. 20247 provides the regulations for the registration of new varieties in the Registry. *See id.*

55. Chapter V of Law No. 20247 provides the regulations for requesting the property of a new variety and its registration in the National Registry. *See id.*

56. Article 26 states:

> The property title requested for a foreign variety should be done by its inventor or legally authorized representative established in Argentina, and it will be granted only if the country of origin of the variety has similar property right protection for Argentine invented varieties. In such cases, the term of the property will be up to the term that is left in the country of origin for the same variety.

Id. at art. 26.

57. *See id.* at art. 28. Article 29 limited the use of such right to two years, although the Executive Power could extend it for another two years. *See id.* at art. 29.

58. Article 25 states: "The property of a variety does not prevent that other persons could use the variety for the creation of a new variety, which could be claimed by its creator without the consent of the owner of the original variety used in the process of creation." *Id.* at art. 25. Article 27 provides that: "The property right of a variety is not affected if the seed is given by authorization of the owner, or somebody saves and sow seeds for his/her own

registration of new varieties in the country began in 1978, after the law was enacted by the Executive Power Decree No. 1995 of 1978.[59] This Decree was proposed by the CONASE[60] and slightly modified by Decree No. 50/89.[61] Nonetheless, this legislation did not provide enough protection and enforcement of intellectual property rights for new seed varieties, since its regulations are similar to the PVPA certificates in the United States.

A modification to the 1978 Decree was enacted in 1991, introducing important changes to the regulatory regime and updating the legislation according to international standards. The Executive Power issued Decree No. 2183/91 on October 21, 1991.[62] The modification to Law No. 20247 originated not only from the need for modernization of property rights legislation, but also from the political pressure exerted by some associations of seeders and other interest groups inside CONASE, such as the Argentine Seed Association (ASA) and the Association for the Protection of Plant Breeders (ARPOV).[63]

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use, or use or sell as primary product or feeding the seed obtained from the crop of the variety." *Id.* at art. 27.

59. *See* Decree No. 1995 of 1978, *available at* www.mecon.gov.ar.

60. *See* CASEM, Camara Argentina de Semilleros Multiplicadores, 1er Congreso Nacional de Multiplicadores de Semillas, Circular Interna No. 066 (Oct. 15, 1999), http://www.cedasaba.com.ar/CircularesInternas/CircInt066.htm.

61. *See* Decree No. 50/89, Poder Ejecutivo Nacional, June 11 1989.

62. *See* Decree No. 2183/91, Poder Ejecutivo Nacional, November 1, 1991, *available at* http://www.sagpya.mecon.gov.ar/new/0-0/inase/pdf/Normativa/DECR-2183-91.PDF.

63. At a symposium on Intellectual Property Rights in Plant Biotechnology, Oscar Domingo presented the relevant legal framework in Argentina:

> ASA, which has been in operation for 54 years and groups together the 67 main seed companies, and ARPOV, set up more recently, are the bodies which deal with sectoral union activity and work for the technological development and protection of phytogenetic creations. ASA, which is member [sic] of CONABIA, since it was set up 11 years ago, has played a major role in the discussion of the regulations which Argentina now possesses for the commercial release of a transgenic event.
>
> Three years ago, the Association of Agricultural Technology Chambers (ACTA) was set up and groups together the sectors providing technological material for agricultural production, seeds (ASA), agrochemicals and fertilizers (Chamber of Plant Health and Fertilizers – CASAFE), veterinary products (Chamber of Veterinary Producers – CAPROVE) and agricultural machinery (Association of

There were several significant modifications. First, CONASE continued to be an advisory committee to the Secretary of Agriculture[64] and other specific agencies created by this Decree.[65] Second, a new agency, the National Seed Service (Servicio Nacional de Semillas, SENASE) was created to manage and enforce the regulatory regime for new varieties.[66] As a result, all the activities concerned with the management of the system were concentrated in a specific government agency instead of being dispersed among different secretaries inside the Secretary of Agriculture. Accordingly, this change would allow the government to focus on enforcement and the definition of norms for the market of new varieties. Third, the Decree defined the specific steps and requirements for registration of a new variety and the granting of property rights.[67] Fourth, the Decree defined the different types of plants that could be registered, including seeds or germ and phytogenetic breeding varieties.[68] Fifth, the special "restricted public use" right of the Executive Power was preserved.[69] Finally, the use of saved seed was restricted only for research purposes and farmer's privilege.[70] In addition, Decree No. 2817 of December 30, 1991, created the National Seed Institute (Instituto Nacional de Semillas, INASE), which

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> Tractor Manufacturers – AFAT), which has been acquiring major importance in agro-industrial production activities, and is the most important in Argentina.
>
> As a result of the work of those institutions, Argentina acceded to the 1978 Act of the UPOV Convention and discussions regarding accession to the 1991 Act of the UPOV Convention are very advanced.

DOMINGO, *supra* note 14, at 11.

64. In this text, "Secretary of Agriculture" and "Ministry of Agriculture" are the same, since the Ministry of Agriculture was renamed to Secretary of Agriculture in the early 1990s. Its role in the government continues to be the same.

65. Chapter II of the Decree established the role of the CONASE. *See* Decree No. 2183/91, Poder Ejecutivo Nacional, Nov. 1, 1991, *available at* http://www.sagpya.mecon.gov.ar/new/0-0/inase/pdf/Normativa/DECR-2183-91.PDF.

66. Chapter III of Decree No. 2183/91 established the main activities for the Servicio Nacional de Semillas. *See id.*

67. Chapters V to VII of Decree No. 2183/91 describe the procedures for registration of new varieties. *See id.*

68. *See id.*

69. *See id.*

70. Article 41 of Decree No. 2183/91 establishes the different cases in which authorization from the owner of the variety is needed. *See id.*

replaced the SENASE in the management of Law No. 20247.[71] This agency is in charge of the national registry for varieties and property of seeds, the enactment of rules regarding the management of the system, and the enforcement of the regulations of the law.[72] By creating this new agency, the government sought to improve enforcement and control of property rights in new varieties:

> One of the main achievements of the process, initiated in 1990 and completed and consolidated with the creation of INASE, was to make more transparent the commerce of self-pollinating seed species, particularly soybean and wheat, where the legal market for these species reached just 25% of the total demand of seeds. This meant that most of the market for seeds had no guarantee of identity and quality, there was a high degree of tax evasion and there was no recognition of the property rights of the inventors of varieties registered in property giving as a result a disincentive to invest in new varieties.[73]

However, this kind of property rights protection has not been useful in protecting the soybean seed market from "brown-bagging" and stealing.[74]

In contrast to the CONASE, the INASE's only role is the management and enforcement of the different issues concerning commercial rights on seeds, although the same constituencies that formed the CONASE were represented in this agency.[75]

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71. *See* Decree No. 2817/91 Poder Ejecutivo Nacional, Apr. 6, 1992, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/5000-9999/8052/texact.htm.

72. *See id.*

73. Evolucion, *supra* note 46, at 15.

74. Discussing the depression of soybean seed prices by the black market sale of seeds in Argentina, the U.S. General Accounting Office found:

> A group of Argentine seed companies and breeders, called the Argentine Association for the Protection of Plant Varieties, in cooperation with the government, have had an effort under way since 1990 to enforce the law and limit the sale of uncertified seed on the black market. The effort helped reduce black market sales from about three-quarters of all soybean seed sales in 1992 to about half in 1994. However, according to Argentine industry officials, black market sales subsequently increased in response to higher prices for commercial seeds following the initial marketing of Roundup Ready soybean seeds in 1996.

U.S. GEN. ACCOUNTING OFFICE, *supra* note 13, at 15-16.

75. *See* Decree No. 2817/91 Poder Ejecutivo Nacional, Apr. 6, 1992, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/5000-9999/8052/texact.htm.

With respect to the farmer's privilege, the INASE issued Norm 35/96 INASE in February 1996 to define the limits and scope of this privilege, broadly established in Law No. 20247.[76] Under Norm 35/96 INASE tried to limit the application of the farmer's privilege to specific cases in which the farmer actually saves some seed for the next crop, limiting the scope of saved seed established by Article 27 of Law No. 20247, which allowed other uses for saved seed.[77] It established specific rules for saved seeds to be considered under this privilege. For example, the main criteria for being considered under this rule are that first, the solicitor should be a farmer. Then, the farmer should prove that the original seed was legally bought, and the saved seed was obtained from the original, legally bought seed. Next, the saved seed should be specifically set aside and distinguished from other varieties. Finally, the farmer must show the purpose of use, noting the prohibition on any transfer or sale of the saved seeds.[78] The Norm increased the difficulty for farmers to save seed for other purposes, as it tried to control the trade of non-legal varieties.

In 1994, Law No. 24376, enacted on September 21, modified Law No. 20247 and its decrees,[79] bringing the legislation up to the guidelines set by the International Agreement for the Protection of the Vegetal Obtentions (UPOV 78), approved in Paris, France in 1961 and modified in Geneva, Switzerland in 1972 and 1978.[80] Law No. 24376 approved the UPOV 78 agreement and established that the clauses of this agreement should prevail over the regulations of Law No.

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76. *See* Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion INASE No. 35/96 (Feb. 28, 1996), *available at* http://www.inase.gov.ar/tikiwiki/tiki-list_file_gallery.php?galleryId=2&offset=0&sort_mode=description_desc.

77. *See id.* at art. 1; *see* Law No. 20247, Poder Ejecutivo Nacional, Mar. 30, 1973, at art. 27, *available at* www.sagpya.mecon.gov.ar/new/0-0/inase/pdf/Normativa/LEY-20.247.PDF.

78. *See* Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion INASE No. 35/96, at art. 1 (Feb. 28, 1996), *available at* http://www.inase.gov.ar/tikiwiki/tiki-list_file_gallery.php?galleryId=2&offset=0&sort_mode=description_desc.

79. *See* Law No. 24376, Honorable Congreso de la Nacion Argentina, Oct. 25, 1994, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/0-4999/768/norma.htm.

80. *See* International Union for the Protection of New Varieties of Plants, The UPOV System of Plant Variety Protection, http://www.upov.int/en/about/upov_system.htm (last visited Feb. 24, 2006) (describing the UPOV system of plant protection).

20247 and its regulatory decrees.[81] The changes with respect to the previous legislation are not too relevant, except for the political decision to be a part of the UPOV international agreement.[82] That said, the adoption of the UPOV 78 guidelines is a limited gesture since the UPOV 78 guidelines are not as thorough as the more recent UPOV 91 agreement, which has not yet been adopted in Argentina.[83]

Due to the economic crisis in 2000, the Executive Power ordered the Secretary of Agriculture to close the INASE, leaving the regulatory regime for new varieties without any management.[84] The Institute was reopened in 2004[85] by Law No. 25845.[86] The Board of the INASE represents the different economic stakeholders in the regulatory framework of agricultural seeds (Figure 1).[87]

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81. *See* Law No. 24376, Honorable Congreso de la Nacion Argentina, Oct. 25, 1994, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/0-4999/768/norma.htm.

82. *See id.*

83. *See* http://www.sagpya.mecon.gov.ar/ (documenting the evolution of legislation and the adoption of the UPOV 78 treaty); *see also* Proteccion Legal De Obtenciones Vegetales, http://www.proyectonacion.entupc.com/proyectosart/proteccion_legas_obtecion_vegetales.htm (last visited Feb. 24, 2006) (describing a bill presented this year in Congress by Congressmen Eduardo Di Cola proposing the adoption of UPOV 91).

84. *See* FRANCISCO PIROVANO, U.S. DEP'T OF AGRIC., GAIN REPORT AR4022: ARGENTINA PLANTING SEEDS ANNUAL 2004, at 4 (2004) (noting that although the INASE was dissolved in 2000 due to a lack of budget, it was reactivated on January 6, 2004 "to assure quality and proper identification of the seed to be marketed, to promote the supply of improved varieties through the protection of their property rights, to foster production and marketing of planting seeds as a way to improve crop production in Argentina").

85. *See id.*

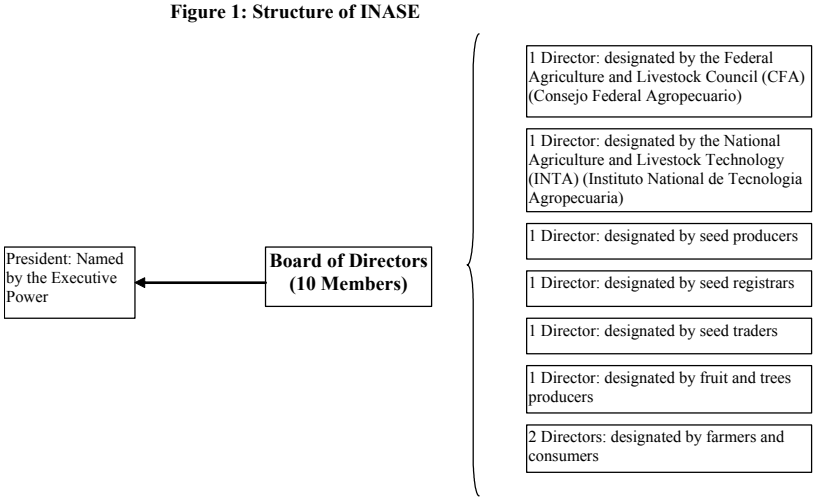
86. The law states:

> Article 1: the Decree 1104/200, which dissolved the Instituto Nacional de Semillas (INASE), is derogated.
>
> Article 2: By the present law we ratify the validity of the Decree 2817/91, restoring the Instituto Nacional de Semillas (INASE) the functions, missions and structures regulated by the Law 20247, the Decree 2183/91 and the Administrative Decision 489/96.

Law No. 25845, Honorable Congreso de la Nacion Argentina, Jan. 7, 2004, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/90000-94999/91549/norma.htm.

87. *See id.* The Consejo Federal Agropecuario was created by Law No. 23843 of 1990 and is a Council comprised of representatives of the rural sector from the different regions of the country. The director of the Secretary of Agriculture, Livestock and Fishing of the Nation presides over this council.

FIGURE 1. STRUCTURE OF INASE[88]



The evolution of the legislation in Argentina has focused on the development and improvement of a Plant Variety Protection type of property rights without any advance in the field of patenting new varieties.

GENETICALLY MODIFIED SEED AND THE QUEST FOR PATENT PROTECTION

The Argentine government was one of the first, together with the United States, to allow the use of genetically modified crops. In 1991, the Secretary of Agriculture created the Advisory National Commission for Rural Biotechnology (CONABIA, Comision Nacional Asesora de Biotecnologia Agropecuaria).[89] This advisory group, composed of representatives from the government and the private sector, helped the government to develop a regulatory framework for

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See Law No. 23843, Honorable Congreso de la Nacion Argentina, October 19, 1990, *available at* http://www.carbap.org/root/MostrarDocumento.asp?id=614&accion=4.

88. For figure data, see Law No. 25845, Honorable Congreso de la Nacion Argentina, Jan. 7, 2004, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/90000-94999/91549/norma.htm.

89. *See* Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion No. 124/91 (Oct. 24, 1991), *available at* http://www.senasa.gov.ar/marcolegal/Res_RY/ry_124_91.htm.

the application and commercialization of biotechnology in agriculture.[90] As a consequence, in 1992 the CONABIA recommended that the Secretary of Agriculture, Livestock and Fishing enact a set of rules and requirements for the approval of experimentation with genetically modified seeds. The Secretary responded with Resolution 656/92 for Genetically Modified Microorganisms.[91] Accordingly, the CONABIA is in charge of reviewing all the applications for the use of genetically modified organisms and recommending the approval or denial of each application to the Secretary of Agriculture, Livestock and Fishing.[92] This resolution was

90. Resolution 328/97 establishes that:

> The Commission is composed of two representatives from INTA (National Institute of Agriculture and Livestock Technology), two from the National University of Buenos Aires (UBA), two from the Argentine Forum of Biotechnology, two from the Asociacion de Semilleros Argentinos (Argentine Seed Producers Association), two from the private livestock sector, two from the Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICET), two from INASE, four from the National Service of Agricultural and food Safety and Quality (SENASA) and some directors of specific government agencies, two professionals on issues of livestock safety and quality, two professionals on issues of plant safety and quality, and other directors from specific government agencies.

Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion No. 328/97 (May 28, 1997), *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/40000-44999/43548/norma.htm. The composition of the CONABIA was modified in part by Resolution 244/04:

> The Commission is composed of two representatives from INTA (National Agriculture and Livestock Technology Institute), two from the National University of Buenos Aires (UBA), two from the Argentine Forum of Biotechnology, two from the Asociacion de Semilleros Argentinos (Argentine Seed Producers Association), two from the private livestock sector, two from the Consejo Nacional de Investigaciones Cientificas y Tecnicas (CONICET) and some directors of specific government agencies.

Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion No. 244/04 (Feb. 18, 2004), *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/90000-94999/93050/norma.htm.

91. *See* OFICINA DE BIOTECNOLOGÍA, SECRETARÍA DE AGRICULTURA, GANADERÍA, PESCA Y ALIMENTOS, MARCO REGULATORIO DE LA BIOTECNOLOGÍA AGROPECUARIA EN LA REPÚBLICA ARGENTINA 234 (2005).

92. *See* Secretaría de Agricultura, Ganadería, Pesca y Alimentos, Bioseguridad Agropecuaria: La Experience de la CONABIA [hereinafter CONABIA Experience], http://www.sagpya.mecon.gov.ar/new/0-0/programas/conabia/bioseguridad_agropecuaria2.php (last visited Feb. 27, 2006).

improved with further regulations for the trials in each crop by Resolution 226/97, also recommended by the CONABIA.[93] The regulation of these permits was enacted by Resolution 289/97, complemented by Resolution 131/98, and replaced by Resolution 39/03.[94] From 1991 to 2004, the Secretary gave 788 permits for experimentation with genetically modified organisms.[95]

The procedure for obtaining a permit consists of two stages. First, the CONABIA evaluates the application and grants or denies a permit for experimentation. The second stage, which allows for extensive use of experimentation, consists of determining whether the use of the genetically modified organism will have an impact on the environment similar to the one produced by a similar non-genetically modified organism.[96] Only eleven applications passed the second stage (Table 5).

TABLE 5. PERMITS GRANTED BY CONABIA[97]

Table 5: Permits Granted

Seed	Characteristic	Resolution – Date	Company
Soybean	Tolerance to Glifosato	SAPyA 115, 3-7-96	Nidera S.A.
Corn	Resistance to Leptidopteros	SAPyA 458, 8-2-96	Ciba-Geigy
Corn	Tolerance Glufosinato de Ammonia	SAGPyA 77 2-11-98	AgrEvo S.A.
Corn	Resistance Lepidopteros	SAGPyA 289 3-29-98	Monsanto
Cotton	Resistance Lepidopteros	SAGPyA 290 5-29-98	Monsanto
Corn	Tolerance to Glifosato	SAGPyA 79 10-8-98	Monsanto
Cotton	Tolerance to Glifosato	SAGPyA 721 11-11-99	Monsanto
Corn	Resistance Lepidopteros	SAGPyA 442 8-16-00	Novartis
Soybean	Tolerance Glufosinato de Ammonia	SAGPyA 47 5-7-01	Hoechst Schering AgrEvo S.A.
Corn	Tolerance to Glifosato	SAGPyA 361 5-2-03	Monsanto
Corn	Resistance Lepidopteros and Tolerance Glufosinato de Ammonia	SAGPyA 209 9-1-03	Dow AgroSciences S.A. and Pioneer Argentina S.A.

93. *See id.*
94. *See id.*
95. *See id.*
96. *See id.*
97. *See id.*

After obtaining this permit, companies need to obtain another authorization to commercialize the genetically modified variety. Ten of the varieties listed in Table 4 obtained this authorization.[98] To obtain this last authorization from the Secretary and CONABIA takes at least three years.[99]

Given the increased interest in genetically modified organisms and the high number of registrations of new varieties that are genetically modified (Table 6), the government decided to create a special agency in charge of advising on biotechnology policy. By Resolution 219/2001, the Secretary created the National Advisory Commission for Agricultural Biotechnology,[100] and by Resolution 362/2003 made the Biotechnology Area independent from the Sub-Secretary of Agricultural and Food Policy.[101] Finally, by Resolution 244/2004, the Secretary eliminated these two agencies and created the Office of Biotechnology (Oficina de Biotecnologia), which is in charge of advising and managing all issues related to the biotechnology policy of the country.[102] Pursuant to this change, the CONABIA depends directly on the Office of Biotechnology. As we can see, the regulatory framework for biotechnological discoveries in agriculture is in constant flux, with different agencies in charge and changes to the structure of the management system. This differs from the more stable and well-defined system in place in the United States.

98. *See* CONABIA Experience, *supra* note 92.

99. *See id.*

100. *See* Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion No. 219/2001 (Sept. 10, 2001), *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/65000-69999/68853/norma.htm.

101. *See* Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion No. 362/2003 (May 2, 2003), *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/80000-84999/84847/norma.htm.

102. *See* Secretaria de Agricultura Ganaderia y Pesca [SAGyP], Resolucion No. 244/2004 (Feb. 18, 2004), *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/90000-94999/93050/norma.htm.

TABLE 6. NEW TRANSGENIC VARIETIES REGISTERED IN ARGENTINA[103]

Table 6: Registration of New Transgenic Varieties 1995-2003

	Soybean				Corn				
Year	Transgenic	Non transgenic	Total	Transgenic as % of Total	Total	Conventional	IMI (Non-GMO)	Transgenic	Transgenic as % of Total
1995	-	8	8	0.0	34	33	1	0	0.0
1996	5	11	16	31.3	33	32	1	0	0.0
1997	12	23	35	34.3	47	46	1	0	0.0
1998	18	18	36	50.0	42	32	2	8	19.0
1999	28	13	41	68.3	58	39	10	9	15.5
2000	19	7	26	73.1	49	31	3	15	30.6
2001	32	3	35	91.4	82	51	1	30	36.6
2002	13	2	15	86.7	55	36	2	17	30.9
2003	9	-	9	100.0	39	24	1	14	35.9

In contrast to the situation in the United States, companies in Argentina cannot look for patent protection for new varieties or genetically modified organisms. Despite the many changes to the law and the demand for new technologies in genetics, the new legal framework does not allow for strict property rights protection via a patent system; new genetically modified varieties must resort to the same weak protection as other varieties.

From 1864 to 1995, the patent system in Argentina was regulated by Law 111.[104] This law did not specify any particular regulation with respect to plants, but during this period there were no patent applications for a new variety. Furthermore, all the matters with regard to plant varieties were derived from the regulations of Law No. 20247[105] and, later, Law No. 24376.[106] In 1995, Congress enacted new patent laws modifying Law No. 111 (Law Nos. 24481 and 24572).[107]

103. *See* DOMINGO, *supra* note 14, at 9.

104. *See* MIGUEL ANGEL RAPELA, DERECHOS DE PROPIEDAD INTELECTUAL EN VEGETALES SUPERIORES (2000).

105. *See* Law No. 20247, Poder Ejecutivo Nacional, Mar. 30, 1973, *available at* www.sagpya.mecon.gov.ar/new/0-0/inase/pdf/Normativa/LEY-20.247.PDF.

106. *See* Law No. 24376, Honorable Congreso de la Nacion Argentina, Oct. 25, 1994, *available at* http://infoleg.mecon.gov.ar/infolegInternet/anexos/0-4999/768/norma.htm.

107. *See* RAPELA, *supra* note 104.

According to the new regulatory framework, the patenting of new plants is expressly prohibited, although it does not specify new plant varieties.[108] Furthermore, patenting of new varieties is not legally possible, as the law of 1994 adhered to UPOV 78, which prohibited a regulatory system of double protection. There is already, moreover, a government agency that grants Plant Variety Protection certificates,[109] and new laws passed in 2000, Laws Nos. 24481 and 24575, allow the patenting of biotechnology products and organisms, including pharmaceutical products.[110] Apparently, these laws could provide a legal vehicle for patenting plant varieties, but the prohibitions of the Patent Law of 1995, the UPOV 78, and the Decree 260/96, which all prohibit the patenting of plant varieties, generate uncertainty over the ability to obtain a patent.[111] Congress has been dealing with some pressure from seed producers to approve a new law with the UPOV 91 guidelines, which support the existence of multiple systems for property rights protection (Figure 2). Nonetheless, even if this legislation is passed, the courts will have to interpret the patent law and decide if the prohibition of patenting plants can be extended to plant varieties. As a consequence, the legal framework is far from creating sweeping changes in the way property rights are regulated and enforced.

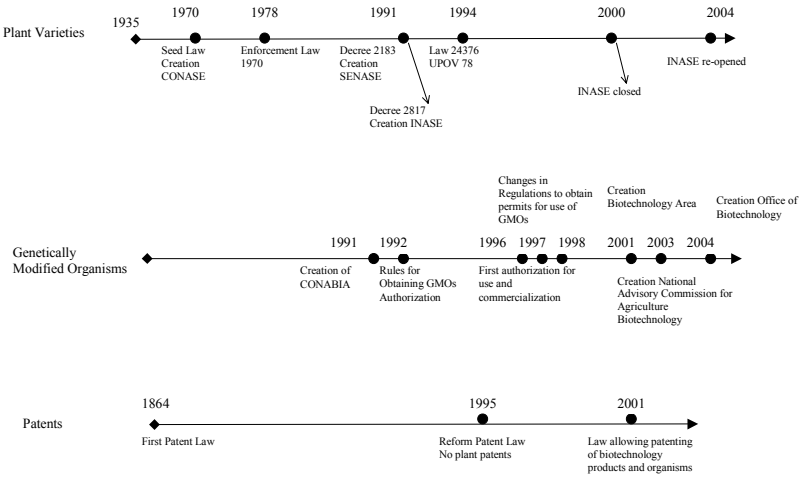
108. "Since the Patent law in Argentina prohibits the patenting of plants, in fact prohibits the patenting of varieties since, even though not all plants can be labeled as plant varieties, all plant varieties are composed by plants without exception." *See id.* at 151. (author translation from the original: "[L]a ley de patentes de Argentina al prohibir taxativamente el patentamiento de plantas esta, de hecho, prohibiendo el patentamiento de variedades ya que, si bien no todas las plantas pueden ser categorizadas como variedades vegetales, todas las variedades vegetales estan compuestas por plantas sin excepcion alguna.").

109. *See id*.

110. *See* VICIEN, *supra* note 12, at 19.

111. *See id.*

FIGURE 2. TIMELINE OF ARGENTINE LEGISLATION[112]



As Figure 2 shows, the legal framework for plant varieties, both genetically and non-genetically modified, is diffuse, complex, and rapidly changing, producing complaints and hesitation from seed producers. This particular system has been widely criticized by international seed producers. For example, Monsanto decided to stop selling soybean seeds in Argentina because its Roundup Ready soybean variety was being widely used by farmers who did not pay royalties or user rights of any kind.[113] As a consequence, they decided to stop the commercialization of any soybean varieties in the country, given the lack of protection. The government has tried to find a solution without having to change the legal framework—a daunting task given the economic interests at stake—by proposing the creation of a tax.[114]

112. For figure data, see generally http://www.sagpya.mecon.gov.ar (last visited Mar. 18, 2006).

113. *See* Tony Smith, *Argentine Soy Exports Are up, but Monsanto Is Not Amused,* N.Y. TIMES, Jan. 21, 2004, at W1.

114. *See Argentina to Propose New Royalty Payment Rules for GM Seed,* SEEDQUEST, Jan. 27, 2005, http://www.seedquest.com/News/releases/2005/january/11144.htm.

USING TAXES TO OVERCOME PROPERTY RIGHTS FAILURE

In early 2004, Monsanto decided to stop the commercialization of soybeans in Argentina due to the lack of property rights protection. This decision caused authorities concern, since genetically-modified seeds, such as Monsanto's Roundup Ready soybean, represent around 95% of the soybean planted in the country.[115] As a result of Monsanto's protests, the government is proposing a tax on farmers' crops. This tax would be distributed among seed producers as a mechanism to compensate them for the lack of property rights enforcement.[116] If we consider the effect of a tax on the price of the seed in our model, we can show that, theoretically, the implementation of a tax can be a substitute for the effective protection of property rights. In the case that the government can find the optimal tax, investment will reach the optimal level of secure property rights. Even though the imposition of a tax would ideally increase the level of property rights protection close to the optimal level, there are some drawbacks to this approach.

First, nothing ensures that seed producers are going to receive the full revenue from this tax. There is always a chance that part of the revenues will be used by the government. This is very different from secure property rights, where inventors are certain to receive the full revenue of their royalties. Second, even though the government distributes all the revenue to producers, there could be transfers to other producers, and it is not clear how the government is going to determine the exact market share of each producer. Third, a general tax does not discriminate among different users and uses of the invention. Since it seems that there is no particular exemption to this tax, we are in the presence of a compulsory license, which can have important effects on the allocation of research and development resources. Finally, it is assumed that the cost of implementing and enforcing a tax are equal to or less than the costs of enforcing property rights. If that is not the case, then society may be paying a higher transaction cost in order to protect property rights.

115. *See id.*
116. *See id.*

CONCLUSION

The impact of the definition, scope of protection, and enforcement of property rights on biotechnology in agricultural markets is a topic of much debate. Scholars and policymakers debate the pros and cons of different property regimes that protect plant innovation. According to the literature, the effective protection of property rights offers adequate incentives for research and development in a biotechnology market controlled by private firms. This kind of protection was not needed decades ago when most of the research was done by governmental or nonprofit institutions. However, in the last few decades the growth of private research and the consolidation of the private sector in multinational corporations have brought the issue of property rights to the international arena. This Article addressed the issue of property rights protection in the United States and Argentina. Both countries represent an important share of the world seed market and are important actors in international agricultural markets.

The legal framework for property rights protection is very different in Argentina than in the United States. Seed producer rights are more loosely defined, and the enforcement of those rights is limited. Patenting is not available for new varieties, and UPOV 91 has not yet been approved. This situation has generated complaints from seed producers, especially foreign producers, who were unable to enforce their rights on the seeds they introduce into the market. Nonetheless, farmers and even the government have been eager to adopt new technologies for seeds. This situation has created an interesting problem since the demand for new technologies is high, but the incentives for those technologies to be marketed and distributed are distorted.

Some initiatives, like compulsory licensing through a tax on the sales of grains, have generated an intense debate and can prove to be more burdensome and costly than the creation of a more effective regulatory system. Furthermore, the evolution of property rights legislation has advanced at a very slow pace, with many drawbacks and political stalemates. In addition, enforcement has been slow and inadequate.

The comparative analysis of this Article provides a useful framework to understand the complexities of international regulatory systems and the challenges that multinational and local seed producers face in developing countries with weak regulatory systems for the protection of property rights. The

implications of not creating and providing significant legal regimes protecting agricultural biotechnology innovation has significant impact in terms of the allocation of resources devoted to both indigenous research on plant innovation and also on the choices being made by growers acting in response to current weak property regimes. These issues merit additional inquiry and careful consideration as we debate the various policy options with respect to intellectual property protection in developing countries. Furthermore, this Article shows the complexity and changing characteristics of property rights regimes in developing countries. In order to promote a more efficient international market, the issues raised by this Article must be addressed. Otherwise, companies will face important challenges investing in international markets, and technologies will not be disseminated as a consequence of incongruent and inadequate intellectual property regulations.