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Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds

Lara E. Ewens

SEED WARS: BIOTECHNOLOGY, INTELLECTUAL PROPERTY, AND THE QUEST FOR HIGH YIELD SEEDS

Abstract: *Presently, intellectual property law is the mechanism that determines international protection and control over biotech innovations in plant varieties and the genetic resources that form the basis for those innovations. The intellectual property paradigm that is utilized employs western definitions of property in order to provide a framework in which to allocate rights. This has resulted in serious distributive problems: western-specific ideas about property, authorship, and individual creative inventors do not translate well to areas where cultural knowledge or generational innovation form the basis of important societal achievements. The default solution in the international agricultural context has been to almost entirely forego any sort of property protection for cultural and indigenous knowledge and innovation. Until international intellectual property law increases awareness of the importance of the public domain in preserving genetic diversity, protecting the global food supply, and safe-guarding genetic resources, intellectual property law will under-value and under-compensate the contributions and agricultural concerns of the developing countries that safeguard the vast majority of the world's plant genetic resources.*

INTRODUCTION

From the time people first began cultivating and harvesting cereal grains, plants and their products have been a necessary component of the material foundations upon which human societies are formed.[1] We all need to eat, and what we eat, whether it be steak or

[1] *See* JACK RALPH KLOPPENBURG, JR., FIRST THE SEED: THE POLITICAL ECONOMY OF PLANT BIOTECHNOLOGY, 1492–2000, at 1 (1988). Dates vary on when humans first began to cultivate crops. The general estimates fall between ten and fifteen thousand years ago. *See* SHELDON KRIMSKY & ROGER P. WRUBEL, AGRICULTURAL BIOTECHNOLOGY AND THE ENVIRONMENT 9 (1996); H. Garrison Wilkes, *Plant Genetic Resources over Ten Thousand Years: From a Handful of Seed to the Crop-Specific Mega-Gene Banks, in* SEEDS AND SOVEREIGNTY: THE USE AND CONTROL OF PLANT GENETIC RESOURCES 67, 68 (Jack R. Kloppenburg, Jr. ed., 1988). Wilkes writes:

> The change from being wild to domesticate is characterized more accurately as a process than as an event. And the transition from being a wild plant to being a plant dependent on humans has not been uniform among useful plants. There is not an origin of cultivated plants; rather, there are origins for each crop. Some are ancient, others are recent domesticates of this century.

tofu or chocolate cake, is ultimately derived from plant material.[2] Plants provide us not only with food, but also with the raw materials required for the production of innumerable goods from cotton T-shirts, to automobile tires, to life-saving drugs.[3] Since agriculture began over 10,000 years ago, human beings have selectively bred plants and animals in order to create stronger, healthier, higher yielding organisms.[4]

Selective plant breeding is accomplished by choosing seeds with the most desirable traits from each year's harvest in the hope that the desired characteristics of the selected parent will surface in its offspring.[5] Thus, over thousands of years the steady accumulation of desirable genes has produced more productive plants.[6] In the last two decades, scientists have been able to engage in a more specific form of crop selection by isolating genetic material of organisms and inducing specific modifications so that the plants carry and reproduce desired genetic traits such as resistance to pesticides, higher nutritional content, and improved appearance.[7] These biotechnological innovations pose large ramifications for agriculture—for farmers, seed companies, and consumers.[8]

Seeds reproduce themselves almost indefinitely and thus do not lend themselves to commodification.[9] Because seeds are not easily commodified, two things have remained true until the latter part of this century: the genetics of most major crop plants have been regarded as common heritage, and little private investment has been made in plant and crop improvement.[10] In this century, there have been technological routes, such as hybridization, taken towards commodification of the seed.[11] There also have been legalistic routes,

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See id. at 67–68.

[2] *See* KLOPPENBURG, *supra* note 1, at 1.

[3] *See id.*

[4] *See id.* at 1–2; David G. Scalise & Daniel Nugent, *International Intellectual Property Protections for Living Matter: Biotechnology, Multinational Conventions and the Exception for Agriculture,* 27 CASE W. RES. J. INT'L L. 83, 83 (1995). Note that while "agriculture" encompasses both livestock animals and plants, this Note focuses on biotechnological developments in plants, e.g., fruits, vegetables, and seed crops. Any reference to "agriculture" or "agricultural biotechnology" should be read in this limited sense.

[5] *See* KLOPPENBURG, *supra* note 1, at 2.

[6] *See id.*

[7] *See* Scalise & Nugent, *supra* note 4, at 83–84.

[8] *See id.*

[9] *See* KLOPPENBURG, *supra* note 1, at 10–11.

[10] *See generally id.*

[11] *See id.* at 11.

such as the granting of property rights to plant varieties and, more recently, utility patent protection to certain "new" plant varieties.[12] The almost infinite reproduction of the seed, however, has always posed a problem for its ultimate commodification: not all plant varieties—especially crops—are able to be hybridized, and even patented plants have numerous offspring.[13]

In recent years, advances in biotechnology have allowed for increased commodification of seeds not only by relying on utility patent protection for bioengineered varieties, but also by taking a new route to commodification—through biotechnical processes that, among other things, render seeds sterile or insert easily recognizable "marker" genes that identify plants' DNA strains as the intellectual property of various biotech firms.[14] The translation of these innovations into the international realm of global trade and property protection has been awkward and at times controversial.[15] Nevertheless, intellectual property law seems to be the framework under which international protection and control of genetic resources will be discussed and decided.[16]

Part I of this Note describes the commodification of the seed and the history of the United States' intellectual property protections for plant varieties. Part II discusses the emergence of biotech crops and the biotech market, on the one hand, and international intellectual property protections for biotech innovations, on the other. Concerning the latter, the Note focuses on two international agreements: the Biodiversity Treaty and the Trade Related Intellectual Property Rights (TRIPs) component of the General Agreement on Trade and Tariffs (GATT). Part III concludes with an analysis of the structure of intellectual property law and an examination of the serious distributive problems this intellectual property structure causes in terms of international agriculture and the global food supply. The Note concludes by advocating for an increased awareness of the importance of the public domain and for diminishing the strength of intellectual property protection for plants by lowering the number of years patents extend protection.

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[12] *See id.*

[13] *See id.*

[14] *See* Michael Pollan, *Playing God in the Garden*, N.Y. TIMES, Oct. 25, 1998 § 6 (magazine), at 44.

[15] *See* Charles McManis, *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 WASH. U. L.Q. 255, 255–56 (1998).

[16] *See generally id.*

I. The Commodification of Seed & the United States' Intellectual Property Protections for Plant Varieties

A. *Commodification of Seed*

1. Routes to Commodification

The natural characteristic of the seed—that it is used in production and then re-emerges in multitudinous replacement of the original seed—constitutes a biological barrier to its commodification.[17] As long as a farmer can purchase seed of an improved plant variety and thereafter propagate the seed indefinitely for future use, there is little reason for capital to engage in plant breeding to develop superior crop varieties.[18] During this century, private plant breeding has been responsible for several routes taken towards commodifying the seed industry by controlling the natural reproductive characteristics of the seed.[19] Hybridization, which drastically lowers yield in the second and subsequent generations, has been one technological route towards commodification and the increase in private resource investment in plant breeding.[20] An alternate, legalistic route has been the granting of property rights to privately developed plant varieties through such mechanisms as the Plant Patent Act of 1930 (PPA), the Plant Variety Protection Act (PVPA), and utility patents.[21] Recently a third route towards the privatization and commodification of plant breeding has emerged in the form of a patented biotechnological innovation that renders seeds sterile after the first planting, thus definitively controlling the seed's ability to reproduce and the farmer's ability to replant.[22]

2. International Commodification & Germplasm Flow

Scientific and technical development in plant improvement has increasingly led to the privatization and commodification of the seed market. Almost all of this development has taken place within the

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[17] *See* Kloppenburg, *supra* note 1, at 10–11.

[18] *See id.* at 11.

[19] *See id.*

[20] *See id.*

[21] *See* Plant Patent Act, 35 U.S.C. § 161 (1988 & Supp. 1996); Plant Variety Protection Act, 7 U.S.C. § 2402 (1988 & Supp. 1996).

[22] *See* Leora Broydo, *A Seedy Business,* Mother Jones Online (Apr. 7, 1998) <http://www.motherjones.com/news_wire/broydo.html>.

context of the world market and the transfer of germplasm[23] from the Third World to the First World.[24] The developed countries of the North are notably gene-poor in their plant varieties, while almost every crop of economic importance has originated in the gene-rich developing countries of the Southern Hemisphere.[25] The quantitative flow of germplasm from the gene-rich countries to the gene-poor is immensely disproportionate.[26] There is, however, an added character to the germplasm flow. Third World germplasm has generally been thought of as a free good, part of the cultural commons and the common heritage of humankind.[27] As a free good, germplasm has been liberally appropriated by the developed countries with no direct remuneration to the Third World countries from which the germplasm is taken.[28] The final consequence of this appropriation occurs when plant varieties that include genetic material originally obtained from the Third World are returned back to the developing countries' markets, appearing there now as high-priced commodities, usually with the strict intellectual property protections afforded such products.[29]

3. International Control of the Market for Genetically Engineered Seeds

Genetically engineered seed products, which are the final result of Third World germplasm flow, are primarily controlled by large international seed companies.[30] These global corporations have positioned themselves in a biotech market that has immense potential—Merrill Lynch estimates the global market for genetically engineered seeds is set to grow from $450 million US in 1995 to $6.6 billion in 2005.[31] In mid-1998, the top ten largest seed companies controlled

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[23] Germplasm is the genetic information encoded in the seed and the raw material used by the plant breeder. *See* KLOPPENBURG, *supra* note 1, at 14.

[24] *See id.* at 9, 14.

[25] *See id.* at 14. Of crops of economic importance, only sunflower, blueberry, cranberry, and Jerusalem artichoke originated in North America. *See id.* at 50.

[26] *See id.* at 15.

[27] *See* KLOPPENBURG, *supra* note 1, at 15.

[28] *See id;* McManis, *supra* note 15, at 268.

[29] *See id.*

[30] *See* Cath Blackledge, *Life Sciences Firms Will Make Money By Controlling the Whole Food Chain,* EUROPEAN, May 18, 1998, at 20; RAFI Communique, *Seed Industry Consolidation: Who owns Whom?* (July 1998) <www.rafi.org/web/allpub-display.shtml?pfl=com-list-all.param> [hereinafter RAFI Communique].

[31] *See* Cath Blackledge, *supra* note 30, at 20. The Rural Advancement Foundation International (RAFI) cites an equally large estimate from the International Seed Federation

30% of the seed trade worldwide ($7 billion US in trade in both biotech and non-biotech seeds),[32] and the industry is quickly consolidating as companies compete to seize control of a lucrative global market.[33] For an example of just how attractive this market is, look to the American company Monsanto, the new technological front-runner in the seed market and, in 1998, the second largest seed company in the world.[34] In 1997 and 1998, Monsanto spent $6.7 billion US, positioning itself to become a top giant in what is now being called the "life sciences" industry.[35] Biotech innovation in agriculture and the consolidation of the biotech market have brought intense competition to the seed industry.[36] As a result, companies are fighting legal battles over the right to use germplasm with desirable traits in breeding and are seeking increasingly broader and stronger intellectual property rights in order to protect their research investment and plant innovations.[37]

B. *Intellectual Property Rights in the United States*

1. The Policies Behind Patents

Article 1, Section 8 of the United States Constitution grants patents to inventors "[t]o promote the Progress of Science and useful

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that the world market for genetically engineered seeds is expected to reach $2 billion by the year 2000 and $20 billion by 2010. *See* RAFI Communique, *supra* note 30. An article in the New York Times describes some analysts' prediction that "[C]ontrol of genetic resources, the raw material for biotechnology, will be to the next century what oil and metal were to this one." *See* Michael Pollack, *U.S. Sidetracks Pact to Control Gene Splicing,* N.Y. TIMES, Feb. 25, 1999, at A1.

[32] *See* RAFI Communique, *supra* note 30. In specific seed markets corporate market share may be much higher. *See* RAFI Communique, *The Gene Giants: Update on Consolodation in the Life Industry,* (Mar. 1999) <www.rafi.org/web/allpub-display.shtml?pfl+com-list-all.param>. For example, in 1999, four companies controlled 69% of the North American seed corn market, and five vegetable seed companies controlled 75% of the global vegetable seed market. *See id.*

[33] *See* Scott Kilman & Susan Warren, *Dupont, Monsanto Going to Seed,* WALL ST. J., May 28, 1998, at C7.

[34] *See* RAFI Communique, *supra* note 30. Seed industry mergers are occurring at a breakneck pace, and the largest corporations continue to reposition themselves. *See id.* In 1998, the top three life industry giants were Pioneer Hi-Bred International (U.S.), Monsanto/American Home Products (U.S.), and Swiss giant Novartis. *See id.*

[35] *See* Kilman & Warren, *supra* note 33.

[36] *See* Peter J. Goss, *Guiding the Hand that Feeds: Towards Socially Optimal Appropriability in Agricultural Biotechnology Innovation,* 84 CAL. L. REV. 1395, 1398 (1996); Kilman & Warren, *supra* note 33.

[37] *See* Goss, *supra* note 36, at 1398.

Arts . . . ."[38] A patent is an exclusive right granted to an inventor to prevent all others from making, using, and/or selling the patented invention.[39] The rationale of the patent system is to establish a form of protection that provides incentive to research, development, and innovation.[40] Patents provide an incentive to invent because they permit inventors to exclude others from using newly developed technology, and in so doing, allow inventors to make profits and recoup research expenses and development costs.[41] Additionally, it is thought that patents facilitate the dissemination of technical information which, if not protected by patents, would likely be kept secret.[42]

However, patents exert a negative cost on society as well: the more costly and restricted the access to information protected by patents, the more inefficient the market.[43] Conceptually, the idea of patents is antithetical to the concept of a liberal democracy founded on the ideal of public discourse and free access to, and transmission of, information.[44] In the United States and countries with similar intellectual property systems, patent protection draws the line between protected information and information that will circulate in what is called the public commons—that realm of information that all people contribute to, and extract from, in creating ideas, language, and social structure.[45] Thus, intellectual property rights set conceptual boundaries between the public and private domains, and in so doing, extend protection to areas of creation and thought that seem infinite.[46] Because we think of creativity as flowing from a universe of infinite possibilities, there is a tendency to systematically increase intellectual property protection.[47] But, as Keith Aoki notes, the expan-

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[38] U.S. CONST. art. I, § 8, cl. 8.

[39] *See* F.H. Erbisch & C. Velazquez, *Introduction to Intellectual Properties, in* INTELLECTUAL PROPERTY RIGHTS IN AGRICULTURAL BIOTECHNOLOGY 3, 8 (F.H. Erbisch & K.M. Maredia eds., 1998). There are three types of patents granted in the United States: plant patents, utility patents, and design patents. *See id.* Plant and utility patents will be discussed in this Note. *See infra* notes 47–63 and accompanying text.

[40] *See* PAUL GOLDSTEIN, COPYRIGHT, PATENT, TRADEMARK AND RELATED STATE DOCTRINES, CASES AND MATERIALS ON THE LAW OF INTELLECTUAL PROPERTY 16 (1997).

[41] *See id.*; Scalise & Nugent, *supra* note 4, at 86–87.

[42] *See id.*

[43] *See* JAMES BOYLE, SHAMANS, SOFTWARE, AND SPLEENS: LAW AND THE CONSTRUCTION OF THE INFORMATION SOCIETY xii (1996).

[44] *See id.* The First Amendment is one of the most obvious examples of this ideal. *See id.*

[45] *See* Keith Aoki, *Neo-colonialism, Anticommons Property and Biopiracy in the (Not-So Brave) New World Order of International Intellectual Property Protection*, 6 IND. J. GLOBAL LEGAL STUD. 11, 34–35 (1998).

[46] *See id.* at 35.

[47] *See id.*

sion of intellectual property protections "make[s] us ignore the common-sense knowledge that new intellectual creations are formed from pre-existing thoughts and ideas in a long chain stretching back into antiquity."[48] In other words, patent everything and there is no longer any common material from which to create.[49] Economically, when too many owners hold the right of exclusion—through patents or other means—then underuse and underutilization of the resource occurs.[50] If this phenomenon were to occur in the global food market, the dangers are clear: over-protection of high-yield seeds could severely limit farmers' ability to plant the most desirable crops as well as farmers' and seed companies' ability to breed future generations of seeds.[51] The result would be the underutilization of genetic resources that have been in the cultural commons for over 10,000 years.

2. United States Patents for Plants and Living Organisms

The "utility patent" statute, 35 U.S.C. § 101, provides seventeen-year patent protection for "[w]ho[m]ever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[52] Until 1970, the Plant Patent Act of 1930 (PPA) contained the only intellectual property rights available to protect new inventions that contained living matter.[53] The PPA enabled plant breeders to obtain patent-like protection for their inventions but limited the protection to asexually reproducing plants (produced from cuttings or grafts but not grown from seed).[54] In 1970, Congress enacted the Plant Variety Protection Act (PVPA) to protect breeding innovations in sexually reproducing plants, thereby including most crops.[55] The PVPA provides patent-like protection for new, distinct, uniform, and stable plant varieties for

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[48] *Id.*

[49] *See id.*

[50] *See* Aoki, *supra* note 45, at 35.

[51] *See generally id.*

[52] 35 U.S.C. § 101 (1994). Until 1980 and *Diamond v. Chakrabarty,* utility patents were not extended to living matter. *See* Scalise & Nugent, *supra* note 4, at 95–96.

[53] *See* Plant Patent Act, 35 U.S.C. § 161 (1988 & Supp. 1996).

[54] The PPA grants that "Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor . . . ." 35 U.S.C. § 161 (1996).

[55] *See* 7 U.S.C. § 2402 (1988 & Supp. 1996); David Tilford, *Saving the Blueprints: The International Legal Regime for Plant Resources,* 30 CASE W. RES. J. INT'L L. 373, 402 (1998).

twenty years.[56] The protection the PVPA grants is limited by two significant exceptions that have been narrowed in recent years.[57] These exceptions allow breeders to use protected seed to create new varieties and allow farmers to save seed from crops grown with the protected variety and replant those seeds without compensating the protected plant breeder.[58]

Today, most biotechnology inventions are filed as utility patents and not as plant patents.[59] Instead of only protecting the plant, utility patents make protection of plant genes possible, as well as allow the breeder to protect the use of the genetic material of a number of plants, and to protect for multiple uses such as pharmaceutical, pest protection, and herbicide resistance.[60] Prior to 1980, the U.S. Patent and Trademark Office (PTO) and the federal courts were reluctant to allow utility patents to extend to living matter.[61] This practice ended

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[56] *See* 7 U.S.C. § 2401(a). Plants that do not exhibit the same traits when grown out over several generations (i.e., plants that are not stable) are not eligible for protection. *See* 7 U.S.C. § 2402(a)(3). Thus, hybrids are excluded from protection because they do not breed true after one generation. *See* Goss, *supra* note 36, at 1407 n.70.

[57] *See* Goss, *supra* note 36, at 1408–09.

[58] *See id.* The first exception is called the "research exception" and the second the "crop exemption" exception. *See id.* In 1994, Congress passed amendments to the PVPA to limit the potential for abuse of both exceptions. *See id.* at 1409–11. For an example of judicial efforts to limit the scope of the crop exemption, see *Delta & Pine Land Co. v. Peoples Gin Co.*, 694 F.2d 1012 (5th Cir. 1983), which found that farmers who save seed must do so individually and not through intermediaries such as farm cooperatives; and *Asgrow v. Winterboer*, 513 U.S. 179 (1995), which determined that a farmer could sell to other farmers no more than the amount of seed the farmer would otherwise need to plant her crop for the next year. Congress has now removed any sale provision from the crop exemption—presently farmers can only sell seed for other than reproductive purposes (food or feed but not for planting). *See* Goss, *supra* note 36, at 1414.

[59] *See* Erbisch & Velazquez, *supra* note 39, at 9. Although note that because plant patents are not available for sexually reproducing plants, and utility patents are often very expensive and difficult to obtain, the PVPA is often still an attractive option. *See* Goss, *supra* note 36, at 1414.

[60] *See* Erbisch & Velazquez, *supra* note 39, at 9. The PVPA does not provide adequate protection for a breeder who has inserted a new gene into a plant variety because it allows another breeder to purchase the genetically altered, and PVPA protected, plant and breed the new gene into a new variety. *See* John H. Barton, *Acquiring Protection for Improved Germplasm and Inbred Lines, in* INTELLECTUAL PROPERTY RIGHTS IN AGRICULTURAL BIOTECHNOLOGY 19, 22 (F.H. Erbisch & K.M. Maredia eds., 1998).

[61] *See* Scalise & Nugent, *supra* note 4, at 95. Scalise and Nugent write:

> Despite anomalous patents, such as that issued to Louis Pasteur in 1873 for his purified culture of yeast, the courts invariably rejected patents that pertained to living matter. The most effective weapon was the products of nature doctrine, as discussed in the American Fruit Growers case. When that doctrine failed, the PTO and private plaintiffs relied upon the plant protection acts of 1930 and 1970 as evidence that Congress intended that only living or-

when, in *Diamond v. Chakrabarty,* the U.S. Supreme Court recognized the patentability of living inventions.[62] Chakrabarty, a microbiologist, challenged a denial of his patent application for a bacterium he invented that broke down crude oil.[63] The Court held that Chakrabarty's bacterium was a product of human labor, contained characteristics "markedly different" from any found in nature, and showed the potential for "significant utility," thus making Chakrabarty's bacterium eligible for a patent.[64]

Although *Chakrabarty* was the groundbreaking case, the question remained of whether the PTO and courts would grant patents that extended protection to complex living organisms such as plants or animals.[65] In *Ex parte Hibberd,* the PTO originally rejected Hibberd's application for a patent on a maize plant that possessed an extremely high level of amino acids, determining that the existence of the PVPA indicated that plants do not qualify for standard utility patents.[66] The PTO's Board reversed the decision and held that "neither the PPA nor the PVPA expressly excludes any biological subject matter from protection under Section 101 [utility patents]."[67] Thus, new plant varieties became eligible for utility patents under *Ex parte Hibberd.*[68]

II. Discussion: Intellectual Property Rights and Biotech Crops in the International Context

A. *The Emergence of Biotech Crops*

In 1998, the fourth year that genetically altered seeds have been on the market, about 45 million acres of U.S. farmland have been planted with biotech crops.[69] Most of these crops are corn, soybeans,

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ganisms qualifying under one of the acts were to be afforded intellectual property rights.

See id.

[62] *See* Diamond v. Chakrabarty, 447 U.S. 303 (1980).

[63] *See id.* at 305.

[64] *See id.* at 310. The court also examined the committee reports of the 1952 recodification of the patent laws which, in the court's view, made clear Congress's intent that the statute include "anything under the sun that is made by man." *Id.* at 309.

[65] *See* Scalise & Nugent, *supra* note 4, at 98.

[66] *See Ex parte* Hibberd, 227 U.S.P.Q. 443, 444 (1985).

[67] *See id.* at 444–45.

[68] *See* Goss, *supra* note 36, at 1405.

[69] *See* Pollan, *supra* note 14. One estimate is that about half of U.S. cotton fields, 40% of soybean fields, and 20% of corn fields were genetically altered in 1998. *See* Kilman & Warren, *supra* note 33, at C7.

cotton, and potatoes that have been engineered to either produce their own pesticides or withstand herbicides.[70] Through genetic engineering, breeders are able to bring qualities from many living organisms into the genome of the plant.[71] For instance, it is possible to take a flounder gene that permits the fish to tolerate the extreme cold of the deep ocean and insert it into a strawberry plant to induce frost tolerance.[72] Other examples include inserting genes for disease resistance taken from viruses and a gene from a bacterium, Bacillus thuringiensis, that causes a plant to produce a protein harmless to humans but toxic to many pests.[73] Biotechnology is also instrumental in creating "end-use-tailored" varieties such as cotton of a certain color, soybeans with a specific oil content, or corn with high energy content that is especially useful for livestock feed.[74]

The great hope for genetically engineered crops is that they will feed the world.[75] Globally, there are 80 million new people to feed each year, while growth in world grain production has slowed from 3% per year in the 1970s to 1% per year over the last decade.[76] Biotech crops offer a potential answer to the great fear that with burgeoning populations the occurrence of mass starvation is only a matter of time.[77] Hopes for genetically engineered crops include crops with immunity to insects, disease, drought, pesticides, and herbicides, as well as crops with substantially higher yields and nutritional content.[78] Higher yields and disease resistance are attractive not only because they increase the world's food supply but also for purely economic reasons: farmers who choose a higher yield, more disease resistant seed will bring more goods to the market.[79] Additionally, some think genetic engineering offers ecologically sound alternatives

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[70] *See* Pollan, *supra* note 14.

[71] *See id.*

[72] *See id.*; Michael Specter, *Europe, Bucking Trend in U.S., Blocks Genetically Altered Food*, N.Y. TIMES, July 20, 1998, at A1.

[73] *See* Goss, *supra* note 36, at 1401; Pollan, *supra* note 14.

[74] Goss, *supra* note 36, at 1401–02; *See Monsanto*, (visited Jan. 19, 2000) <http://www.monsanto.com/ag/_asp/monsanto.asp>.

[75] *See* Christopher Hallowell et al., *Will the World Go Hungry? The Population Will Hit 10 Billion, But Farmers Can Meet the Challenge with Modern Biotechnology and a Little Bit of Ancient Wisdom*, TIME INT'L, Nov. 1, 1997.

[76] *See id.* The world population growth rate has also decreased from a high of 2.2% in 1963 to 1.4% today. *See id.*

[77] *See id.*

[78] *See* Jimmy Carter, *Who's Afraid of Genetic Engineering?*, N.Y. TIMES, Aug. 26, 1998, at A21.

[79] *See* Goss, *supra* note 36, at 1400.

to today's herbicide and pesticide rich agriculture by replacing expensive and toxic chemical inputs with expensive but apparently benign genetic information.[80]

Many people have also raised serious concerns about the impact genetically engineered crops—generally protected by strict intellectual property laws—will have on agriculture around the world.[81] Environmental fears have focused on the possibility of genetic erosion—the depletion of the genetic gene pool—caused by increased intellectual property rights that restrict access to genetic resources.[82] Genetic erosion holds two potentially serious dangers: extinction and genetic uniformity.[83] The extinction of a species means its genes are lost along with any beneficial traits it might contain.[84] The ramification of extinction is that remaining plants are unable to appropriate those lost beneficial characteristics that might help them ward off disease and pests.[85] Genetic uniformity—the genetic similarity in varieties used to produce a crop—is another concern.[86] When crops are genetically similar, they react similarly to drought, disease, insects, and other factors, thus increasing the likelihood of large-scale crop failure.[87] Economic fears center on the increased productivity and economies of scale created in corporate farming by biotechnological innovation that may make less efficient family and subsistence farmers unable to compete.[88] Additionally, there is the concern that intellectual property rights protecting biotech plant engineers will increase economic concentration in the seed industry, leading to higher seed costs and the disintegration of small farms.[89]

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[80] *See* Pollan, *supra* note 14.

[81] *See* Aoki, *supra* note 45, at 47.

[82] *See* Pollan, *supra* note 14.

[83] *See* Goss, *supra* note 36, at 1402–03.

[84] *See id.* at 1402. Kloppenburg writes of "the need to address the global erosion of genetic diversity, because that which is being lost is the raw material out of which responses to future pest and pathogen challenges must be fashioned and with which the broadening of the crop genetic base can be accomplished." KLOPPENBURG, *supra* note 1, at 163.

[85] *See* Goss, *supra* note 36, at 1402. Note, however, that although biotechnology cannot create genetic traits after the loss of a species, it can help prevent extinction by numerically increasing failing species or inserting greater disease resistance into endangered plant species. *See id.* at 1402–03.

[86] *See id.* at 1403.

[87] *See id.* Genetic uniformity exacerbated the Irish potato famine and the 1970 corn leaf blight in the United States. *See id.*

[88] *See* Scalise & Nugent, *supra* note 4, at 84–85.

[89] *See* Goss, *supra* note 36, at 1399.

B. *Intellectual Property Rights in the International Context*

Both the advantages and disadvantages of biotech crops must be interpreted in the international context where agricultural progress and exchange has traditionally taken place. The debate over biotechnology has begun to take place internationally in order to encompass adequately issues like global genetic diversity, the continued viability of important land races, north-south seed trade and appropriation, and industrial and rural agricultural concerns.[90] The international community now acknowledges that world-wide cooperation in biotechnology trade and global genetic diversity is necessary in order to respond to the varied concerns of a number of key constituencies: industry, First and Third world farmers, indigenous people, nations, environmentalists, scientists, and First and Third world consumers.[91] In the area of biodiversity and biotech crops, much of the international debate has taken place in the area of intellectual property law or under the aegis of trade agreements.[92]

There is no unifying system of international commercial law and, particularly, no unifying system of intellectual property or patent law.[93] Thus for an inventor who would like to pursue patent protection outside of the United States, thousands of dollars are required per jurisdiction in filing costs and attorney's fees without the guarantee that a patent will be granted.[94] In the realm of biodiversity, plant biotechnology, and the granting or withholding of intellectual property rights, as in most areas of international trade debate, there is sharp conflict between the interests of the technology-rich industrial countries of the North and those of the biodiversity-rich developing countries of the South.[95] In the legal realm of intellectual property rights the debate can be couched in fairly general terms. Developed countries want their technological innovations and investments to be granted strong intellectual property rights in developing countries to protect against piracy and to insure monetary return on their invest-

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[90] *See* United Nations Convention on Biological Diversity, June 5, 1992, S. Treaty Doc. No. 103–20 (1993) [hereinafter Biodiversity Treaty]; General Agreement on Tariffs and Trade—Multilateral Trade Negotiations (The Uruguay Round): Agreement on Trade-Related Aspects of Intellectual Property Rights, Including Trade in Counterfeit Goods, Dec. 15, 1993, 33 I.L.M. 81 (1994) [hereinafter TRIPs Agreement].

[91] *See* Biodiversity Treaty, *supra* note 90; TRIPs Agreement, *supra* note 90.

[92] *See* Biodiversity Treaty, *supra* note 90; TRIPs Agreement, *supra* note 90.

[93] *See* McManis, *supra* note 15, at 265; Scalise & Nugent, *supra* note 4, at 105.

[94] *See* Scalise & Nugent, *supra* note 4, at 105.

[95] *See generally* McManis, *supra* note 15, at 255.

ments.[96] Developing countries would prefer to modify the present system of free appropriation of genetic resources from gene-rich countries with a system of intellectual property rights that support and promote the fair and equitable sharing of benefits that arise from the utilization and development of genetic resources.[97] Additionally, developing countries are concerned that intellectual property law favors technological innovation that has emerged from the industrialized countries and disfavors farmers in developing countries who, over generations, have contributed to and improved plant species.[98] The criticism is that traditional agricultural innovation—taking place for thousands of years in the gene-rich developing countries—which has preserved species and contributed to genetic diversity is inimical to the "innovation," "novelty," and "inventiveness" requirements that intellectual property law demands when granting protection.[99]

C. *International Treaties*

There have been a number of international treaties and agreements regarding trade and intellectual property rights.[100] The most pertinent recent treaties addressing the area of biotechnology and biodiversity are the United Nations Convention on Biological Diversity (Biodiversity Treaty) and the Trade-Related Aspects of Intellectual Property Rights (TRIPs), part of the General Agreement on Trade and Tariffs' (GATT) Final Act of the Uruguay Round of Multilateral Trade Negotiations.[101]

1. Biodiversity Treaty

In 1992, Rio de Janeiro, Brazil was the site of the global convention on biodiversity.[102] The three stated objectives of the Biodiversity Treaty are (1) the conservation of biological diversity, (2) the sustainable use of biological components, and (3) the fair and equitable sharing of the benefits arising from the utilization of genetic resources through (a) appropriate access to genetic resources, (b) appropriate transfer of relevant technologies, and (c) appropriate fund-

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[96] *See id.* at 268–69.
[97] *See id.* at 269.
[98] *See id.* at 268–69.
[99] *See id.*
[100] *See* Biodiversity Treaty, *supra* note 90; TRIPs Agreement, *supra* note 90.
[101] *See* Biodiversity Treaty, *supra* note 90; TRIPs Agreement, *supra* note 90.
[102] *See* Biodiversity Treaty, *supra* note 90.

ing.[103] Although the United States, under the Bush administration, did not sign the treaty—in large part due to concerns about adequate protection of U.S. intellectual property law and biotechnology interests[104]—162 other nations did sign the treaty, and it was ratified by the requisite number of nations, entering into effect on December 29, 1993.[105]

The United States' objection to the treaty largely centered on the vague language of Article 16 which addresses what constitutes appropriate access to, and transfer of, technology.[106] Article 16, entitled "Access to and Transfer of Technology," attempts to mollify both Northern and Southern concerns.[107] Paragraph 1 of Article 16 begins:

> Each Contracting Party, recognizing that technology includes biotechnology, and that both access to and transfer of technology among Contracting Parties are essential elements for the attainment of the objectives of this Convention, undertakes subject to the provisions of this Article to provide and/or facilitate access for and transfer to other Contracting Parties of technologies that are relevant to . . . biological diversity or make use of genetic resources.

Paragraph 2 provides for favorable transfer of biotechnology to developing countries, yet modifies that provision with "terms that are consistent with intellectual property rights:"[108]

> Access to and transfer of technology referred to in paragraph 1 . . . to developing countries shall be provided and/or facilitated under fair and most favourable terms, including on concessional and preferential terms where mutually agreed. . . . In the case of technology subject to patents and other intellectual property rights, such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights.

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[103] *See id.* art. 1.

[104] *See* McManis, *supra* note 15, at 256; Tilford, *supra* note 55, at 418. President Bush, in a speech at the Rio Convention, voiced U.S. concerns, saying, "[The Convention] threatens to retard biotechnology and undermine the protection of ideas." FIONA MCCONNELL, THE BIODIVERSITY CONVENTION A NEGOTIATING HISTORY 111 (1996).

[105] *See* Scalise & Nugent, *supra* note 4, at 110.

[106] *See* Biodiversity Treaty, *supra* note 90, art. 16; Tilford, *supra* note 55, at 417.

[107] *See* Tilford, *supra* note 55, at 419.

[108] Biodiversity Treaty, *supra* note 90, art. 16, ¶ 2.

Paragraph 5 seems to assert that intellectual property rights should be revised if they run counter to the goals of the treaty:[109]

> The Contracting Parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation and international law in order to ensure that such rights are supportive of and do not run counter to its objectives.[110]

The United States' reluctance to sign the treaty was influenced by biotech industry concerns stemming mainly from the fear that technology transfer under the Biodiversity Treaty may call for transfer that does not require full payment by the transferee for use of the technology.[111] In contrast, the developing countries requested preferential transfer of technology in order to reduce the payment demanded of them for receipt of the technologies.[112] As David Tilford writes of this conflict: "The South wants the technology and the North wants the South to have it. But while the South sees itself as a potential partner, the North looks south and sees only paying customers."[113] In response to business and global concerns, the Clinton Administration has submitted the signed treaty to Congress for approval, accompanied by a letter of interpretation that clarifies the United States' understanding of the treaty—particularly of Article 16 and the application of the treaty to intellectual property rights.[114] The U.S. letter of interpretation declares that a company has exclusive rights to its own technology, that transfers of technology must be voluntary, and that compulsory licensing will be forbidden.[115]

United States' disapproval of the treaty, as well as the fact that the treaty only serves to lay the groundwork for subsequent international negotiations, insures that its effect will not be felt by the biotechnol-

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[109] *See* Biodiversity Treaty, *supra* note 90, art. 16, ¶ 5; Tilford, *supra* note 55, at 419.

[110] Biodiversity Treaty, art. 16, ¶ 5.

[111] *See* Tilford, *supra* note 55, at 418–20.

[112] *See id.* at 419.

[113] *See id.*

[114] *See* Scalise & Nugent, *supra* note 4, at 112–13. The Senate must consent for U.S. ratification of the treaty. *See id.* at 113.

[115] *See id.* at 112–13. The International Community has been unhappy with the letter of interpretation criticizing the U.S. for attempting to create the terms it was unable to obtain in the treaty negotiations. *See id.* at 113.

ogy industry in the near future.[116] Commentators have noted that one substantial achievement of the treaty is that "for the first time, . . . indigenous and local communities embodying traditional lifestyles are expressly mentioned . . . and their central contributions to biodiversity conservation are recognized."[117] Final control over many of the stipulations in the treaty is left to national determinations and legislation, leaving a vague precedent—although a potentially empowering one for developing countries—upon which future agreements are to be modeled.[118]

2. Trade Related Intellectual Property Rights (TRIPs) Agreement

Since its inception in 1947-48, the General Agreement on Trade and Tariffs (GATT) has functioned as a vehicle for implementing trade policy.[119] The most recent round of negotiations sponsored by GATT, the Uruguay Round, began in 1986 and was concluded on December 15, 1993.[120] The Trade Related Intellectual Property Rights (TRIPs) is the portion of the Uruguay Round that addresses multinational intellectual property rights and, specifically, intellectual property protection for plants.[121]

The TRIPs Agreement establishes specific standards on the availability, scope, and use of intellectual property rights.[122] Articles 27(1) and 27(2) are the applicable articles for the area of biotechnology and plant varieties protection. Article 27(1) states that "patents [are] available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application." "All fields of technology" is interpreted to include biotechnology, although transitional arrangements granted by TRIPs to developing countries and qualify-

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[116] *See id.* For instance, an outgrowth of the Biodiversity Treaty, the Biosafety Protocol, collapsed in disarray when the United States—influenced once again by the biotech industry—and five other large agricultural exporters rejected a biosafety proposal that had the support of approximately 130 other nations. *See* Pollack, *supra* note 31, at A1.

[117] DARRELL A. POSEY & GRAHAM DUTFIELD, BEYOND INTELLECTUAL PROPERTY: TOWARD TRADITIONAL RESOURCE RIGHTS FOR INDIGENOUS PEOPLES AND LOCAL COMMUNITIES 103–04 (1996). See particularly Article 8(j) of the Biodiversity Treaty.

[118] *See id.* at 104; *see generally* Biodiversity Treaty, *supra* note 90, arts. 8(j), 8(k).

[119] *See* Scalise & Nugent, *supra* note 4, at 114.

[120] *See id.* GATT has sponsored eight rounds of multilateral negotiations relating to tariffs and trade. *See id.*

[121] *See id.* Spurred on by a desire to protect against patent violations by developing countries, the United States. was originally the main sponsor of TRIPs. *See id.*

[122] *See* McManis, *supra* note 15, at 266.

ing provisions in Articles 27(2) and (3) may allow concerned countries some control in areas where there is strong national or public interest.[123] For instance, Article 27(2) modifies 27(1): "members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre [sic] public morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment . . . ."

The protection of plant varieties is dealt with specifically in Article 27(3), where protection of some form is required: "members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof." The final version of this article is different from the draft offered by the United States, which asked for mandatory recognition of plant patents in order to bring international standards into line with U.S. policy stemming from *Ex parte Hibberd*.[124] Although the United States' request was not fully granted in Article 27(3), some form of minimum intellectual property protection for plant varieties—thus including genetically engineered plants—is required by TRIPs, whether it be through patents or a sui generis system.[125] Those countries that do not currently allow the patenting of plants or agricultural products—India is an example—will be obliged to offer some sort of protection for plant varieties even if this contradicts national policies.[126]

III. Analysis: Intellectual Property Law and Biotech Innovations—Structural Flaws and Distributive Inequalities

The Biodiversity Treaty and the TRIPs Agreement offer two conflicting visions of future global trade in genetic resources: one dedicated to strengthening international biodiversity protection, the other establishing strong intellectual property protections in order to

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[123] *See* Ruth L. Gana, *Prospects for Developing Countries under the TRIPs Agreement*, 29 Vand. J. Transnat'l L. 735, 753 (1996); McManis, *supra* note 15, at 266.

[124] *See* Tilford, *supra* note 55, at 408.

[125] *See id.*

[126] *See id.* at 408–09. From the United States' point of view this means signatories may decide to offer separate and perhaps weaker plant variety protection rather than the full patent rights advocated by the U.S. *See id.* at 408. In India, reaction to this provision was so vehement that in October 1993 half a million farmers rallied together to protest the patenting of agricultural products. *See* McManis, *supra* note 15, at 257, 267. The head of the association that organized the protest, M. D. Nanjundaswamy, said the farmers were demonstrating "for collective, not individual control over seeds and plants." *See id.*

promote world trade, including trade in biodiversity.[127] Both treaties use intellectual property rights as the foundation for achieving these goals.[128] The use of intellectual property rights to accomplish arguably different international goals (biodiversity protection versus free market international trade in biological resources) highlights the preeminent place intellectual property plays, and will play, in international attempts to control and regulate plant genetic resources and biodiversity.[129]

In the area of plant genetic resources, the ideological debate focuses on the appropriate subject of property rights.[130] Although living matter has been patentable in the United States since 1980,[131] the controversy over patentability of living organisms is at the center of the conflict over intellectual property rights between developing and developed countries.[132] This debate is not only about ethical issues (should plant life be patented?), but also about legal issues (are biotechnological patents on plants "new"?), economic issues (how to allocate rights between farmers in developing countries and patentholders who are usually multinational corporations), and biological issues (will increasing use of plant varieties contribute to the denigration of global genetic diversity?).[133] Although plants and living matter seem to be allowed some form of patent protection on the global market,[134] the solutions to the ethical, economic, legal, and biological questions mentioned above are less easily located. The search for

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[127] *See* McManis, *supra* note 15, at 255.

[128] *See infra* notes 100–26 and accompanying text.

[129] As Darrell Posey writes:

> [D]oes anyone have a better mechanism than IPR [intellectual property rights] to provoke a new, more socially just and economically sound paradigm of "wealth," to strengthen positions of local communities, or to recognize the intellectual contribution of indigenous peoples to human patrimony? Alternative strategies are welcome and needed. But the deadly serious race to conserve biological and cultural diversity of the Planet is on: IPR seems to be one of the most interesting intellectual, legal, economic and political tools available to us at the present.

Darrell A. Posey, *International Agreements and Intellectual Property Right Protection for Indigenous Peoples, in* INTELLECTUAL PROPERTY RIGHTS FOR INDIGENOUS PEOPLES: A SOURCE BOOK 225, 226 (Tom Greaves ed., 1994).

[130] *See* Gana, *supra* note 123, at 745.

[131] *See* Diamond v. Chakarbarty, 447 U.S. 303 (1980).

[132] *See* Gana, *supra* note 123, at 752–53.

[133] *See id.* at 753.

[134] *See* Biodiversity Treaty, *supra* note 90; TRIPs Agreement, *supra* note 90.

these solutions form the crux of the debate between developing and developed countries.

In the legal realm, many have questioned whether the structure of intellectual property rights and the western definitions of "property" which it uses provide an appropriate framework in which to discuss and allocate rights for agricultural resources, plant varieties, and genetics.[135] The intellectual property regime enshrined in TRIPs, and to a lesser extent in the Biodiversity Treaty, raises serious questions of distributive justice.[136] The intellectual property laws cemented in TRIPs seem a continuation of United States' intellectual property policy—allowing little leeway for concerns of developing countries, specifically in the area of germplasm and other resource flows, and control over economic development.[137] The Biodiversity Treaty, which acknowledges the contribution of knowledge and resources from developing countries, only offers vague language about protecting those resources and seems easily hijacked by the interests of industry and developed countries.[138] Similarly, as James Boyle writes, "On the institutional level, the GATT has been used both to expound and to enforce the developed world's view of intellectual property."[139]

The pertinent contention in this debate is that western ways of thinking and legislating intellectual property—with the idea of "original" and "new" creation by a transformative individual at the center of its framework—have been utilized by the West as a "one way valve for property claims."[140] As a result, the flow of germplasm and indigenous agricultural knowledge from the Third World to the First has largely been an uninterrupted and uncompensated exchange of valuable information and resources because what comes out of the Third World is not, in the legal context, deserving of protection.[141] Vandanna Shiva comments on the free flow of information and resources to western industry: "At the heart of the GATT treaty and its patent laws is the

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[135] *See* Aoki, *supra* note 45, at 46.

[136] *See* VANDANA SHIVA, BIOPIRACY: THE PLUNDER OF NATURE AND KNOWLEDGE (1997).

[137] *See* BOYLE, *supra* note 43, at 141; SHIVA, *supra* note 136.

[138] *See* POSEY & DUTFIELD, *supra* note 117, at 4; *infra* notes 102–18 and accompanying text. The interests of the developing countries are not neutral either. As Posey argues, "The Earth Summit [Conference on the Biodiversity Treaty] was more of a political game to re-divide the world's resources between new global players than a gathering to address the issues of poverty and environmental degradation. Environmentally rich countries want to be given as much power as technologically rich countries." *See* Posey, *supra* note 129, at 226.

[139] *See* BOYLE, *supra* note 43, at 141.

[140] *See id.*

[141] *See id.* at 141–42.

treatment of biopiracy as a natural right of Western corporations, necessary for the 'development' of the Third World."[142]

Western countries have pushed for quick adoption of TRIPs to protect against Third World piracy of their products which accounts for millions of dollars in lost profits.[143] But note, developed countries' claim to piracy is an assertion about a certain kind of ideological piracy: that of high-tech innovations in computer programs, CDs, and genetic technology, but not the equally acute piracy occurring in the opposite direction.[144] The hypocrisy of western demand for intellectual property protections is twofold: not only do developing countries pay a high premium for the patented products that are reintroduced in their countries (yet made from local resources), but developing countries are unable to use the intellectual property framework to protect against the piracy of their own indigenous and local resources and knowledge.[145]

The culture-boundedness of our concepts of property seems largely responsible for the distributive inequalities in global intellectual property. Shiva sees the western conception of property as the modern day colonizer: the West views non-European property as "natural" and thereby equates such property with "unowned," thus available for discovery and ownership.[146] To extend her analogy, the freedom transnational corporations claim through intellectual property rights in TRIPs is the same freedom European colonizers have claimed since 1492—only now instead of land titles, it is the genetic code of life which is being claimed.[147] In less charged language, western-specific ideas about property and authorship and individual creative inventors do not translate well to areas where cultural knowledge or generational innovation form the basis of important societal achievements.[148] The default solution in the international context has been to almost entirely forego any sort of property protection for cultural and indigenous knowledge and innovation even when it is exactly this knowledge that forms the basis for most biotech patents.

The distinction intellectual property law makes between different kinds of knowledge is at its most obvious in the intellectual property

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[142] *See* SHIVA, *supra* note 136, at 5.

[143] *See* Aoki, *supra* note 45, at 49.

[144] *See id.*

[145] *See id.* at 47–50.

[146] *See* Aoki, *supra* note 45, at 50; SHIVA, *supra* note 136, at 2–5.

[147] *See* SHIVA, *supra* note 136, at 2–5.

[148] *See id.*

rights that guard plant genetic resources. Agriculture, more than many other areas of industry and creativity, is the product of generational innovation by farmers who save, share, and combine seeds over time and a variety of conditions to attain a constantly adapting product that forms the basis of all agricultural crops today. That sort of generational innovation has long been thought to be in the public domain, as perhaps it ought to be. The discrepancy is that now, with genetic engineering, corporations are patenting seeds that are based almost entirely (minus one or two genes) on a product created through farmers' innovations over many years.

The policy behind intellectual property law has been directed toward achievement of a proper balance between the rights of inventors or authors and of public consumers.[149] The increasing privatization of plant genetic research and control of biotech crops may suggest a growing imbalance between public and private access to plant genetic resources. But the balance (or lack of balance) between public and private rights that forms the basis for the paradigm of western intellectual property law must also confront the need to protect the rights of people who are not inventors or authors, under traditional definitions, yet who produce a product that is immensely valuable both to consumers and to traditional inventors. The inability of intellectual property law to address this question suggests that a disparity exists between its attention to private interests and those of public consumers. The de facto solution has been in favor of private, corporate interests and indicates a growing tendency in intellectual property protection towards the support of stronger private property rights over the recognition of the need for equitable global management of finite resources.

The advent of sterile "terminator" seeds represents a biological means to ensure even stronger protection for biotech products than intellectual property law is able to grant. In the past, and at present, large seed companies patent their high-yield seeds and sign a contract with farmers who promise not to plant the seeds their crops produce—thus ensuring that farmers will return to the seed company to buy next year's seeds.[150] However, this arrangement "works only if farmers honor it—something that's difficult to police in the U.S. and almost impossible to enforce in the developing world."[151] In engineer-

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[149] *See id.*

[150] *See* Jeffrey Kluger et al., *The Suicide Seeds Terminator genes could mean big biotech bucks—but big trouble too, as a grass-roots protest breaks out on the Net*, TIME, Feb. 1, 1999.

[151] *Id.*

ing the sterile seeds, corporations are able to combat the weak patent protection offered in many developing countries.[152] In essence, the newly patented sterile seeds enforce biologically what has been impossible to fully enforce contractually or through property rights, and they also signal the ultimate commodification of the seed by destroying its reproductive capabilities. As one critic of the sterile seeds has said, "From a marketing perspective, the technology is brilliant. From a social perspective, it's pathological. This is a question of who controls the seeds of life."[153] Sterile seeds have the potential to pose disastrous results for the global food supply and almost certainly pose problems for Third World farmers who rely on saving seeds each year in order to replant their fields the following year.[154] For intellectual property policy, the development of sterile seeds represents one method by which those who hold the technology can bypass some of the impracticalities of intellectual property law (such as the ability of farmers to replant patented seeds) as well as the tedious requirements of international trade agreements. Sterile seeds allow corporations to make and enforce what is, in essence, their own intellectual property law regime, thereby suggesting that our intellectual property law system may be growing obsolete.

Concrete solutions to the many problems described in this Note are difficult to locate. The challenge for intellectual property law today is to encompass the competing goals of preserving biodiversity, increasing international trade, protecting indigenous interests, and facilitating research for improved plant varieties. Given the predominance of intellectual property law in international law and the strength of its support from western nations and corporations, traditional intellectual property law is likely to continue to serve as the legal guide for trade in global plant genetic resources. As suggested in this Note, defaulting to western intellectual property law openly neglects the interests of developing countries and ignores nontraditional conceptions of property. Because of the immense investment western corporations have made in plant genetics and plant genetic research, and of the important potential biotechnology offers for increases in global food supply, modification of the system is likely to come from within, if at all.

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[152] *See id.*

[153] *Id.*

[154] *See id.*; Tracey Henderson, *Technology-Protected Seed: A Development Worker's Perspective*, ECHO DEVELOPMENT NOTES, Dec. 1998, Issue 62, at 5–6.

One way to address the myriad of distributive, political, biological, and other practical problems described in this Note is to focus on the delineation intellectual property law draws between public and private goods. In the realm of biotechnological innovations and plant genetic resources, more attention must be paid to the importance of the public domain: that area of ideas and genetic resources from which future innovations are created. The balance in today's intellectual property protection for plant varieties has tipped decisively in favor of private corporate interests. The dangers this poses are multiple. Strong and lengthy intellectual property protections encourage increases in genetic uniformity, increases in market concentration, higher costs for farmers, and potentially higher food prices for the public.[155] Additionally, and importantly, strong intellectual property protections begin to fence off portions of the public domain, in this case portions of genetic information, thereby making that information unavailable to future creators and potentially limiting creators' ability to innovate.

One way to address and limit the dominance of the western seed corporations is to reduce the length of time patents extend protection to plant varieties. This has the advantage of releasing bio-engineered seeds and hybrids to farmers far earlier than under the normal patent structure, making plant genetic information more readily available to the public and to other plant breeders, and perhaps beneficially influencing genetic diversity. However, maintaining some patent protection, perhaps as much as ten years, also has the advantage of allowing corporations to recoup their research costs and make profits by selling licenses and charging a premium for patented goods.[156]

Good patent policy offers a financial incentive for investment in research while still allowing for the circulation of ideas within the public realm. The maintaining of equilibrium in the modern patent system for living organisms may be achieved by shortening the time for which patents extend protection. Addressing the deeper structural concerns that intellectual property law poses—how to adequately define property, how to compensate developing countries who serve as the source of much of the genetic material that is later patented, and how to speak about innovations that take place over generations rather than in a sudden innovative moment—demands a rethinking

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[155] *See* Goss, *supra* note 36, at 1435.

[156] One estimate has been that plant breeders earn most of the profit from a new variety in its first five years. *See id.* at 1434.

of the concept that underlies intellectual property law—that of an original or new creation by a transformative individual. It is not likely that such deep structural flaws will soon be addressed by lawmakers, private interests, or the public. However, given the fragility of global plant genetic diversity, and the inability of seed companies to market diversity,[157] it is essential that a system emerge which controls and preserves genetic diversity.

CONCLUSION

Intellectual property law in the international context continues to inadequately address the legitimate concerns of developing countries and indigenous communities about control of their natural and cultural resources. In the area of plant genetic resources, intellectual property has established a system that treats plant germplasm as a free good, and that same germplasm which is then inserted into plant varieties as a commodity deserving of property right protection. There are several consequences of this policy: the continuing dependence of developing countries on developed countries; the threat of increasing genetic uniformity among plants and crops and of decreasing global genetic diversity as corporations mass market uniform, high-yield seeds; and the consolidation of private ownership of seeds that form the basis of the global food supply. The debate is over how to weigh public and private rights and wealth. The solution thus far has been to tip the scale in favor of free trade and corporate capital. This policy has serious ramifications, as well as distributive inequities, that affect not only capital and resources, but also genetic diversity and the viability of the world's plants. At the very least, the formulators of intellectual property law in the field of plant genetic resources must make renewed efforts to protect the public domain. In part, this means protecting the plant genetic diversity that is our common heritage by de-

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[157] Tilford writes:

> Seed companies cannot market diversity. To protect investment, the seed industry must have intellectual property protections. To receive protection under the current intellectual property system, seed companies must develop uniform products, a task made easier through biotechnology. To financially gain from these uniform products, the seed industry must then pursue the obvious strategy of mass production of products for a public willing to buy them. . . . Perversely, therefore, the agricultural industry must follow the typical formula for market success, it must do so by eroding the very pedestal upon which its success is built.

See Tilford, *supra* note 55, at 444.

creasing the strong intellectual property protections corporations have been granted.

LARA E. EWENS