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In the Aftermath of the "Terminator" Technology Controversy: Intellectual Property Protections for Genetically Engineered Seeds and the Right to Save and Replant Seed

by

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IN THE AFTERMATH OF THE "TERMINATOR" TECHNOLOGY CONTROVERSY: INTELLECTUAL PROPERTY PROTECTIONS FOR GENETICALLY ENGINEERED SEEDS AND THE RIGHT TO SAVE AND REPLANT SEED

Abstract: *Throughout history, farmers have engaged in the practice of saving seed from each harvest to use in planting the following year's crop. This practice, however, has been a significant concern for those developing new varieties of seed. The "terminator" technology was developed to prevent the saving and replanting of genetically engineered seeds by blocking the germination of these seeds after one growing season. The terminator technology, however, caused worldwide controversy over the scope of intellectual property protections for genetically engineered seeds used in agriculture because farmers believed that seeds incorporating the terminator technology would interfere with the traditional and historical right to save and replant seed. This Note argues that use of the terminator technology in genetically engineered seeds would be an effective way to enforce existing intellectual property protections and that public property doctrines would fail to recognize a common law right to save and replant seed.*

INTRODUCTION

Advancements in the genetic engineering of plants important to agriculture and the proliferation of the sale of genetically engineered seeds have created unique problems for seed developers interested in protecting their biological innovations.[1] The seed by its very nature presents an enormous biological obstacle to seed developers—when a farmer plants a genetically engineered seed, the seed will produce a plant that will in turn produce more genetically engineered seed.[2] Seed developers have been concerned that they spend enormous amounts of time and financial resources in developing genetically en-

[1] *See* Frederick H. Buttel & Jill Belsky, *Biotechnology, Plant Breeding, and Intellectual Property: Social and Ethical Dimensions, in* OWNING SCIENTIFIC AND TECHNICAL INFORMATION, VALUE AND ETHICAL ISSUES 110, 110 (Vivian Weil & John W. Snapper eds., 1989).

[2] *See* R.C. Lewontin, *The Maturing of Capitalist Agriculture: The Farmer as Proletarian*, MONTHLY REV., July 1, 1998, at 72.

gineered crop varieties, yet farmers are allowed to use the seeds harvested from these crops in future seasons without paying for them.[3]

On March 3, 1998, the United States Patent and Trademark Office granted Patent No. 5,723,765, titled "Control of Plant Gene Expression," jointly to the United States Department of Agriculture ("USDA") and the Delta and Pine Land Co. ("D&PL") for a technology that blocks genetically altered seeds from germinating after one season.[4] This new technology, officially named the "Technology Protection System," provides the ability to genetically alter seeds so that the crops produced from these seeds will in turn bear sterile seeds.[5] This innovation has been nicknamed the "terminator" technology by critics, due to the fact that it results in a cessation of a plant's reproduction process.[6] Seeds that incorporate the terminator technology would look and grow like normal seeds—the only difference is that the seeds would lack germination capabilities.[7] Although there are legal protections in the United States available to seed developers interested in preventing farmers from saving genetically engineered

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[3] *See* Nigel Hawkes, *War on Killer Seed*, TIMES (London), Nov. 4, 1998, at 20.

[4] *See* "Control of Plant Gene Expression," U.S. Patent No. 5,723,765; Danielle Knight, *Science-Rights: New Seed Technology Threatens Farmers*, INTER PRESS SERVICE, Mar. 31, 1998, *available in* 1998 WL 5986450; Bill Lambrecht, *Critics Vilify New Seed Technology that Monsanto May Soon Control—"Terminator" Would Prevent Saving Seeds by Making them Sterile*, ST. LOUIS POST-DISPATCH, Nov. 1, 1998, at A1. The patent for this technology is enormous in scope—it covers all seeds and could be incorporated into the seeds of all major crops. *See* Leora Broydo, *A Seedy Business: A New "Terminator" Technology Will Make Crops Sterile and Force Farmers to Buy Seed More Often—So Why Did the USDA Invent It?*, MOJO WIRE (Apr. 7, 1998) <http://www.motherjones.com/news_wire/broydo.html>.

[5] *See* Danielle Knight, *Environment: U.S. Biotech Giant Patents on "Terminator Technology,"* INTER PRESS SERVICE, Oct. 19, 1998, *available in* 1998 WL 19901054.

[6] *See* M. Ahmed, *Terminator III*, BUSINESS STANDARD, May 22, 1998, at 6. The name "terminator" was coined by Patrick Mooney of Canada, who is the executive director of the Rural Advancement Foundation International ("RAFI"). Lambrecht, *supra* note 4, at A1. RAFI often criticizes genetic engineering technologies and efforts by American companies to export the United States system of patent protection around the world. *See id.* Indeed, RAFI was very much opposed to the terminator technology. *See* Ricarda A. Steinbrecher & Patrick Mooney, *Terminator Technology: The Threat to World Food Security*, THE ECOLOGIST, Sept. 1, 1998, at 276.

[7] *See* Bob Williams, *"Terminator Technology" Could Curtail Brown-Bagging*, NEWS & OBSERVER (Raleigh, NC), Nov. 8, 1998, at B7. The new technique consists of inserting an array of new genes into a plant that, when sprayed with a chemical compound, turns off a "blocker" switch that normally allows the plant's seeds to be fertile. *See* Curt Anderson, *Discord Grows over Plant Patents—Sterile Seeds Protect Biotechs, Irk Farmers*, SAN DIEGO UNION-TRIB., May 24, 1998, at A8. Seeds with the terminator technology would produce crop bearing plants, but the seeds produced by the plant would not able to germinate because the "blocker" gene would not work. *See id.*

seeds, use of the terminator technology would enforce these legal protections.[8]

News of the terminator technology, however, sparked heated controversy around the globe.[9] Farmers planting seeds incorporating the terminator technology would have to return to the commercial seed market every year because they would no longer be able to save seed from their harvests to plant the following year's crop.[10] As a result, farmers would be unable to retain and replant the best seeds from their crops and would be precluded from the traditional practice of creating locally-adapted seed varieties.[11] Thus, farmers perceived the terminator technology as interfering with a traditional and historical right to save and replant seed.[12] As such, the terminator technology raised concerns over the scope of intellectual property protections for genetically engineered seeds.[13]

On October 4, 1999, in response to the widespread international opposition of the terminator technology, the company planning to acquire D&PL, Monsanto Co. ("Monsanto"),[14] declared that it would never commercialize the terminator seed technology.[15] Monsanto also

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[8] *See* Hawkes, *supra* note 3, at 20.

[9] For example, in October 1998, at the World Bank in Washington, D.C., scientists and farm economists in the Consultative Group on International Agriculture, which is the world's largest agriculture research network, voted to condemn the technology and prohibit it in their projects. *See* Lambrecht, *supra* note 4, at A1. In August 1998, India's agriculture minister told the Indian Parliament that he had banned the importation of seeds containing the terminator technology because of concerns that it would harm the country's agriculture. *See* Knight, *supra* note 5. In May 1998, the United Nations Conference of the Parties to the Convention on Biological Diversity directed its scientific body to examine the technology's impact on farmer's and biodiversity, and recommend that the "precautionary principle" be applied to the new technology. *See id.*

[10] *See* Knight, *supra* note 5. Fears about the terminator technology were especially prevalent in developing countries, as a vast majority of the world's farmers still collect their best seeds each year and replant them the following year. *See* John Vidal, *World Embraced For Terminator 2,* THE GUARDIAN, Oct. 6, 1999, *available in* 1999 WL 25735652.

[11] *See* Knight, *supra* note 5.

[12] *See* Frank Furhig, *Hasta La Vista Baby—Terminator Is Gone For Now, But It Could Be Back,* ST. J. REG. (Springfield, IL), Oct. 10, 1999, at 55.

[13] *See id.*; Bill Lambrecht, *"Terminator" Genes Render Seeds Sterile—Farmers No Longer Could Save Them for Next Year—U.S. Government Helped Develop It,* ST. LOUIS POST-DISPATCH, Apr. 19, 1998, at A1.

[14] Monsanto was inundated with protests to the terminator technology despite the fact that it has neither developed the technology nor held the patent for it at the time of the announcement. *See The Transgenic Scare,* TIMES (India), Oct. 13, 1999, *available in* 1999 WL 28425544. The public was aware, however, the Monsanto had been set to acquire D&PL, which was enough to ignite worldwide protest against Monsanto. *See id.*

[15] *See* Samuel K. Moore, *Terminating the Terminator,* CHEMICAL WEEK, Oct. 13, 1999, at 9; Yves Savidan, *Terminator Genes: Fertility Rights,* THE ECONOMIST, Oct. 9, 1999, at 104. At the

announced that it would not license the technology to other companies, but indicated that the company may use it internally for research.[16] Although Monsanto has promised to abandon any commercial use of the terminator technology, this does not foreclose other companies from using a similar seed sterilization technology in the future.[17]

This Note examines whether use of the terminator technology or a similar sterilization technology would have expanded intellectual property protections for genetically engineered seeds. Additionally, this Note examines whether public property doctrines could recognize a common law right to save and replant seeds. Part I of this Note explores the development of the seed industry and genetically engineered seeds in modern agriculture.[18] Part II discusses how the legal protection of intellectual property rights in genetically engineered seeds can vary depending on whether the seed is subject to a patent, protected by the Plant Variety Protection Act or sold through a licensing agreement, and analyzes the effect that the terminator technology would have on existing intellectual property protections available under United States law.[19] Part III introduces and examines the application of the various forms of public property rights that could enable farmers to claim a right to save and replant seed.[20] Finally, Part IV discusses the balancing of competing values, interests and policy considerations in the context of intellectual property protections for genetically engineered seeds.[21]

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time the announcement was made, Monsanto's Chief Executive Officer explained that "Though we do not own any sterile seed technology, we think it is important to respond . . . by making clear our commitment not to commercialize gene protection systems that render seed sterile." *See* Savidan, *supra*, at 104.

[16] *See* Moore, *supra* note 15, at 9.

[17] *See* Savidan, *supra* note 15, at 104. For example, one company has developed a seed sterilization technology called the "verminator" technology. *See Zeneca Pits Verminator Against Terminator*, ECONOMIC TIMES, Aug. 27, 1998, *available in* 1998 WL 16762266. Like the terminator technology, the verminator technology would render second generation seeds sterile. *See id.* The only difference between the two technologies is in the particular genes that are altered. *See id.* The verminator technology incorporates a rat gene into a plant seed to render seeds infertile. *See id.*

[18] *See infra* notes 22–55 and accompanying text.

[19] *See infra* notes 56–151 and accompanying text.

[20] *See infra* notes 153–213 and accompanying text.

[21] *See infra* notes 214–39 and accompanying text.

I. Genetically Engineered Seeds in Modern Agriculture

A. *A Brief History of the Development of the Seed Industry*

Establishing a secure supply of food, both in quality and safety, has been one of the primary driving forces in the world since the beginning of humankind.[22] Guided by this impetus, farmers throughout the centuries have selected varieties of seeds containing the most desirable characteristics each planting cycle in order to plant in subsequent cycles.[23] As a result, the genomic composition of seed varieties has been directly influenced by human intervention, rather than through Darwinian natural selection.[24]

Historically, the United States has lacked much in the way of native plant genetic resources for use in agriculture.[25] Accordingly, American agriculture has relied on access to and the use of plants introduced into the United States from foreign countries.[26] The infusion of new crop genetics, whether carried by immigrant farmers or brought in by plant explorers working for the government, provided the basis for the development of American agriculture and the American seed industry.[27] Thus, most of the major crops grown in the United States are not indigenous to North America.[28]

Until about a decade ago, a majority of the development of crop and seed throughout the world was accomplished mainly through

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[22] *See* Karen Lehman & Al Krebs, *Control of the World's Food Supply, in* The Case Against the Global Economy and For a Turn Toward the Local 122, 123 (Jerry Mander & Edward Goldsmith eds., 1996).

[23] *See* Danielle Knight, *Agriculture: Agro-Giants Expand "Terminator" Seed Technology,* Inter Press Service, Feb. 10, 1999, *available in* 1999 WL 5946975.

[24] In *The Origin of Species,* Charles Darwin argued that present species of life had evolved from ancestral species and proposed a mechanism for this evolution, which he termed "natural selection." *See* Neil A. Campbell, Biology 399 (4th ed. 1996). Natural selection involves the interaction between the environment and the variability that is present in any population, resulting in environmental factors favoring some characteristics over others and these favored traits being disproportionately represented in the next generation. *See id.* at 407. Artificial selection occurs when humans, rather than the environment, select the individuals with the desired breeding characteristics. *See id.* The genomic composition of modern crops has been largely the result of artificial selection. *See id.*

[25] *See* Neil D. Hamilton, *Who Owns Dinner: Evolving Legal Mechanisms for Ownership of Plant Genetic Resources,* 28 Tulsa L.J. 587, 607 (1993).

[26] *See id.* Many American staple crops originated in other areas of the world, such as corn, wheat, soybeans and potatoes. *See id.* Plants indigenous to the United States include blueberries, cranberries, sunflowers, pecans, and black walnuts. *See id.* at 607–08.

[27] *See id.* at 607.

[28] *See* Buttel & Belsky, *supra* note 1, at 113.

governmental occupation.[29] In the United States, plant research entered the governmental realm with the establishment of the USDA in the mid-nineteenth century.[30] In conjunction with the nation's land grant colleges and local agricultural organizations, the USDA guided the development and testing of new varieties of seed and distributed these seeds to farmers free of charge.[31] Through this governmental influence, the practice of saving and trading seed in the agricultural community became commonplace in order to develop new seed varieties.[32]

Seed development and research began to shift from the public realm to the private sector with the development of hybridization during the early twentieth century.[33] In 1908, George Shull developed the method of hybridization in order prevent farmers from saving seed and allow breeders to capitalize on their development of new varieties of seed.[34] Breeding plants through the hybridization process involves selecting and reproducing plants with favorable characteristics while rejecting plants with undesirable traits.[35] Using hybrid crosses between various inbred lines, seed developers can sell seed that produces hybrid plants, but which in turn does not reproduce hybrids.[36]

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[29] *See* Rick Weiss, *Seeds of Discord; Monsanto's Gene Police Raise Alarm on Farmers' Rights, Rural Tradition*, WASH. POST, Feb. 3, 1999, at A1.

[30] *See* Buttel & Belsky, *supra* note 1, at 113.

[31] *See* Weiss, *supra* note 29, at A1.

[32] *See id.*

[33] *See* Buttel & Belsky, *supra* note 1, at 114. The private seed industry began during the middle of the nineteenth century, when a small private seed trade revolving around vegetables and flowers for home gardeners emerged. *See id.* at 113.

[34] *See* Steinbrecher & Mooney, *supra* note 6, at 276.

[35] *See id.*

[36] *See* Lewontin, *supra* note 2, at 72. Hybrid seed varieties, of which corn is probably the most prominent, have the distinct characteristic of not being able to maintain its vigor in the next generation. *Id.* Hybrid seeds result from the interbreeding of two distinct and distant parental lines of the same plant species. *See* Steinbrecher & Mooney, *supra* note 6, at 276. The hybrid seeds that are produced will incorporate and express the desired genetic traits of each parental line. *See id.* The offspring of these hybrid plants, however, will not express the desirable genetic qualities of the parent hybrid seeds. *See id.* Thus, the second generation are not true hybrids, resulting in plants with a loss of yield and increased variability. *See* Lewontin, *supra* note 2, at 72. The hybrid vigor is not transmitted to the next generation, because undesirable recessive genes combine, and their unwanted trait becomes expressive. *See id.* As a result of the substantial profits made by seed developers in the sale of hybrid corn seed, the hybrid method has been applied to other crops, such as cotton, sunflowers and tomatoes. *See id.*

The hybrid method, however, cannot be applied to many seed innovations. *See id.* First, the method cannot be made economically workable in many important crops like soybeans and wheat. *See id.* Second, although the hybrid method has been successful for increases in general yield, specific characteristics of a plant are not able to be incorporated

Farmers producing crops from hybrid plants must purchase new seed each year.[37]

The traditional system of mainly governmental seed development changed significantly with legislation passed by Congress during the twentieth century that encouraged the growth of the private seed industry. For example, Congress enacted legislation in 1924 that ended the free federal distribution of seeds to farmers and forced farmers to rely on varieties offered by private seed companies.[38] Additionally, the Plant Patent Act of 1930 and the Plant Variety Protection Act of 1970 encouraged the trend towards the privatization of the seed industry by providing intellectual property protections for seed developers.[39] Furthermore, Congress passed legislation in the 1980s that encouraged federal agencies to cooperate more closely with the private-sector.[40] Private seed companies have been able to generate substantial profits by selling seeds that were developed in conjunction with the government.[41]

B. *The Introduction of Genetically Engineered Seeds to Modern Agriculture*

In recent years, advances in the genetic engineering of plants have revolutionized the agriculture industry.[42] Scientists in both the government and private industry have expended considerable effort to understand more about the genetics of the plants important to agriculture and how to use genetic engineering to improve agricultural quality and productivity.[43] Genetic engineering has made it possible to snip, insert and recombine genes in order to edit and reprogram the genetic makeup of plants.[44]

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into the seed through the hybrid method. *See id.* Third, the hybrid method is restricted by the incompatibility of some plants that possess appealing characteristics with plants that are desired to be cultivated. *See id.*

[37] *See* Lewontin, *supra* note 2, at 72.

[38] *See* Buttel & Belsky, *supra* note 1, at 113.

[39] *See id.* at 115–16.

[40] *See* Weiss, *supra* note 29, at A1.

[41] *See id.* For instance, the terminator technology was developed by D&PL in conjunction with the USDA. *See supra* note 4 and accompanying text.

[42] *See* David Ehrenfeld, *A Techno-Pox Upon the Land (Negative Side-effects of the Green Revolution and Agricultural Genetic Engineering)*, HARPER'S MAG., Oct. 1, 1997, at 13.

[43] *See* CAMPBELL, *supra* note 24, at 390.

[44] *Id.* at 411. The cells of plants have proven easier to genetically engineer than the cells of many animals, because an adult plant can be regenerated from a single cell grown in tissue culture. *Id.* at 410. Commercially important plants that have been grown from single cells include alfalfa, asparagus, cabbage, carrots, citrus fruits, potatoes, sunflowers, tobacco and tomatoes. *Id.*

Even with modern advances in genetic engineering, however, the altering of plant genomes has been a challenging endeavor.[45] The process of cloning plant DNA is generally straightforward, but identifying particular genes of interest often proves to be very complex and time-consuming.[46] The basic concept behind genetic engineering is to take a desirable gene from one species and insert the gene into another species where it presumably will continue to have the desired effect.[47] This is often not the case, however.[48] Gene expression can change when a gene encounters a new genetic and cellular environment and result in the expression of previously-suppressed undesirable traits.[49] Furthermore, many agriculturally desirable plant traits, such as high crop yield, are extremely difficult to engineer genetically because they involve multiple genes.[50]

Despite these difficulties, many crops important to agriculture have been successfully genetically engineered, mostly in cases where the desired traits are determined by one or only a few genes.[51] As a result of these scientific successes, the genetic engineering of agriculturally important crops has grown from a young science to a hot business since the first genetically engineered seeds were introduced into

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In order to genetically engineer plant cells, molecular biologists commonly use one of two methods. *See id.* For some crops, such as corn, scientists insert genes into a single cell using a DNA particle gun that fires .22 caliber plastic bullets tipped with tiny metal pellets coated with DNA. *See id.* For other crops, such as cotton and soybeans, genes are carried into the target cell through the use of a common soil bacteria (*Agrobacterium tumefaciens*). *See id;* Nelson Antosh, *Seeds of Change—Genetically Engineered Crops Will Be Planted in More Fields than Ever,* HOUS. CHRON., Jan. 18, 1998, at 1. Taking advantage of the capacity to regenerate whole plants from these single cells, plants then are grown from these genetically engineered cells that contain and express the inserted gene. *See* CAMPBELL, *supra* note 24, at 390.

[45] *See* CAMPBELL, *supra* note 24, at 390.

[46] *See id.*

[47] *See* Ehrenfeld, *supra* note 42, at 13.

[48] *See id.*

[49] *See id.* To alleviate the concerns of bioengineering in the United States, three federal agencies share responsibility for setting policies and regulating new developments in genetic engineering: the USDA, the Environmental Protection Agency ("EPA") and the Food and Drug Administration ("FDA"). *See* Judith E. Beach, *No "Killer Tomatoes": Easing Federal Regulation of Genetically Engineered Plants,* 58 FOOD & DRUG L.J. 181, 181 (1998). In the absence of legislation enacted with the specific intent of providing a federal agency or agencies with the authority to regulate genetically engineered organisms, these three federal agencies have taken the position that the existing laws are sufficient for the regulation of genetically engineered organisms. *See id.* Pursuant to existing laws, the USDA, EPA and FDA have promulgated stringent regulations and have established policies providing specific guidelines for the regulation of genetically engineered organisms. *See id.*

[50] *See* CAMPBELL, *supra* note 24, at 390.

[51] *See id.* at 390–91.

the commercial seed market.[52] In 1998, approximately 50% of U.S. cotton fields, 40% of soybean fields and 20% of corn fields were grown with genetically engineered seeds.[53] Farmers have made the decision to plant genetically engineered seeds despite the high price of the seed compared to traditional varieties.[54] Indeed, genetically engineered seeds appear to be changing the agricultural landscape as we embark upon the new century.[55]

II. Use of the Terminator Technology to Enforce Intellectual Property Protections for Genetically Engineered Seeds

The development of genetically engineered crops and the proliferation in the sale of genetically engineered seeds have raised concerns for seed developers interested in protecting their biological innovations.[56] The saving and replanting of seed by farmers has caused significant concern because seed developers have spent enormous amounts of time and financial resources to develop these genetically engineered crop varieties.[57] Thus, intellectual property protections are important to seed developers because they safeguard the investments made in developing new varieties of genetically engineered seeds.[58]

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[52] *See* Scott Kilman & Susan Warren, *Food: Old Rivals Fight for New Turf,* Wall Street J., May 27, 1998, at B1.

[53] *See id.*

[54] *See* Antosh, *supra* note 44, at 1. In addition to the price charged for genetically engineered seeds, some seed companies have charged "technology fees" to recover the substantial research costs of developing genetically engineered seeds. *See* Heather Scoffield, *Monsanto Draws Fire from Farmers—Patent Protection Tactics Controversial,* Globe & Mail (Toronto), Aug. 23, 1999, at B3. Other companies, however, have built their research costs into the price of genetically engineered seed. *See id.*

[55] Genetically engineered seeds have had a substantial impact on agriculture despite the warning of United States Supreme Court Chief Justice Warren E. Burger in 1980 "that genetic research and related technological developments may spread pollution and disease, that it may result in a loss of genetic diversity, and that its practice may tend to depreciate the value of human life." Diamond v. Chakrabarty, 447 U.S. 303, 316 (1980). Chief Justice Burger suggested that "it is sometimes better 'to bear those ills we have than fly to others that we know not of.'" *Id.*

[56] *See* Buttel & Belsky, *supra* note 1, at 110.

[57] *See* Hawkes, *supra* note 3, at 20; Lewontin, *supra* note 2, at 72.

[58] *See infra* Part II.A.

A. *Intellectual Property Protections*

When an individual expends intellectual power which results in the creation of a new entity, such as genetically engineered seed, a distinct property interest arises in that creation that is separate and independent from physical ownership of that entity.[59] In the absence of common law or statutory rights, however, an inventor's property rights are limited to the physical entity that embodies the expenditure of intellectual power.[60] As a result, others can freely imitate these inventions.[61]

The creation of statutory intellectual property rights has been the legal answer to protect those who have expended considerable amounts of time and energy in the creation of new varieties of seeds.[62] Intellectual property law restrains the free use and disposition of property and vests in the creator the recognition of property rights in the creation.[63] In this sense, what makes inventions or creations valuable is not their specific physical embodiment, but rather the intellectual protection of the physical embodiment.[64] Indeed, the inventions or creations that are most appealing to intellectual property protection are those that are easily duplicated.[65]

The creation of statutory intellectual property rights is provided for in the United States Constitution, which grants Congress the power "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[66] The first legislation in the United States to grant intellectual property rights to plant breed-

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[59] *See* D.F. Libling, *The Concept of Property: Property in Intangibles*, 94 L.Q. REV. 103, 104 (1978).

[60] *See* Cheney Brothers v. Doris Silk Corp., 35 F.2d 279, 280 (1929), *cert. denied*, 281 U.S. 728 (1930).

[61] *See id.*

[62] *See* Buttel & Belsky, *supra* note 1, at 113. Intellectual property is defined broadly as "a category of intangible rights protecting commercially valuable products of the human intellect." BLACK'S LAW DICTIONARY 813 (7th ed. 1999).

[63] *See* Keith Aoki, *Authors, Inventors and Trademark Owners: Private Intellectual Property and the Public Domain*, 18 COLUM.–VLA J.L. & ARTS 191, 266 (1994).

[64] *See id.*

[65] *See* Keith Aoki, *The Stakes of Intellectual Property Law*, in THE POLITICS OF LAW 265 (David Kairys ed., 3rd ed. 1998).

[66] U.S. CONST, art. I, § 8, cl. 8. The first legislation implementing this provision, passed in 1790, granted patent rights for mechanical inventions. *See* Yoder Brothers, Inc. v. California-Florida Plant Corp., 537 F.2d 1347, 1377 (5th Cir. 1976), *cert. denied* 429 U.S. 1094 (1976).

ers was the Plant Patent Act ("PPA"), enacted by Congress in 1930.[67] The PPA granted "the right to exclude others from asexually reproducing the [patented] plant or selling or using the [patented] plant so reproduced."[68] The purpose behind the enactment of the PPA was to "afford agriculture, so far as practicable, the same opportunity to participate in the benefits of the patent system as has been given to industry, and thus assist in placing agriculture on a basis of economic equality with industry."[69] In promulgating the PPA, Congress alleviated two concerns that were previously thought to preclude plants from being applicable to patent law: first, the belief that plants were products of nature and therefore not subject to patent protection; and second, that plants were not considered amenable to the "written description" requirement of patent law.[70]

The PPA only provides protection for asexual varieties of plants, which are plants reproduced through propagation or grafting.[71] The PPA, however, does not provide protection for sexual varieties of plants, which are plants grown from seed.[72] Thus, the PPA does not provide protection for genetically engineered seeds as these seeds are produced from sexual varieties of plants. The original rationale for restricting patent protection to asexually reproduced plants under the PPA was the belief that new plant varieties could not be reproduced reliably by seed.[73]

In order to address the need for protecting intellectual property rights in sexually reproduced plants, Congress enacted the Plant Variety Protection Act ("PVPA") in 1970.[74] As such, the PVPA provides one method of intellectual property protection for seed developers to pro-

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[67] *See* Imazio Nursery, Inc. v. Dania Greenhouses, 69 F.3d 1560, 1563 (9th Cir. 1995) (citing S. REP. No. 315, 71st Cong., 2d Sess. 3 (1930)). At least as early as 1892, legislation was proposed to grant plant breeders patent rights for their inventions. *See id.* at 1562 (citing H.R. REP. No. 5435, 52d Cong., 1st Sess. (1892)). Patent protection for plants was supported by many prominent individuals, including Thomas Edison, who stated that "[n]othing that Congress could do to help farming would be of greater value and permanence than to give to the plant breeder the same status as the mechanical and chemical inventors now have through the law." *See id.* at 1563 (citing S. REP. No. 315, 71st Cong., 2d Sess. 3 (1930)).

[68] *See* 35 U.S.C. § 163 (1994).

[69] *See Imazio*, 69 F.3d at 1563 (citing S. Rep. No. 315, 71st Cong., 2d Sess. 3 (1930)).

[70] *See id.*

[71] *See* 35 U.S.C. § 161; *see also* CAMPBELL, *supra* note 24, at G3 (defining asexual reproduction).

[72] *See* 35 U.S.C. § 161; *see also* CAMPBELL, *supra* note 24, at G27 (defining sexual reproduction).

[73] *See Imazio*, 69 F.3d at 1566.

[74] *See* 7 U.S.C. § 2581 (1994).

tect genetically engineered seeds. The PVPA provides patent-like protection to sexually reproduced plant varieties which parallels the protection afforded asexually reproduced plant varieties under the PPA.[75] The PVPA was enacted "to encourage the development of novel varieties of sexually reproduced plants and to make them available to the public, providing protection available to those who breed, develop, or discover them, and thereby promoting progress in agriculture in the public interest."[76]

The PVPA is administered by the Plant Variety Protection Office ("PVPO"), which is operated through the USDA.[77] The PVPO is charged with the task of issuing certificates of protection to breeders who apply for protection for their innovations.[78] The certificate grants the breeder "the right, during the term of the plant variety protection, to exclude others from selling the variety, or offering it for sale, or reproducing it, or importing it, or exporting it, or using it in producing (as distinguished from developing) a hybrid or different variety therefrom."[79] Anyone violating the rights granted by the PVPA certificate can be sued for infringement.[80] The protection provided by a PVPA certificate lasts for a period of twenty years.[81] The PVPA has played a significant role in encouraging the development of seed breeding in the private-sector due to its cost-effectiveness and ease of application.[82]

The protections available under the PVPA are restricted, however, by two significant limitations: the "research exemption"[83] and the "crop exemption."[84] The "research exemption" allows other breeders to use a protected seed variety in order to create new varie-

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[75] *See* Asgrow Seed Co. v. Winterboer, 513 U.S. 179, 181 (1995).

[76] *See* H.R. REP. No. 1605, 91st Cong., 2d Sess., 84 Stat. 1542 (1970).

[77] *See* 7 U.S.C. §§ 2321, 2323.

[78] *See id.* § 2481. A plant variety must meet four requirements to qualify for PVPA protection: the variety must be 1) novel, 2) distinct, 3) uniform, and 4) stable. *See id.* § 2402(a). The applicant for the certificate must provide a description which is as "complete as is reasonably possible" and which also includes breeding procedures and genealogy. *See id.* § 2422. Furthermore, the applicant must make a deposit of the seed for viability testing. *See id.*

[79] *See id.* § 2483(a)(1).

[80] *See id.* § 2541.

[81] *See id.* § 2483(b).

[82] *See* Neil D. Hamilton, *Why Own the Farm If You Can Own the Farmer (and the Crop)?: Contract Production and Intellectual Property Protection of Grains*, 73 NEB. L. REV. 48, 95 (1994). Since the passage of the PVPA in 1970, the USDA has issued over two thousand PVPA certificates. *See id.*

[83] *See* 7 U.S.C. § 2544.

[84] *See id.* § 2543.

ties of the seed without the permission of the PVPA certificate holder.[85] The "crop exemption" allows farmers to save seed from crops grown from a PVPA protected variety of seed and use the seed without compensating the owner of the protected variety.[86] Since the enactment of the PVPA, the crop exemption has caused controversy between farmers and the seed industry.[87] Although the crop exemption was included in the PVPA to allay fears that the legislation would burden farmers—and ultimately consumers—with increased costs, it was not intended to give farmers unlimited disposition to save and sell protected varieties.[88]

In 1995, in *Asgrow Seed Co. v. Winterboer,* the United States Supreme Court held that a farmer who met the requirements of the crop exemption provision could engage in "brown-bag" sales of protected seed for reproductive purposes only and could sell only as much seed as he had saved for the purpose of replanting his own farm.[89] In *Asgrow,* the plaintiff was the holder of PVPA certificates that protected two varieties of soybean seed it had developed.[90] The defendants operated a farm and raised these protected varieties, selling brown-bagged versions of the seed to other farmers.[91] The defendants

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[85] *See id.* § 2544.

[86] *See id.* § 2543.

[87] *See, e.g., Asgrow,* 513 U.S. 179 (farmer was engaged in sale of protected seeds varieties to other farmers under the auspice of the crop exemption); Delta & Pine Land Co. v. Peoples Gin Co., 694 F.2d 1012 (5th Cir. 1983) (non-profit agricultural cooperative stored seed from farmers harvest and distributed the protected seed based on the crop exemption).

[88] *See Delta & Pine,* 694 F.2d at 1015–16.

[89] *See Asgrow,* 513 U.S. at 192. A "brown-bag" sale derives its name from the process in which farmers purchase seed from a seed company, plant the seed in their own fields, harvest the crop, clean it and then sell the reproduced seed to other farmers in non-descriptive brown bags. *See id.* at 181. Although brown-bag sales of protected seed varieties may seem insignificant, the aggregate effect of these sales can significantly decrease a seed company's profits. *See* Hamilton, *supra* note 25, at 632. One example of the substantial effect that brown-bag sales can have on seed developers occurred in 1990, when Pioneer Hi-Bred International ceased production of its red winter wheat variety in Kansas when it discovered that only eight percent of the variety grown there had been raised from seed actually purchased from Pioneer, with the illegal brown-bag market accounting for the rest of that variety grown. *See* Hamilton, *id.* at 632 n.142 (citing Brief for Pioneer Hi-Bred International, Inc., as amicus curiae, Asgrow Seed Co. v. Winterboer, 982 F.2d 486 (8th Cir. 1992)).

[90] *See id.* at 181.

[91] *See id.* at 181–82. The defendants' sales were significant: during 1990, they planted 265 acres of the protected soybean and sold the entire saleable crop of 10,529 bushels to others for use as seed—enough to plant 10,000 acres. *See id.* at 182. Due to a concern that the defendants were deriving substantial profits out of selling the protected soybean seed varieties, Asgrow sent an agent to their farm and subsequently determined that the defendants were indeed selling Asgrow's protected soybean variety. *See id.* at 182. As a result,

did not dispute that they had engaged in sales of seed grown from protected varieties, but rather argued that these sales were allowed under the crop exemption of the PVPA.[92] The Supreme Court, however, held that a farmer who meets the requirements as set forth in the crop exemption provision may sell for reproductive purposes only as much seed as he has saved for the purpose of replanting his own fields.[93]

Recognizing the adverse effect of brown-bag sales on the seed industry, Congress narrowed the provision for sale of seed in the crop exemption.[94] Farmers now only may sell seed "for other than reproductive purposes," which includes selling seed as a food product or animal feed, but not for planting of new crops.[95] Thus, sales similar to those of the defendants in *Asgrow* are not allowed by the crop exemption, regardless of the amount sold.

In addition to the PVPA, utility patents provide another means of intellectual property protection for genetically engineered seeds.[96] Utility patents provide protection for "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[97] The purpose of granting patent rights to inventors is to reward inventors for their contribution to "the useful Arts" in exchange for their making the invention and providing public disclosure of the invention.[98]

The Patent and Trademark Office ("PTO"), part of the Department of Commerce, is responsible for the issuing of patents.[99] Utility patents grant inventors a limited monopoly to make, use, offer for sale or sell an invention throughout the United States.[100] Any person violating the rights of a patent holder can be sued for infringement.[101]

Asgrow sued the defendants, seeking damages and a permanent injunction to keep them from selling the protected variety of seed. *See id.* at 182.

[92] *See id.* at 183–84.

[93] *See Asgrow*, 513 U.S. at 192.

[94] *See* Plant Variety Protection Act Amendments of 1994, Pub. L. No. 103–349, 108 Stat. 3142, 3144 (1994). The Supreme Court decided *Asgrow* shortly after the 1994 amendment of the crop exemption, but before the effective date of the amendment. *See Asgrow*, 513 U.S. at 184 n.2.

[95] *See* 7 U.S.C. § 2543 (1994).

[96] *See* 35 U.S.C. § 101 (1994).

[97] *See id.*

[98] *See* Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1022 (1989).

[99] *See* 35 U.S.C. § 1.

[100] *See id.* § 154.

[101] *See id.* § 271(b).

Upon satisfying the requirements imposed by the Patent Act,[102] the scope of protection that utility patents provide can be quite expansive. For instance, under the "doctrine of equivalents," patentees are protected from imitations of their inventions.[103] Additionally, patentees are protected from inventors who independently come up with the same invention.[104] Patents provide the inventor with protection for their inventions for a period of twenty years from the date of filing for the patent.[105]

Utility patent protection for living inventions was first recognized in 1980 in *Diamond v. Chakrabarty*, where the United States Supreme Court held that living bacteria were patentable subject matter.[106] In *Chakrabarty*, a microbiologist sought to patent a bacterium that he invented which was useful for cleaning oil spills because of its capacity to break down crude oil.[107] The patent examiner allowed patent claims for the method of producing the bacteria and the process for application of the bacteria, but rejected the claim for patenting the bacteria itself on the ground that microorganisms are "products of nature" and therefore not patentable under the statute.[108] In deciding the case, the Supreme Court reasoned that the bacteria sought to be patented were "a product of human ingenuity 'having a distinctive name, character [and] use,'" and were not naturally occurring living matter.[109] Thus, the Court held that genetically altered living organisms were patentable as "manufactures" or "compositions of matter" because human agency—through genetic engineering techniques—effectively disqualified these organisms from being considered naturally occurring.[110] As a result, *Chakrabarty* established that the relevant distinction in patent law is not between animate and inanimate objects, but rather between products of nature and products of human effort.[111]

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[102] To receive a patent, an inventor must prove several elements in regard to their invention: the invention must be (1) useful, (2) novel and (3) non-obvious. *See id.* §§ 101, 103(a). Additionally, upon issue of a patent, the patent holder must provide sufficient information to enable "others skilled in the art" to create the invention. *See id.* §§ 111, 112.

[103] *See* Warner-Jenkinson Co. v. Hilton Davis Chemical Co., 520 U.S. 17 (1997).

[104] *See* MARTIN J. ADELMAN ET AL., CASES AND MATERIALS ON PATENT LAW 860–61 (1998).

[105] *See* 35 U.S.C. § 154(a)(2).

[106] *See* 447 U.S. 303, 310 (1980).

[107] *See id.* at 305.

[108] *See id.* at 305–06.

[109] *See id.* at 309–10 (quoting Hartranft v. Wiegmann, 121 U.S. 609, 615 (1887)).

[110] *See id.*

[111] *See* 447 U.S. at 313.

The *Chakrabarty* decision greatly expanded the number of subjects for patentability.[112] Additionally, in 1985, in *Ex Parte Hibberd,* the Patent and Trademark Office Board of Appeals ruled that the principles of *Chakrabarty* could be extended to allow the patenting of genetically engineered plants, seeds and plant tissue.[113] In *Hibberd,* the patent applicant sought a utility patent for maize plants that had been genetically engineered to contain increased levels of free tryptophan, an amino acid.[114] The patent examiner argued that because Congress enacted two "plant-specific" statutes—the PPA and the PVPA—to provide specific intellectual property protection for plant breeders, the intent of Congress was to exclude plants from utility patent protection.[115] The board of appeals, however, found there was no express congressional intent indicating that the PPA and PVPA should preempt utility patent protection for plants.[116] The board of appeals determined that Congress enacted the plant-specific acts out of concern that plants would not qualify for patent protection, not because Congress thought plants were inherently unpatentable.[117] Thus, the board of appeals concluded that genetically engineered plants, seeds and plant tissue were patentable subject matter.[118] As a result of the *Hibberd* decision, genetically engineered seed varieties became eligible for utility patents.[119] Thus, seed developers responded to the *Hibberd* decision by applying for patent protection for their genetically engineered plants.[120]

In addition to utility patent and PVPA protection, licensing agreements provide intellectual property protection for genetically engineered plants. It is currently standard practice in the seed industry for a farmer who wishes to purchase genetically engineered seeds to sign a contract ("Technology Use Agreement") with a seed com-

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[112] *See* Hamilton, *supra* note 82, at 91.

[113] *See* 227 U.S.P.Q. 443, 443, 447–48 (Pat. Off. Bd. App. 1985).

[114] *See id.* at 443.

[115] *See id.* at 444.

[116] *See id.* at 445. The Board found that Congress originally enacted the PPA in 1930 to combat two obstacles that plant breeders faced in obtaining intellectual property protection: 1) that plants were considered unpatentable "products of nature," and 2) that it was difficult for new plant varieties to satisfy the "written description" requirement of patent law. *See id.* at 445. Additionally, the Board stated that when Congress enacted the PVPA, it believed that "it [did] not alter protection currently available within the patent system." *See id.* at 445 (quoting S. REP No. 1246 at 3 (1970)).

[117] *See id.* at 446.

[118] *See Hibberd,* 227 U.S.P.Q. at 443, 448.

[119] *See id.* at 443, 448.

[120] *See* Hamilton, *supra* note 82, at 91.

pany in which rights are relinquished to seeds produced by the crop.[121] Through licensing agreements, farmers not only agree to refrain from selling seed from the crop to other farmers (i.e. "brown-bagging"), but more importantly, are prohibited from using the seed harvested from a crop in subsequent growing seasons.[122] Thus, licensing agreements restrict the use of genetically engineered seeds to a single growing season.[123] Furthermore, farmers who purchase genetically engineered seed under licensing agreements must return to the seed company the next season if they desire to continue production of those varieties.[124] Seed developers engaged in the sale of genetically engineered seeds are able to use licensing agreements to gain better protection than the PVPA or utility patents can offer.[125]

To insure compliance with the licensing agreements, seed developers have hired investigators to search out violators.[126] Nonetheless, farmers have breached their licensing agreements, either through replanting or brown-bagging licensed varieties.[127] Fear of legal action, however, prevents many farmers from breaching the terms of their licensing agreements.[128]

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[121] *See* Lewontin, *supra* note 2, at 72; Weiss, *supra* note 29, at A1.

[122] *See* Lewontin, *supra* note 2, at 72.

[123] *See id.*

[124] *See id.* For example, Monsanto requires that purchasers of its Roundup Ready seeds agree to use them only once. *See id.* To ensure that the seeds are only used once, Monsanto includes a provision in the licensing agreement giving Monsanto the right for three years after the purchase of the seed to enter and test a producer's farm in order to determine whether Monsanto-grown seed had been planted. *See* Weiss, *supra* note 29, at A1.

[125] *See* Lewontin, *supra* note 2, at 72.

[126] For instance, Monsanto hires full-time Pinkerton investigators in the United States and retired Mounted Police in Canada to deal with a growing caseload of violators. *See* Weiss, *supra* note 29, at A1.

[127] *See* Lewontin, *supra* note 2, at 72. Monsanto has reached hundreds of settlements with farmers who have violated the terms of licensing agreements. *See* Weiss, *supra* note 29, at A1. Many of these settlements have been in the range of tens or hundreds of thousands of dollars each. *See id.*

[128] *See* Lewontin, *supra* note 2, at 72. Monsanto has placed full-page advertisements in popular farming magazines in an effort to prevent farmers from unlawfully using its product:

> When a farmer saves and replants Monsanto patented biotech seed, he understands that what he is doing is wrong. And that, even if he did not sign an agreement at the time he acquired the seed, he is committing an act of piracy. . . . Furthermore, seed piracy could cost a farmer hundreds of dollars per acre in cash settlements and legal fees, plus multiple years of on-farm and business records inspection.

B. *The Effect of the Terminator Technology on Existing Intellectual Property Protections*

Genetically engineered seeds have created unique problems for innovators interested in protecting the intellectual property rights embodied in their inventions. The seed presents seed developers with a simple biological obstacle—when a farmer plants a seed of a desirable variety, the seed will produce a plant that will produce more seed of the particular variety.[129] Thus, when a farmer plants a genetically engineered seed, the seed company has provided the farmer with a free good—the altered genetic information contained in the seed—which the farmer reproduces again and again in the practice of farming.[130] Without intellectual property protections or a method to prevent farmers from saving seed, the innovator of the genetically engineered seed loses ownership and control over its intellectual investment in the seed.[131]

Intellectual property protections—either through utility patents, the PVPA or licensing agreements—seek to restrict the free access and replication of genetically engineered seeds.[132] Indeed, with massive amounts of capital and research invested into the genetic engineering of plants, seed developers have made considerable efforts to prevent "seed piracy" and to protect the intellectual property rights in the agricultural products that they have created.[133] The existing intellectual protections, however, are not without deficiencies and have thus presented enforcement limitations for seed developers.

First, seeds pose significant problems for patent protection. Although the Supreme Court's decision in *Chakrabarty* allowed innovators to seek patent protection for genetically altered life forms,[134] seeds provide problems for utility patent property protection because of their ability to recreate themselves and provide the consumer with

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Id. Apparently, Monsanto has determined that the risk of alienating some farmers is compensated for by the benefit of being able to promise "a level playing field." *See* Weiss, *supra* note 29, at A1.

[129] *See* Lewontin, *supra* note 2, at 72.

[130] *See id.*

[131] *See id.*

[132] *See supra* notes 74–128 and accompanying text.

[133] For example, Monsanto estimates that it takes a period of ten years and about 300 million dollars to create commercial viable products of genetically engineered seeds. *See* Weiss, *supra* note 29, at A1. Additionally, Monsanto claims that for every new kind of engineered seed that makes it to field trials, 10,000 have failed somewhere along in the developmental process. *See id.*

[134] *See* 447 U.S. 303, 310 (1980).

a potentially unlimited supply of the patented seed. When a farmer purchases genetically engineered seed and plants this seed, the resulting plants produce more patented genetically altered seed. Thus, the farmer who plants seed gathered from a plant grown from a patented seed variety is in essence receiving a free "copy" of the patented variety of seed.

The question of whether farmers raising crops from patented seed are able to save or sell any of the crop for seeding purposes without infringing the patent is subject to debate.[135] According to the "first sale" doctrine of patent law, the right of the patentee to limit sales ends when the patented item is sold.[136] The first sale doctrine arguably could be applied to include patented varieties of seed sold to farmers, thus foreclosing seed developers from suing farmers for patent infringement when a farmer saves and replants patented varieties of seed.[137]

Seeds also pose significant problems to the PVPA, because of the crop exemption that allows farmers to save seed for subsequent growing seasons.[138] Although the crop exemption was amended to narrow its applicability, seed developers may continue to encounter difficulty recapturing their research and development investment for seed varieties protected under the PVPA.[139] While the main body of the PVPA grants developers of novel varieties of seeds the exclusive right to reproduce the variety, the crop exemption weakens this exclusive right by permitting farmers to save and plant seed produced from PVPA protected varieties without liability.[140] Farmers no longer are allowed to sell saved seed for reproductive purposes, but they still are allowed to use protected seed for replanting.[141] Thus, every time a farmer uses saved seed to replant their fields, the seed developers lose a potential sale of new seed. As such, the PVPA allows farmers to use protected varieties of seed every year, having paid for it only once with the initial

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[135] There are some scholars, however, who believe that because the Patent Act does not have a "crop exemption" like that of the PVPA and that farmers do not have a right to save seed under the Patent Act. *See, e.g.*, Peter J. Goss, *Guiding the Hand that Feeds: Toward Socially Optimal Appropriability in Agricultural Biotechnology Innovation*, 84 Cal. L. Rev. 1395, 1400 (1996); Hamilton, *supra* note 82, at 101.

[136] *See* Adams v. Burke, 84 U.S. 453, 456–57 (1873).

[137] *See id.*

[138] *See* 7 U.S.C. § 2543 (1994).

[139] *See* Hamilton, *supra* note 82, at 95.

[140] *See Delta & Pine*, 694 F.2d at 1016.

[141] *See* 7 U.S.C. § 2543.

purchase.[142] Indeed, the crop exemption appears to be at odds with the primary purpose of the PVPA.[143]

Furthermore, licensing agreements pose problems for seed developers who seek to reinforce the patent and PVPA protection available for seeds.[144] Although licensing agreements provide the benefit of overriding the "crop exemption" of the PVPA and the "first sale" doctrine of patent law, the effectiveness of these agreements is severely limited by the enormous monitoring costs that they demand.[145] Thus, licensing agreements are only as effective as the means to catch violators and as a result, the agreements provide protection only to the extent that they can be enforced.[146]

Considering the intellectual property protections available to seed developers and the problems with enforcing such protections, the terminator technology would be an extremely effective method of enforcing the intellectual property rights in genetically engineered seeds. In essence, the terminator technology would make concrete what seed developers have sought through licensing agreements. Currently, seed companies only offer genetically engineered seed varieties to farmers through licensing agreements.[147] Seed developers, through licensing agreements, have attempted to forbid the use of the licensed seeds in subsequent growing seasons and ensure that farmers pay each time they plant protected genetically engineered seed.[148] Seeds incorporating the terminator technology would bear plants that produce only sterile seeds, thereby limiting use of the seeds to one growing season.[149] Thus, seeds incorporating the terminator technology would eliminate the need to monitor farmers to enforce licensing agreements.[150] Furthermore, if farmers wanted to replant genetically engineered seed, the terminator technology would ensure that farmers compensated seed developers each time they plant protected genetically engineered seed.[151]

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[142] *See id.*

[143] *See Delta & Pine*, 694 F.2d at 1016.

[144] *See* Hamilton, *supra* note 82, at 92.

[145] *See supra* note 126 and accompanying text.

[146] For instance, although the computer industry has used licensing to enhance the patent and copyright protection of computer software, infringement of the licenses has been difficult to detect. *See generally*, Mark Lemley, *Intellectual Property and Shrinkwrap Licenses*, 68 S. CAL. L. REV. 1239 (1995).

[147] *See* Lewontin, *supra* note 2, at 72; Weiss, *supra* note 29, at A1.

[148] *See* Lewontin, *supra* note 2, at 72.

[149] *See* Knight, *supra* note 5.

[150] *See* Weiss, *supra* note 29, at A1.

[151] *See* Knight, *supra* note 5.

III. Analysis of the Claim of a Common Law Right to Save and Replant Seed

Although use of the terminator technology would enforce the intellectual property protections of seed developers, farmers have claimed that they have a right to save and replant seed.[152] Ever since humans began the transition from nomadic herders to farmers, saving seed for planting the following year's crop has been a basic tenet in the practice of agriculture.[153] By selecting seeds with the most desirable traits from each year's harvest, farmers perpetuate the desirable characteristics in the next generation of the seeds, such as increased yield and ability to resist disease.[154] Farmers view the practice of saving and replanting seed as a historical and traditional right.[155] Public property law rights are important because these rights could provide farmers with a common law claim to save and replant seed.[156]

A. *Public Property Rights*

Property law affects the rights and relationships among people with respect to the control, use and transfer of valued resources.[157] The law of property determines both the allocation and scope of interests in these resources.[158] Property rights involve many different kinds of interests and social contexts.[159] As such, the extent of legal protection varies depending on the interest being protected and the context in which social conflict about the interest arises.[160] Property rights, however, are not absolute.[161] Ownership of property does not entitle a person to sole control and use of the property in total exclusion of others.[162] Rather, property is more properly characterized as containing a number of distinct rights.[163] These rights include the

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[152] *See* Furhig, *supra* note 12, at 55.

[153] *See* Laurent Belsie, *Plants Without Seeds Challenge Historic Farming Practices*, Christian Sci. Monitor, July 30, 1998, at B4.

[154] *See* Ahmed, *supra* note 6, at 6.

[155] *See* Furhig, *supra* note 12, at 55.

[156] *See infra* Part II.B.

[157] *See* Joseph William Singer, Property Law: Rules, Policies, and Practices xli (1997).

[158] *See id.*

[159] *See id.* at xlii.

[160] *See id.*

[161] *See* Jesse Dukeminier & James E. Krier, Property 86 (3d ed. 1993).

[162] *See id.*

[163] *See id.*

right to possess, the right to use, the right to exclude and the right to transfer.[164]

Public property rights can greatly limit private ownership of an entity and can be significant in scope.[165] The common law of property in the United States defines many instances requiring access to property be shared among many parties, even though a formal agreement between the parties is lacking.[166] In certain circumstances, the legal system allows the general public as a whole to possess a property interest in privately owned entities.[167] In many instances, rights of access to property are shifted after a period of shared use.[168] In other instances, non-owners are given access to private property, regardless of any previous use.[169]

One example of a public property right is a prescriptive easement.[170] In most states, the public is able to obtain a prescriptive easement in land under a claim of right through its long continuous use.[171] To meet the requirements of a prescriptive easement, the owner of the property must be put on notice that an adverse right of possession is being claimed by the general public.[172] The extent of the property rights that the public acquires under a prescriptive easement claim depends on the magnitude of the adverse use.[173]

Another example of a public property right is the public trust doctrine.[174] The public trust doctrine recognizes a public right of access to private property in order to effectuate the need for public use

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[164] *See id.*

[165] *See infra* notes 170–85 and accompanying text.

[166] *See* Joseph William Singer, *The Reliance Interest in Property*, 40 STAN. L. REV. 611, 665 (1987).

[167] *See infra* notes 170–85 and accompanying text.

[168] *See* Singer, *supra* note 166, at 665.

[169] *See id.*

[170] One instance of where a public prescriptive easement could be claimed is for a privately owned road that has been under a long continuous use by the public. Thus, in Rockefeller Center in New York City, to prevent a public prescriptive from being claimed in a publicly used, but privately owned roadway, the street is closed for all uses for one day each year in order to break the long continuous use by the public. *See* DUKEMINIER & KRIER, *supra* note 161, at 826 n.14.

[171] *See* DUKEMINIER & KRIER, *supra* note 161, at 826.

[172] *See id.*

[173] *See* Singer, *supra* note 166, at 669.

[174] *See, e.g.*, Leydon v. Town of Greenwich, 57 Conn. App. 712 (2000) (applying public trust doctrine to provide noninhabitants of the Town of Greenwich access to its public parks and beaches); Matthews v. Bay Head Improvement Ass'n, 471 A.2d 355 (N.J. 1984) (applying public trust doctrine to give nonresidents both access to and use of privately owned dry sand areas).

of the property.[175] The public trust doctrine has been applied in states that contain seacoast, where the availability of coastal beaches for public use is a matter given considerable importance.[176] The premise of the public trust doctrine is that "the ownership, dominion and sovereignty over land flowed by tidal waters, which extend to the mean water mark, is vested in states in trust for the people."[177] The public trust doctrine is based on the belief that fundamental things in nature—such as air, running water, the ocean and the seashore—are common to humankind, and thus, access to these things cannot be forbidden.[178]

A further example of a public property right is the doctrine of customary rights.[179] The doctrine of customary rights grants the public an interest in private property where the public has relied both on access to the property in the past and on the private owners having allowed such use in the past.[180] In a few jurisdictions, courts have applied the doctrine of customary rights in beaches used by the public.[181] In these situations, the public is granted a customary right to use the beaches if the public has used the beach and the dry sand area subject to private ownership for so long that "the memory of man runneth not to the contrary."[182]

In addition to public prescriptive easements, the public trust doctrine and customary rights, a common law public property right is

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[175] *See* Singer, *supra* note 166, at 674.

[176] *See* DUKEMINIER & KRIER, *supra* note 161, at 826. Although the dry sand portion of beaches bordering the ocean is subject to private ownership, the public trust doctrine has been enlarged to give access to the public and use of privately-owned dry sand area as reasonably necessary. *See Matthews*, 471 A.2d at 365.

[177] *See Matthews*, 471 A.2d at 358.

[178] *See id.* at 360.

[179] In 1969, in *State ex rel. Thorton v. Hay*, the Oregon Supreme Court applied the doctrine of customary rights to property in that state, holding that after years of use by the public, a public property right had been acquired for recreational use of previously privately owned coastal beaches in the state. *See* 462 P.2d 671, 677–78 (Or. 1969). In *Thorton*, the court applied the doctrine of customary rights to protect the public's interest in property where the public had relied both on prior access to the beach property and on the private owners' acquiescence in allowing such use of the property. *See id.* at 678. Thus, the court found that the public had used the coastal beaches for generations, and that as a result, the public had a customary right to use the beaches. *See id.* at 677–78.

[180] *See Thorton*, 462 P.2d at 677.

[181] *See, e.g.*, City of Daytona Beach v. Tona-Rama, Inc., 294 So.2d 73 (Fla. 1974) (holding that the general public could continue to use the dry sand area for recreational purposes because rights had been granted through customary use); Matcha v. Mattox, 711 S.W.2d 95 (Tex. Civ. App. 1986) (holding that public had acquired a right of use in beaches even though a hurricane had moved the natural line of vegetation).

[182] *See Thorton*, 462 P.2d at 677.

recognized where the public has acted in reliance of access to certain private properties.[183] The doctrine of public reliance is premised on the belief that private property owners have an obligation to allow access to their property when they have opened their property to others on prior occasions.[184] The obligation to open private property to non-owners is done to effectuate public policy considerations.[185]

An additional example of a public property right is the community property claim. A community property right based on a long established relationship, however, has never been recognized in the United States.[186] In 1980, in *Local 1330, United Steel Workers of America v. United States Steel Corp.*, the United States Court of Appeals for the Sixth Circuit rejected a claim for community property rights derived from a long established relationship between the community and the corporation.[187] In *Local 1330,* the plaintiffs, who were employees of the defendant steel corporation, sought to force the defendant either to keep operating two plants it planned on closing or to sell these plants to the plaintiffs.[188] The defendant steel corporation had operated in the area for almost seventy years, becoming a dominant factor in the lives of its thousands of employees and their families, and an institution in the life of the city where the plants were located.[189] The plaintiffs asserted that a long-standing relationship was in existence between the community and the corporation from which a property right had been created.[190] The court concluded, however, that there was no legal authority that recognized a community property right arising from the long established relationship between the community and the corporation.[191]

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[183] *See* Singer, *supra* note 166, at 676.

[184] *See id.* at 675. Thus, in 1971, in *State v. Shack,* the Supreme Court of New Jersey held that a farm owner who employed migrant farm workers and let them live on his land could not prevent these farm workers from having guests. *See* 277 A.2d 369, 374 (N.J. 1971). The court reasoned implicitly that the farm owner had functionally relinquished part of his right to exclude others from his property once he had opened his property to the migrant farm-workers. *See id.* The court stated that the right of access in this case rested on the fundamental rights of the farm workers and their relative vulnerability. *See id.* at 374–75. Thus, the court created a public property interest by which the farm workers were allowed to receive guests on the private property of the farm owner. *See id.* at 374.

[185] *See* Singer, *supra* note 166, at 675.

[186] *See, e.g.*, Local 1330, United Steel Workers v. United States Steel Corp., 631 F.2d 1264 (6th Cir. 1980) (rejecting a claim of community property rights).

[187] *See id.* at 1279–82.

[188] *See id.* at 1265–66.

[189] *See id.* at 1265.

[190] *See id.* at 1280.

[191] *See Local 1330,* 631 F.2d at 1282.

B. *The Application of Public Property Doctrines to Claim a Right to Save and Replant Seed*

Currently in the United States there is no legislative codification that recognizes the inherent right of farmers to save seed.[192] At first glance, the crop exemption of the PVPA may appear to represent the codification of the "historical and traditional right of small farmers" to save seed.[193] This, however, is not the case.[194] Although the title of the PVPA crop exemption of the PVPA reads "*Right* to save seed; crop exemption,"[195] the Supreme Court has stated explicitly that the crop exemption of the PVPA "does not, as that title claims and the ensuing text says, reserve any '[r]ight to save seed'—since nothing elsewhere in the Act remotely prohibits the saving of seed."[196]

In the context of the terminator controversy, it was claimed that seed is a common resource of all humankind and thus, farmers have an inherent right to save and replant seed.[197] Indeed, farmers' rights in seeds have been thought of as "an expression of the contribution of farming communities to their innovative capacity as breeders, users and managers of biodiversity."[198] Although the present genetic makeup of most life forms was determined by nature, farmers have contributed greatly to the genetic makeup of crops through the selection of the best seeds in each generation of crop.[199] The principal legal argument made in opposition to the terminator technology is that it would take away the inherent right of farmers to save seed for future plantings.[200] To recognize the right to save and replant seed, however, requires the acknowledgement of a property interest in the right to save and plant seed that is harvested.

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[192] *See, e.g.*, Asgrow Seed Co. v. Winterboer, 513 U.S. 179, 186 (explaining that the PVPA "does not, as that title claims and the ensuing text says, reserve any '[r]ight to save seed'—since nothing elsewhere in the Act remotely prohibits the saving of seed.").

[193] *See* Asgrow Seed Co. v. Winterboer, 795 F. Supp. 915, 918 (N.D. Iowa 1991), *rev'd*, 982 F.2d 486 (8th Cir. 1992), *rev'd*, 513 U.S. 179 (1995).

[194] *See Asgrow*, 513 U.S. at 186.

[195] *See* 7 U.S.C. § 2543 (1994) (emphasis added).

[196] *See Asgrow*, 513 U.S. at 186.

[197] *See* Devinda Sharmer, *The Demon Seeds: From the U.S. Comes the Terminator, A Seed That Will Become Sterile After Just One Crop—As Seed Companies Prepare to Reap a Windfall, Who Will Protect the Farmer?*, BUS. LINE, July 24, 1998, *available in* 1998 WL 12718092.

[198] *See id.*

[199] *See supra* note 23–24 and accompanying text. One commentator has argued that farmers should have the right to benefit from their direct influence on the biological resources of agriculture, and that the "right to save, exchange and improve seeds is, therefore, inalienable." *See* Sharmer, *supra* note 197.

[200] *See* Sharmer, *supra* note 197.

A common law property right for farmers to save seed is difficult to recognize under any of the public property doctrines because these doctrines traditionally are limited in application only to instances involving real property.[201] For instance, prescriptive easements have been applied to give the public access to land,[202] the public trust and customary rights doctrines have been applied to give the public access to beaches,[203] and the reliance doctrine has been applied to require owners to open access to real property where the public has relied on access in the past.[204] In order for a property interest in the right to save and replant seed to be protected under the umbrella of any of the public property doctrines, these doctrine would need to be expanded significantly to included personal property, as well as real property.[205]

Even if the public property doctrines were expanded to cover personal property as well as real property, many of these doctrines require the property to have been used by the public for long periods of time.[206] For instance, a prescriptive easement requires a long continuous use of property by the public,[207] the doctrine of customary rights requires the public use of a property for so long that "the memory of man runneth not to the contrary",[208] and the reliance doctrine requires access to private property where non-owners have relied on access to the property in the past.[209] In the United States, the long continuous practice of saving seed and planting in subsequent growing seasons has been severely restricted through both the use of hybrid seed varieties and the modern use of license agreements for genetically engineered seed.[210]

Finally, the creation of a common law right to save and replant seed neglects the fact that there is a lack of precedent to create such a

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[201] *See supra* Part III.A.

[202] *See supra* notes 170–73 and accompanying text.

[203] *See supra* notes 174–82 and accompanying text.

[204] *See supra* notes 183–85 and accompanying text.

[205] Although these public property doctrines could be judicially expanded to include seeds used in agriculture, these rights would only be able to be enforced on a state-by-state common law basis.

[206] *See supra* Part III.A.

[207] *See supra* notes 170–73 and accompanying text.

[208] *State ex rel. Thorton v. Hay*, 462 P.2d 671, 677 (Or. 1969).

[209] *See supra* notes 183–85 and accompanying text.

[210] *See supra* notes 33–37, 121–25.

right.[211] As was the case in *Local 1330, United Steel Workers v. United States Steel Corp*, there appears to be no constitutional, legislative or judicial authority to create a common law property right based on the contribution of farmers to the genetic makeup of modern crops.[212] As such, the assertion that farmers have an inherent right to save seed appears tenuous at best.[213]

IV. The Balancing of Competing Values, Interests and Policy Considerations in the Context of the Terminator Technology

The formidable issue that the terminator technology brought to the forefront of the bioengineering debate today is the notion that the claim of a right to save and replant seed is not compatible with the private monopoly control of intellectual property rights.[214] Indeed, the advocacy of farmers' rights seeks to end the inequality in the current recognition and reward systems that favor intellectual property inventions over the contributions of farmers to the genetic resources available in crops today.[215] As such, recognizing the impact the farmers have had on the genomic development of the crops would require a significant change in the existing property laws of the United States.[216]

In determining whether to adopt changes to existing property laws, the changes should not be implemented if they are restrictive and add nothing to the social welfare.[217] If the changes are restrictive but contribute some benefit to the social welfare of society, however, the advantages and disadvantages of the proposed changes must be weighed against each other to determine whether such actions should be taken.[218] Although this approach may not furnish a precise guide, it provides an approach that addresses questions of social values, while respecting the notion of private property.[219] Thus, in order to determine whether a farmer's right to save and replant seed should be en-

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[211] *See, e.g.*, Asgrow, 513 U.S. at 186 (explaining that the PVPA "does not, as that title claims and the ensuing text says, reserve any '[r]ight to save seed'—since nothing elsewhere in the Act remotely prohibits the saving of seed.").

[212] *See* 631 F.2d 1264, 1282 (6th Cir. 1980).

[213] *See id.*

[214] *See* Sharmer, *supra* note 197.

[215] *See* M.S. Swamninathan, *The Hindu-Editorial: Giving the Farmer His Due*, The Hindu, Aug. 23, 1998, *available in* 1998 WL 15912460.

[216] *See supra* Part III.B.

[217] *See* 1 Richard Powell, The Law of Real Property 33, 34 (1949).

[218] *See id.*

[219] *See id.*

forced over a seed developer's intellectual property rights, we must balance the competing values, interests and policy considerations in the context of genetically engineered seeds. In doing so, we must decide which interests to protect and which interest to leave unprotected.[220]

First, changing the law to recognize a common law right of farmers to save and replant seed acknowledges the contributions that farmers have made to the genomic composition of crops. Farmers throughout history have selected seeds from crops having the most desirable characteristics from each planting cycle to use in future planting cycles.[221] The history of American seed development by the importation and cultivation of both indigenous and non-domestic seed varieties suggests that all farmers should have full and open access to crop genetics.[222]

Additionally, recognizing a common law right to save and replant seed guarantees that farmers continue this traditional and historical practice in agriculture. Saving seed to use in planting the following year's crop has been a basic tenet in the practice of agriculture since humans began farming.[223] Recognition of a common law right to save and replant seed would guarantee that farmers "have the ability to fine tune seed quality to the agroclimatic characteristics of their fields."[224]

Furthermore, recognition of a common law right to save and replant seed also protects farmers against seed developers. Any technology that provides the ability to genetically alter seeds so that the crops produced from these seeds will in turn bear sterile seeds has significant potential for abuse. Indeed, farmers feared that seed developers would offer only seeds incorporating the terminator technology.[225] Recognizing a common law right to save and replant avoids the potential inequities of farmers being forced to purchase seed each planting season.

Recognizing a common law property right to save and replant seed, however, makes intellectual property protections in this area

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[220] *See* Singer, *supra* note 166, at 648.

[221] *See* Knight, *supra* note 23.

[222] *See* Hamilton, *supra* note 25, at 608.

[223] *See* Belsie, *supra* note 153, at B4.

[224] *See* Ahmed, *supra* note 6, at 6.

[225] Seed developers have claimed that they would not force any farmer to purchase genetically engineered seeds with the terminator technology and that farmers will be free to save traditional seeds if they prefer. *See* Knight, *supra* note 23.

insignificant. The Supreme Court's decision in *Diamond v. Chakrabarty* opened the doors for patent protection of genetically altered life forms.[226] Additionally, the decision in *Ex parte Hibberd* specifically allowed for the patenting of plants.[227] Recognizing a common law right to save and replant seed establishes a system of intellectual property protection in the United States that is strong in theory, but unenforceable in practice. The very purpose of intellectual property protections is to restrain the free use and disposition of property.[228] Without the protection of intellectual property laws, anyone who purchases bioengineered seed is free to grow more seed for there own use or to sell to other farmers.[229] In fact, farmers who save and replant bioengineered seed are likely to reap greater economic benefits therefrom than the seed developers, since farmers are not burdened with the costs incidental to the development of the invention.

Recognizing a common law right to save and replant seed also diminishes the incentive seed developers have in developing new varieties of seed. With massive amounts of capital and research invested into the genetic engineering of plants, seed developers have made considerable efforts to prevent "seed piracy" and to protect the intellectual property rights in the agricultural products that they have created.[230] Unless seed developers receive compensation in some form from farmers receiving a continuous supply of genetically engineered seed by perpetual replication, seed developers can only hope to reap the rewards of their investment in research and development if they are allowed to restrict free access.[231] It is only natural that companies that have invested millions of dollars in developing new technologies will want to take whatever steps necessary to enforce the intellectual property rights in genetically engineered seeds. Seed developers have little motivation to introduce a product in a market where it is inevitable that the product will be pirated.[232] Without the ability to efficiently enforce intellectual property protections, it simply may be easier and perhaps more cost effective not to introduce the genetically engineered seed.[233] In this regard, the availability of statutory

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[226] *See* 447 U.S. 303, 310 (1980).

[227] *See* 227 U.S.P.Q 443, 443, 447, 448 (Pat. Off. Bd. App. 1985).

[228] *See* Aoki, *supra* note 63, at 266.

[229] *See* Cheney Brothers v. Doris Silk Corp., 35 F.2d 279, 280 (1929), *cert. denied,* 281 U.S. 728 (1930).

[230] *See supra* note 133 and accompanying text.

[231] *See* Buttel & Belsky, *supra* note 1, at 110.

[232] *See supra* note 127 and accompanying text.

[233] *See supra* note 127 and accompanying text.

intellectual property protections are meaningless when the protections are easily violated. As paradoxical as it may sound, the terminator technology actually may enhance access to seeds, rather than restrict it, by encouraging seed developers to develop new varieties of seed that might otherwise never have come into existence had protections been difficult to enforce. Indeed, proponents of the terminator technology claimed that it would promote research on staple crops, especially those crops that companies were discouraged from investing in because they were unprofitable.[234]

Critically, recognizing a common law right to save and replant seed ignores the fundamental teaching of property law that the right to exclude others is the very essence of property.[235] As such, patents have been long considered a species of property.[236] In this regard, seed developers should "be able to assume that they may control, for purposes beneficial to themselves, what they have discovered and appropriated to their own use, what they have created by their own effort and what they have acquired under the existing social and economic order."[237] Incorporating the terminator technology into genetically engineered seeds to serve as technological barrier is analogous to the use of the hybridization method in seeds.[238] Much like the terminator technology, the hybrid method was developed to prevent farmers from saving seed and allow breeders to capitalize on their development of new varieties of seed.[239] As farmers have had to decide whether hybrids were worth the cost of purchasing each year, they would have to decide if genetically engineered seeds incorporating the terminator technology are worth the cost of purchasing new seed each year.

Thus, in balancing the competing values, interests and policy considerations in the context of the terminator technology, the intellectual property rights of seed developers should be favored over any claimed right to save and replant seed. As long as seed companies offer traditional varieties of seed that do not have seed sterilization technology, farmers will be allowed to continue the traditional and

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[234] *See* Knight, *supra* note 5.

[235] *In re* Etter, 756 F.2d 852, 859 (Fed. Cir. 1985).

[236] *See* Brown v. Duchesne, 60 U.S. (19 How.) 183, 197 (1856) ("For, by the laws of the United States, the rights of a party under a patent are his private property"); *cf.* Consolidated Fruit-Jar Co. v. Wright, 94 U.S. 92, 96 (1876) ("A patent for an invention is as much property as a patent for land").

[237] ROSCOE POUND, AN INTRODUCTION TO THE PHILOSOPHY OF LAW 192 (1922).

[238] *See* Vidal, *supra* note 10, at 4.

[239] *See* Steinbrecher & Mooney, *supra* note 6, at 276.

historical practice of saving and replanting seed. If farmers use genetically engineered seed, the terminator technology or a similar sterilization technology in genetically engineered seed would allow seed developers to prevent seed piracy, would allow for the enforcement of existing intellectual property rights and would maintain the economic incentives for seed developers in producing new genetically engineered seed varieties.

Conclusion

In the practice of farming, saving seed has been a basic tenet in order to use the seed to plant the following year's crop. The introduction of the terminator technology, however, threatened to end this traditional and historical practice. Farmers planting seeds with the terminator technology would be forced to return to the commercial seed market every year since the seed produced from crops with the terminator technology would be infertile. Accordingly, the terminator technology triggered a debate over the scope of property interests in genetically engineered seeds.

Advocacy of the right of farmers to save and replant seeds conflicts with the current reward and recognition systems that favor intellectual property inventions over the rights of the original cultivators of modern agriculture. Additionally, recognizing a public property right in seeds would require the common law public property doctrines be expanded significantly. Furthermore, although it may be argued that the terminator technology would expand the scope of intellectual property protections of genetically engineered seeds, the technology merely enforces what seed developers have attempted to accomplish through licensing agreements.

The use of the terminator technology or a similar sterilization technology in genetically engineered seed would allow seed developers to prevent seed piracy and control what they have created through their own effort. Additionally, it would allow for the enforcement of existing intellectual property rights and maintain the incentives in producing new genetically engineered varieties of seed. As long as traditional varieties of seed are offered without seed sterilization technology, seed companies should be free to restrict access to their biological innovations.

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