Genetic Use Restriction Technology: How Far Should We Go to Protect Intellectual Property Rights?

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Introduction

Scientists have developed technology that allows them an unprecedented level of control over the genetic makeup of plants. Traditionally, humans have been able to change the genetic traits of domesticated plants, usually employing this method on crops, by selectively mating individual plants that possess desirable traits. Using current technology, we can identify individual sequences of genetic code that control favorable traits, physically extract those DNA fragments, and insert them into a different organism's genome.[1] Scientists can now transfer genetic material between organisms of different species and even between plants and animals. [2]

This process results in the creation of genetically modified organisms (GMOs), which are plants or animals that have had genetic material introduced into their genome.[3] GMOs have made corps resistant to drought, resistant to pests, and increased overall harvest yields.[4] However, the potential consequences of using GMOs have raised significant concerns.

This article focuses on exploring the benefits and harms that might result from implementing genetic use restriction technology (GURT) in the agriculture industry; also called "terminator" technology.[5] Plants with GURTs are a specific subset of GMOs. In GURT plants, the genetically modified (GM) trait renders the plants' progeny sterile, so growers must

[1] *Genetically Modified Foods and Organisms*, HUMAN GENOME PROJECT INFORMATION, http://www.ornl.gov/sci/techresources/Human_Genome/elsi/gmfood.shtml (last visited January 2, 2013).
[2] *Id.*
[3] *Id.*
[4] *Id.*
[5] Robert Shapiro, Is Monsanto Going to Develop or Sell "Terminator" Seeds?, MONSANTO, http://www.monsanto.com/newsviews/Pages/terminator-seeds.aspx (last visited January 2, 2013).

constantly buy new seed from the manufacturer.[6] This article focuses on evaluating whether we should use GURTs in the agricultural industry or not and begins by considering some of its potential environmental effects.

Environmental and Biological Effects of GURTs

The Prevention of Genetic Drift

GURTs potentially greatest benefit is their ability to prevent GMOs from mating with wild plant species.[7] There is great concern that GM plant species are able to mate with their wild type counterparts and pass on their genetic material to naturally occurring species.[8] This transfer of genetic material from a GMO into the genome of another plant is called "genetic drift."[9] If left uncontrolled, genetic drift could result in GM traits entering the environment and possibly mutating or hybridizing to produce "subsequent generations [of plants] with unforeseen properties."[10] Undesirable weed species might be able to adopt GM traits such as drought or pest resistance (an example of genetic drift), creating concerns about a "super-weed."[11] Opponents argue that such "super-weeds" could out-compete wild species for available resources, leading to the extinction of certain non-GM plants.[12]

The use of GURTs may reduce the possibility or amount of harm resulting from genetic drift involving GMOs.[13] Advocates of terminator technology hope that the technology can

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[6] *Id.*
[7] *See* David Daniel, *Seeds of Hope: How New Genetic Technologies May Increase Value to Farmers, Seed Companies, and the Developing World,* 36 RUTGERS COMPUTER & TECH. L.J. 250, 285 (2010).
[8] Stuart Smyth, *Liabilities and Economics of Transgenic Crops*, 20. Nat. Biotechnol. 537, 537 (2002).
[9] Richard Repp, *Biotech Pollution: Assessing Liability for Genetically Modified Crop Production and Genetic Drift*, 36 Idaho L. Rev. 585, 587 (2000).
[10] Jason A. Barron, *Genetic Use Restriction Technologies: Do the Potential Environmental Harms Outweigh the Economic Benefits?*, 20 GEO. INT'L ENVTL. L. REV. 271, 286 (2008).
[11] Daniel, *supra* note 7, at 263.
[12] *Id.*
[13] *Id.* at 285.

prevent genetic drift at the source. GURTs ensure that modified genes cannot enter the wild type gene pool because all GM plant progeny would be sterile.[14] They argue that even if GM plants were to fertilize wild species, the GURT sequence in the GM plants would be passed on to the resulting generation and would stop any further spread of modified genetic material.[15] Furthermore, GURTs provide a way of limiting the spread of GM material on a genetic level. This inherent form of preventing gene transfer could prove far more effective than traditional methods. For example, buffering GM fields with plants that cannot crossbreed can limit genetic drift.[16] However, some species of plants are capable of spreading their genetic material "as far as twenty-one kilometers from the original plot."[17] Even when plants spread their genes much farther than could be physically prevented, GURTs would ensure that any progeny would be sterile; directly preventing any genetic drift.[18] So, GURTs could be an effective and beneficial way of limiting the potential environmental harms posed by GMOs.

However, GURTs may not be able to completely limit genetic drift, which reintroduces the serious concern about modified genes making their way into wild type populations in spite of the GURTs. Concerns have been raised about the effectiveness of GURTs in consistently producing sterile progeny.[19] One study shows that in reality only ninety percent of GURTs are successful in creating sterile progeny, with ten percent of plants capable of passing on the GM genetic material.[20] So, GURTs may be capable of limiting genetic drift, but it seems they cannot

[14] Barron, *supra* note 10, at 288.
[15] *Id.*
[16] *Id.* at 287.
[17] *Id.*; *See Why is Genetic Diversity Important? Why We Care About Genetics, Vol. 1,* National Forests Genetic Laboratory Genetic Resources Conservation Program, UCDAVIS, http://grcp.ucdavis.edu/projects/GeneticFactsheets/Vol_01_screen.pdf (last visited January 2, 2013).
[18] Barron, *supra* note 10, at 274.
[19] Daniel, *supra* note 7, at 286.
[20] *Id.*

entirely prevent it. This significantly reduces the environmental benefit of using GURTs to reduce genetic drift.

Furthermore, GURTs may actually create additional and independent environmental harms. Since GURTs are only about ninety percent effective, they may introduce the GURT sterility sequences themselves into wild type plant species.[21] There is concern that GURTs will be able to spread to wild species and cause a "generalized infertility."[22] Another potential problem is that the other genetic modifications in the GMO (such as pest resistance) would also be introduced into the wild population.[23] Some of the non-sterile progeny may pass on its GM traits sexually, reducing its potential benefit of preventing genetic drift. However, GURT "supporters argue that this result is impossible, since sterile plants cannot pass on their genetic traits."[24]

Furthermore, there is the potential for natural instances of genetic mutation or recombination to occur in GM crop fields.[25] "[I]t is possible that the terminator trait could be attached randomly, again producing unpredictable behavior and possibly decreasing the reproductive ability of natural species. This could ultimately lead to increases in extinction of native plant species or famine—the problem that many advances in seed technology have sought to alleviate."[26] Terminator technology has huge potential for limiting the environmental impact of GMOs by genetically blocking the sexual transmission of GM traits. GURTs may represent a potential strategy for preventing genetic drift, but there are some serious concerns about its overall benefit to the environment.

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[21] *Id.*
[22] *Id.*
[23] *Id.*
[24] *Id.*
[25] Barron, *supra* note 10, at 288.
[26] *Id.*

Reductions in Biodiversity

There is great concern that if GM plant species are able to reproduce in the wild, their genetic advantages will allow them to overtake native plant species.[27] Typically the genetic modifications made to GM plants make them more hardy and competitive than wild type species. Many GMOs are designed to be drought or pest resistant, which allows them to survive in environments where wild type plants cannot.[28] This can result in GMOs creating a decline in biodiversity by dominating ecological niches usually filled by the less vigorous and hardy wild type species.[29]

While the use of GURTs aims to limit adverse environmental impact, it may not succeed. GURTs may fail to prevent the spread of GM genes into wild populations, allowing for the GMOs to outcompete and eventually replace them.[30] Concern about the destruction of plant reproduction arises:

> Plants containing the terminator technology have the potential to cross-pollinate with other non-genetically engineered crops, resulting in genetic contamination. This genetic contamination could ultimately result in the unintended sterilization of open-pollinated or wild crops, effectively destroying plant reproduction entirely and threatening farmer independence.[31]

Thus, if GURTs are not able to prevent GM genetic drift, there is a serious potential for a harmful reduction in biodiversity. This reduction could be disastrous because the "reliance on a single crop of one genetic makeup may make the same crop more vulnerable to disease. If a plague wipes out this single crop, it can devastate a society."[32] The reduction of biodiversity is an

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[27] *See* Daniel, *supra* note 7, at 262.
[28] *See* James Ewing, *Agricultural Biotechnology: Is the International Regulation of Transgenic Agricultural Plants for the Birds (and the Bees)?*, 25 SUFFOLK TRANSNAT'L L. REV. 617, 634 (2002).
[29] *See* Daniel, *supra* note 7, at 262.
[30] *See Id.* at 286.
[31] Justin T. Rogers, *The Encroachment of Intellectual Property Protections on the Rights of Farmers,* 15 DRAKE J. AGRIC. L. 149, 161 (2010).
[32] Daniel, *supra* note 7, at 260.

issue related to GMO use in general, and GURTs have been put forth as a potential method of preventing vigorous GMOs from out-competing their wild type relatives. However, GURTs may not protect biodiversity and could even reduce biodiversity. The environmental effects of GURTs should be thoroughly explored before allowing their widespread use or concluding they are environmentally beneficial.

The Legal Role of GURTs: Protecting Intellectual Property Rights

GURTs as an Alternative to Costly Litigation

In line with a longstanding tradition, farmers will often save a portion of their best plants' seeds to sow the next year's crop.[33] This practice is called seed saving, but it is now considered "seed piracy" because farmers do not actually own the seed produced by their crop.[34] When GM seeds are patented, the owner has intellectual property rights over the genetic technology within each seed, i.e. the modified genetic traits.[35] When a farmer buys those GM seeds and harvests her crop, property laws dictate that the owner of the intellectual property rights has ownership of "any sequent seed produced by the harvest."[36] Thus, farmers must buy GM seeds from manufacturers every growing season because farmers are not allowed to save and plant seeds from a GM harvest (the second-generation seeds are owned by the manufacturer).[37]

In order to protect their commercial interests, companies must often assert their ownership of second-generation seed by suing farmers who infringe on their agricultural patents.[38] Large corporations, such as Monsanto, aggressively pursue lawsuits against infringing

[33] *See* Benjamin Ikuta, *Genetically Modified Plants, Patents, and Terminator Technology: The Destruction of the Tradition of Seed Saving*, 35 OHIO N.U. L. REV. 731, 731 (2009).
[34] Rogers, *supra* note 31, at 151.
[35] *Id*, at 150.
[36] *Id.*
[37] Barron, *supra* note 10, at 274.
[38] *See* Daniel, *supra* note 7, at 282.

farmers in order to protect their significant investment in the research and development of GMOs.[39] This strategy requires companies to find individual infringers and pursue them in court separately.[40] Likewise, farmers, activist groups, and government agencies can file lawsuits against seed manufacturers.[41] The result is that both parties must pay huge legal fees, and some farmers have been put out of business.[42]

GURTs may represent a solution to costly litigation by preventing rights infringements before they occur. If GM crops cannot produce fertile seeds, it is impossible for farmers to infringe GMO patents.[43] This alleviates the need for patent holders to legally protect their business interests, saving them money.[44] The surplus can then be reinvested in the company, and could potentially translate into lower seed costs to farmers. So, the use of GURTs may be a way of reducing costly litigation to farmers and patent holders.

Extralegal Enforcement of Intellectual Property Rights

The development of GURTs has created a dispute between a farmer's right to save seed and commercial property rights. Some argue that farmers have a right to save the seed from their harvest for planting the following year's crop.[45] There is a long tradition of saving seed, and some believe it is a "fundamental principle in agriculture" that ought to be protected.[46] However, there is no legal recognition of a farmer's right to save her seed.[47] Farmers cannot save GM seed

[39] *Id.*
[40] *See id.*
[41] *See id.*
[42] *Id.* at 283.
[43] *Id.* at 285
[44] *See* Daniel, *supra* note 7, at 285.
[45] Keith Aoki, *Malthus, Mendel, and Monsanto: Intellectual Property and the Law and Politics of Global Food Supply: An Introduction*, 19 J. ENVTL. L. & LITIG. 397, 430 (2004).
[46] Rogers, *supra* note 31, at 157.
[47] *Id.* at 158.

from their harvest because patent holders own the genetic technology within the seed.[48] GURTs provide a way of physiologically enforcing intellectual property rights over those seeds.[49]

Supporters argue that GURT's inherent enforcement of patent rights is good because it makes research and development financially viable. For example, in 2008 Monsanto spent over $980 million on research and development.[50] Intellectual property rights allow businesses a limited monopoly of technology they have developed in order to make large research investments profitable.[51]

GURTs provide a reliable and self-policing way of protecting those investments, but opponents are concerned about the negative effects of this extralegal enforcement of patent rights. Current patent laws already give developers a monopoly over their products, giving them a legal avenue to protect their financial investments.[52] GURTs provide an additional avenue for enforcing patents; extending developers' power over the farmers' use of the seed. Opponents argue that the negative effects of this power extension outweigh the additional financial protection developers would gain, especially given that there are already legal remedies for patent infringements.[53]

Usually, when patents expire the developer loses its monopoly over the technology and it may now be marketed freely.[54] Even when GM seed patents expire, competing companies can choose whether or not to leave the GURTs in place.[55] There is little incentive for companies to

[48] *Id.* at 150.
[49] *Id.* at 157.
[50] Daniel, *supra* note 7, at 282.
[51] *See* Rogers, *supra* note 31, at 153.
[52] *See id.*
[53] Barron, *supra* note 10, at 283.
[54] *See* Rogers, *supra* note 31, at 165.
[55] Barron, *supra* note 10, at 284.

remove the GURTs, which leaves farmers still beholden to seed developers.[56] Thus, once GURTs are implemented, they may become a permanent fixture in the seed market.

Another concern is that, outside the legal system, large developers have an unfair amount of bargaining power over farmers. Within the patent system, disputes are resolved by lawsuits.[57] This gives both parties an opportunity to present their case and have the dispute settled impartially. "[I]f there was a dispute regarding protected seeds, it was handled the way any other property suit would be handled: the corporation would bring suit and have the burden of showing infringement of property rights.[58] With GURTs, any disagreement means the corporation can withhold seeds and the farmer is, prima facie, guilty."[59] Opponents believe allowing for extralegal enforcement of intellectual property rights, such as GURTs, can create an unfair balance of power in favor of corporations.[60] Their concern is that the international seed industry is being controlled by a "corporate oligarchy" which "favors the rich over the poor by placing the control of the world's food supply in the hands of a powerful few."[61] This imbalance is even greater when this issue is considered in developing countries. "Some activists estimate that as many as eighty percent of farmers in countries like Brazil and Pakistan save seeds from one season to the next; these farmers will undoubtedly be affected by self-policing seeds that prevent this possibility."[62] Thus, GURTs offer manufacturers a way of protecting their research investments, but they also raise concerns about unequal bargaining power and potential injustices to less powerful parties.

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[56] *Id.*
[57] Barron, *supra* note 10, at 283.
[58] *Id.*
[59] *Id.*
[60] Daniel, *supra* note 7, at 264.
[61] *Id.*
[62] *Id.*

Genetic Technology in the Developing World

Many developing nations are especially vulnerable to the acknowledged problems with GURTs, but they also represent a large potential market for seed manufacturers. GURTs are designed to stop farmers from saving seeds from their harvest for planting the next year's crop.[63] Farmers in developing countries are reliant on the practice of seed saving.[64] For example, "ninety-five percent of the millet grown in Zambia comes from saved seed."[65] More generally:

> A UPOV survey done in 2005 showed that seed saving by farmers in the 14 developed to mid-range countries that responded to the survey was worth nearly $7B. When expanded to encompass the entire world, and *noting that the developing world uses farm saved seed to an even greater extent*, these companies see the seed market as having billions more in untapped potential.[66]

Since seed saving is so prevalent in developing countries, GURTs that inherently disrupt and prevent this practice will have a major impact, if widely used.[67]

Many farmers in developing countries rely on the seed from their harvest not only for future planting but also as a direct food source.[68] It is foreseeable that farmers would use crop seeds as a food source in cases where food shortages arise.[69] This could increase pressure on farmers to buy GM seed. However, if that seed has terminator technology the farmers will then be heavily tied to seed manufacturers, since their traditional seed saving practice is not possible.[70]

However, supporters argue that GURTs provide companies with incentives to market GM crops in developing countries, which will benefit developing countries through the GM traits,

[63] Rogers, *supra* note 31, at 149.
[64] Barron, *supra* note 10, at 282.
[65] *Id.* at 272–73.
[66] *Id.* at 282 (emphasis added).
[67] *See id.*
[68] *Id.* at 284.
[69] *Id.*
[70] *Id.*

such as drought and pest resistance.[71] GM crops can increase yields, providing farmers with direct benefits even though they must buy new seed for each harvest.[72] Yet in order to make developing countries marketable, seed manufacturers must be able to generate enough revenue to offset costs.[73] Furthermore, these countries often lack a legal system that will enforce seed manufacturers' intellectual property rights.[74] GURTs make developing countries financially feasible for seed manufacturers while also providing farmers with improved crop yields.[75] However, GURTs give manufacturers more direct control over farmers, which again raises justice concerns about unequal power, especially for farmers in developing nations.

Conclusion

The information presented here was not meant to advocate for or against the use of GURTs, but to explore their potential benefits and drawbacks. This educational goal is valuable because an understanding of the broader social and environmental impact of GURTs is necessary to properly create and apply the law governing them. For scientific advancements like GURTs, the law must keep pace to ensure that new developments square with our everyday notions of fairness and justice. As discussed, this goal may not be easily achieved. The use of GURTs in the agriculture industry is a complex issue with far reaching and often unpredictable consequences. The legal community must be especially careful in formulating and applying the law governing this issue.

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[71] Daniel, *supra* note 7, at 286.
[72] Luis Herrera-Estrella, *Genetically Modified Crops and Developing Countries*, PLANT PHYSIOLOGY, http://www.plantphysiol.org/content/124/3/923.full (last visited January 2, 2013).
[73] *See* Barron, *supra* note 10, at 282.
[74] Daniel, *supra* note 7, at 286.
[75] Samanatha M. Ohlgart, *The Terminator Gene: Intellectual Property Rights vs. The Farmers' Common Law Right to Save Seed*, 7 Drake J. Agric. L. 473, 474 (2002).