

NOTES

Owning the World’s Seed Supply: How Seed Industry Mergers Threaten Global Food Security

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ABSTRACT

Food security has become a growing concern for many countries. As plant diversity becomes a necessity to ensure global food security, the consolidation of the key players in the seed industry noticeably affects the price and diversity of seeds. Large multinational corporations are monopolizing the seed industry, making it impossible for other companies to compete in the global market. Where these corporations find the most power to dominate seed production is through patents. With the looming threat of climate change, comprehensive patent regulations are of the utmost importance to address anticipated food shortage and disparity. The international system needs to quickly adapt to the changing climate; a task which can only be accomplished if all agricultural systems have access to seeds. To properly invest in a sustainable future, steps need to be taken to deregulate seed patenting to provide access to necessary agricultural resources.

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INTRODUCTION

*Today's milestone means that the two leading innovators in agriculture will now come together as one to shape agriculture through breakthrough innovation for the benefit of farmers, consumers and our planet.*¹

These are the words of Liam Condon, a board member of Bayer AG, an agricultural provider and currently one of only three corporations controlling the seed production industry.² Food security has become a growing concern for many countries.³ As plant diversity becomes a necessity to ensure global food security, the consolidation of the key players in the seed industry is noticeably affecting price and diversity of seeds.⁴ Large multinational corporations are monopolizing the seed industry, making it impossible for other companies to compete in the global market.⁵ Where these corporations find the most power to dominate seed production is through patents.⁶

Patents allow for a “temporary grant of a monopoly on the right to make, use, offer for sale, or import, an invention in a country where the patent is in force.”⁷ Patent protection for seeds has expanded as seed producing corporations around the world strive to ensure their company’s financial security.⁸ Legal systems globally must safeguard innovation while also making sure seeds are available across the world for farmers to provide adequate food production.⁹ Many international agreements attempt to use patents to protect industries from market saturation to sustain incentives for research and development.¹⁰ The agreements lay out

1. Liam Condon, Member of the Bayer Board of Management of Bayer AG and President of Crop Science, Brayer & Monsanto: Advancing Together as One (Nov. 2018), <https://www.bayer.com/en/advancing-together.aspx>.

2. See Katie O’Reilly, *Say Hello to Big Seed: When Bayer swallows Monsanto, it will control a quarter of the world’s seed market*, THE SIERRA CLUB (Jun. 8, 2018).

3. See Christopher Emsden, *Genetic Diversity a Hidden Tool in Coping with Climate Change*, FOOD & AGRIC. ORG. OF THE UNITED NATIONS (2015).

4. See Jie Chen, *Rapid urbanization in China: A real challenge to soil protection and food security*, CATENA, 1–15, ISSN 0341-8162, <https://doi.org/10.1016/j.catena.2006.04.019> (last visited Oct. 15, 2017).

5. See *id.*

6. Debra L. Blair, *Intellectual Property Protection and Its Impact on the U.S. Seed Industry*, 4 DRAKE J. AGRIC. L. 297 (1999).

7. 35 U.S.C. § 271 (2011).

8. Mark R. Patterson, *Contractual Expansion of the Scope of Patent Infringement Through Field-of-Use Licensing*, 49 WM. & MARY L. REV. 157 (2007).

9. See Mark D. Janis & Jay P. Kesan, *U.S. Plant Variety Protection: Sound and Fury. . .?*, 39 HOUS. L. REV. 727, 731 (2002) (recognizing that, because seeds were distributed freely, it created no commercial incentive for potential inventors to devote the necessary research and money to discover new plant varieties).

10. Robert M. Patino, *Moving Research to Patient Applications Through Commercialization: Understanding and Evaluating the Role of Intellectual Property*, 49 J AM. ASSOC. LAB ANIM. SCI., 147–54 (2010).

a legal framework that can then be codified into countries' domestic patent laws.¹¹ Whether a nation state decides to codify and then implement these international patent laws is a sovereign choice.¹²

Patents encourage innovation by guaranteeing certain protections on inventions, such as a seed manipulated to sustain harsh climates.¹³ However, these patents on seed production have consequences such as: (1) increasing prices on seeds for farmers, and thus increasing food prices for consumers; (2) hindering innovation as patents can block access to the seed varieties necessary to sustain breeding and growth of seeds; (3) minimizing seed variety production because patents ultimately create less innovation from the outcome of limited competition; and (4) endangering global food security in the long term.¹⁴

This Note is about the importance of proper patent regulations in the midst of anticipated food shortage and disparity because of the looming threat of climate change. The international system needs to quickly become adaptable to the changing climate and this will only be accomplished if all agricultural systems have access to seeds. Part I of this Note gives a quick overview of the history of patents and past regulations. Part II discusses the growing political problem of food shortage at a time where patentability of produce like seeds is acceptable, and attempts to balance the need for global health and access to agricultural amenities versus the importance of a vast patenting system to promote innovation in the food industry. Part III describes the international strategies of reform being taken through a detailed analysis of international agreements governing agriculture and the benefits and implications of those strategies to the seed industry. Part IV provides an overview of the current practices in anti-trust and the effects on the global seed industry, revealing the monopolistic control over seeds and the underlying antitrust concerns of mergers like Bayer-Monsanto. In conclusion, the implementation of regulations providing companies safeguards over necessary food for the betterment of the international community is leading to food instability. To properly invest in a sustainable future, steps need to be taken to deregulate seed patenting to provide access to necessary agricultural resources.

I. BACKGROUND

In the early 1990s, the international community of member-nations began a range of developments on the protection of biodiversity, like seed varieties,

11. See, e.g., The Convention on Biological Diversity, United Nations (1992); General Agreement on Trade-Related Aspects of Intellectual Property, TRIPS, 1869 U.N.T.S. 299 (1995); See *The UPOV System of Plant Variety Protection*, UPOV (2011), https://www.upov.int/about/en/upov_system.html.

12. See e.g., Kevin M. Baird, *Pioneer Hi-Bred International v. J.E.M. Ag. Supply: Patent Protection of Plants Grows Under the Supreme Courts Latest Decision*, 2002 Ill. J. L. TECH. & POL'Y 269, 269 (2002).

13. See Emsden, *supra* note 3.

14. See Philip H. Howard, *Intellectual Property and Consolidation in the Seed Industry*, 55 CROP SCI. SOC'Y AMER., INC. 6 (2015).

through patent rights.¹⁵ The two international agreements are: The Convention on Biological Diversity (“CBD”), and the Agreement on Trade-Related Aspects of Intellectual Property Rights (“TRIPS”) of the World Trade Organization (“WTO”).¹⁶ The World Intellectual Property Organization (“WIPO”), International Union for the Protection of New Varieties of Plants (“UPOV”), and other international entities are also involved in the field of biodiversity and patent protection.¹⁷ Additionally, it is important to note the international legal framework is commonly altered by domestic law.¹⁸ For instance, the United States offers excessive patent protections for seeds, allowing a utility patent option for seeds, and patents for seeds that reproduce asexually (through cutting or grafting) or sexually (through pollination).¹⁹

Advised by these international agreements and commonly enforced by domestic law, most patent protections last for twenty years and grant the patent owner exclusivity rights.²⁰ Corporations must independently apply for patents in each country where they intend to market their product, to ensure patent protection by the nation state.²¹ Some states enforce protection from patent infringement better than others, and this is something a seed production company must keep in mind.²² The benefits of a strong international patent system are the ability of corporations, who have invested time and money into intensive research, to generate profit.²³

15. See Ken Albala, *THE SAGE ENCYCLOPEDIA OF FOOD ISSUES* (2015).

16. The Convention on Biological Diversity, United Nations (1992); General Agreement on Trade-Related Aspects of Intellectual Property, TRIPS, 1869 U.N.T.S. 299 (1995); See *The UPOV System of Plant Variety Protection*, UPOV, (2011), https://www.upov.int/about/en/upov_system.html.

17. MARCELIN TONYE MAHOP, *INTELLECTUAL PROPERTY, COMMUNITY RIGHTS AND HUMAN RIGHTS: THE BIOLOGICAL AND GENETIC RESOURCES OF DEVELOPING COUNTRIES* 83 (Routledge 2010).

18. See, e.g., John E. Guist, *Noncompliance With TRIPs by Developed and Developing Countries: Is TRIPs Working?*, 8 *IND. INT’L & COMP. L. REV.* 69, 69 (1997).

19. See *PLANT PATENTS REPORT*, U.S. PATENT & TRADEMARK OFFICE (2016), <https://www.uspto.gov/web/offices/ac/ido/oeip/taf/plant.pdf>; see, e.g., Plant Variety Protection Act of 1970, 7 U.S.C. §§ 2321-2582 (2016) (stating that the Plant Variety Protection Act allows for utility patents, thus giving seed producing companies the right to sue farmers for violations, like reproducing the patented seeds or saving leftover seeds for reuse for next season without paying further licensing fees).

20. TRIPS: Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 33 I.L.M. 81 (1994); see also Shigeki Kamiyama, Jerry Sheehan & Catalina Martínez, *Valuation And Exploitation of Intellectual Property* (OECD Sci., Tech. & Industry Working Papers, 2006), available at <http://dx.doi.org/10.1787/307034817055>; see generally Tomoya Yanagisawa & Dominique Guellec, *The Emerging Patent Marketplace*, (OECD, Sci., Tech. & Industry Working Papers, 2009) available at <https://doi.org/10.1787/18151965>.

21. Business Queensland, *How do I apply for a patent in other countries?*, QUEENSLAND GOV’T (2017), <https://www.business.qld.gov.au/running-business/protecting-business/ip-kit/browse-ip-topics/new-products,-processes-and-inventions-patents/how-to-apply-overseas>.

22. See *id*; See, e.g., U.S. Plant Patent Act 1930, 35 U.S.C. § 161 (1954).

23. KAMIL IDRIS, *INTELLECTUAL PROPERTY: A POWER TOOL FOR ECONOMIC GROWTH* 38 (WIPO 2003).

Exclusivity rights allow the patent owner to protect their inventions from competitors who could flood the market using the same innovative idea.²⁴ With seed variety patent protection, patent owners get exclusive rights over their discovered work, including the “vegetative and reproductive materials of . . . [seed] varieties.”²⁵ The patenting of seed varieties varies in different countries, but UPOV has been working to implement an international standard for patent protections of biodiversity.²⁶

Patents expire to ensure the flow of the market while still protecting innovation.²⁷ After the term of the patent expires, the patent holder must disclose the innovation to the public so other market contributors may use the invention; thus opening the market back up.²⁸ Patents also secure legal protections of inventions, essentially binding even foreign jurisdictions to respect the owner’s patent if proper licensing is available in that jurisdiction.²⁹ With these protections in place, patents promote technological innovation sharing in a way that temporarily protects the patent owner’s invention to make it profitable, while eventually allowing a competitive market after the terms of the patent have expired.³⁰

Most problematic is the impact of the patent system on the freedom and costs of research and development.³¹ Recently, expensive licensing fees have negatively affected farmers’ ability to gain access to seeds, and the control that seed production companies have over seed varieties make diverse seeds difficult to obtain.³²

Ultimately, this method of patenting seeds is imperfect and requires sacrifices in one way or another when it comes to balancing the protection of innovation, competitive research, and ensuring food security.³³ Since international patent law began seed patenting, seed production companies have secured seed patents to maximize profits while simultaneously starving out competition.³⁴ The

24. See *id.* at 10.

25. Claudio Chiarolla, *Commodifying Agricultural Biodiversity and Development-Related Issues*, 9 J. WORLD INTELL. PROP. 25, 28 (2006).

26. *Id.*

27. See generally *id.*

28. Eric Budish, Benjamin Roin & Heidi Williams, *Do Fixed Patent Terms Distort Innovation?: Evidence from Cancer Clinical Trials* (Sept. 5, 2013) (Chi. Booth Sch. of Bus. Res. Paper Series, Working Paper No. 97), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2353471##.

29. Letter to Oliver Evans (May 2, 1807), *V Writings of Thomas Jefferson*, 75–76 (Washington ed.).

30. See Int’l Renewable Energy Agency [IRENA], *How Patents Encourage Innovation in Technological Development and Deployment*, at 9–10 (Jun. 2013), https://www.irena.org/-/media/Files/IRENA/Inspire/Intellectual_Property_Rights.pdf?la=en&hash=5B7B01F9B4927DF4817858ACF487BF788E16E9D8.

31. Ashish Arora, Andrea Fosfuri & Alfonso Gambardella, *Markets for Technology: The Economics of Innovation and Corporate Strategy*, 27 THE ACAD. OF MGMT. REV. 4, 8 (2001).

32. See Daryl Lim, *Living with Monsanto*, MICH. ST. L. REV. 559, 591–99 (2015).

33. See MICHELE BOLDRIN & DAVID K. LEVINE, *AGAINST INTELLECTUAL MONOPOLY* 5–6 (Cambridge Univ. Press 2008).

34. See GianCarlo Moschini, *Competition issues in the seed industry and the role of intellectual property*, ECON. WORKING PAPERS 118 (2010), <https://ageconsearch.umn.edu/record/94757/files/25-2%20Competition%20Issues.pdf>.

international community must strongly consider revising the various agreements to limit seed diversity patents to protect food security.³⁵

II. THE SYSTEMIC NEED FOR INCENTIVES IN INNOVATION

The patentability of the world's most fundamental life-forms is a key issue when it comes to sustaining food security.³⁶ Many states are making efforts through national legislation to protect food security, especially in the developing world.³⁷ The main interests of the developing nations are to have access of biological resources so local communities can maintain control over the beneficial resources and their use, "and that goal is compatible with, and indeed conducive to, protecting the global environment from the effects of numerous isolated industrial revolutions."³⁸ However, economic interests of large corporations with intellectual property protections have manipulated the debate, and the patentability of food, chemicals, plants or animals has increased economic profit, but ignored the necessity for nations to control these resources and their use.³⁹ The patent system has been criticized for creating monopolistic practices, and deterring innovation of new diversity by limiting the big players in the field, but this system also allows corporations, and not nation states, to control resources and their use on the planet.⁴⁰

Food is considered fundamental to society for security and sustainability, and takes the highest priority when it comes to global health.⁴¹ Some argue that patenting life forms gives rise to "development, food security, the environment, culture and morality" concerns.⁴² The first concern is the cost of seeds and farmers' access to them is ultimately increasing consumer food costs.⁴³ Second, there are concerns that with the potential for broad patenting of seed varieties, patent standards upheld to protect an invented seed have led to restrictions on the seed's general use, hindering third party research and thus innovation.⁴⁴ A third concern is that global agreements ultimately protect the inventors, the private sector, and

35. See generally WTO, WIPO & WHO, PROMOTING ACCESS TO MEDICAL TECHNOLOGIES AND INNOVATION: INTERSECTIONS BETWEEN PUBLIC HEALTH, INTELLECTUAL PROPERTY AND TRADE (2012).

36. *Id.*

37. See *id.*

38. See Yvonne Cripps, *Patenting Resources: Biotechnology and the Concept of Sustainable Development*, 9 *IND. J. OF GLOBAL LEGAL STUD.* 7, 119 (2001).

39. See Catherine Monagle, *Biodiversity & Intellectual Property Rights: Reviewing Intellectual Property Rights in Light of the Objectives of the Convention on Biological Diversity* (2001), <https://www.ciel.org/Publications/tripsmay01.PDF>.

40. See William F. Baxter, *Legal Restrictions on Exploitation of the Patent Monopoly: An Economic Analysis*, 76 *YALE L. J.* 267 (1966).

41. See FAO, THE FUTURE OF FOOD AND AGRICULTURE—TRENDS AND CHALLENGES (2017).

42. Council for Trade-Related Aspects of Intellectual Property Rights, *Note by the Secretariat: Review of the Provisions of the Article 27.3(B) - Summary of Issues Raised and Points Made*, WTO Doc. IP/C/W/369/Rev.1 (Mar. 9, 2006).

43. *Id.*

44. *Id.*

corporate interests; falling short in protecting international consumers, farmers, and food security.⁴⁵

It is crucial to assess whether there is systemic need for incentives in seed patents. Patents are an important protection measure for innovation.⁴⁶ The patent protection of seed varieties creates an incentive for companies to develop new inventions and share with the global community, to benefit society and promote the collaboration of knowledge and resources.⁴⁷ If patent protections were no longer available companies would have difficulties protecting their innovations. The ability for companies to keep trade secrets is rare and innovation would not be made public for fear of others using the invention for their own benefit and profits.⁴⁸

Patent protection of seeds fluctuates in developed and developing countries, as some countries attempt to be weaker on patent rights, while others prove to have the strongest protections on patents.⁴⁹ The TRIPS Agreement requires all WTO nation-state members to give patent protections for seed varieties.⁵⁰ However, many countries attempt to fulfill these requirements while also allowing farmers to replicate or keep seeds to plant in the future. Despite these international or other foreign-state patent licensing laws, other countries went beyond codifying the international agreements, with stricter patent law protection and remedies.⁵¹ The result is a diverse makeup of patent protection throughout the world, where the mightier nations in patent protection have companies that obtain control of the world economy in seed production.⁵²

A patent owner's investments for the invention's production alone calls for substantial costs upfront, including time, money, and research.⁵³ The market can be structured efficiently to ensure the prosperity of the food is a commercial certainty, along with protecting innovation.⁵⁴ The economy alone will not offer the correct incentives for an innovator to expose their inventions in the market, so

45. *Id.*

46. See generally Robin Feldman & Mark A. Lemley, *Do Patent Licensing Demands Mean Innovation?*, 101 IOWA L. REV. 137 (2015).

47. See ANIL K. GUPTA, WIPO-UNEP STUDY ON THE ROLE OF INTELLECTUAL PROPERTY RIGHTS IN THE SHARING OF BENEFITS ARISING FROM THE USE OF BIOLOGICAL RESOURCES AND ASSOCIATED TRADITIONAL KNOWLEDGE (WIPO 2004).

48. See John H. Barton & Peter Berger, *Patenting Agriculture*, 17 ISSUES IN SCI. & TECH. 4 (2001).

49. Bronwyn H. Hall, *Does Patent Protection Help or Hinder Technology Transfer?*, BERKLEY L. REV. (2016).

50. See Barton & Berger, *supra* note 48.

51. *Seed Laws that Criminalise Farmers: Resistance and Fightback*, GRAIN (Mar. 2015) available at <https://www.grain.org/article/entries/5142-seed-laws-that-criminalise-farmers-resistance-and-fightback>.

52. See Lim, *supra* note 32 at 5.

53. See Julien Pénin & Daniel Neicu, *Patents and Open Innovation: Bad Fences Do Not Make Good Neighbors*, 25 J. OF INNOVATION ECON. & MGMT. 57, 72 (2018).

54. P. Belleflamme, *Patent and incentives to innovate: Some theoretical and empirical economic evidence*, 13 ETHICAL PERSPECTIVES: J. OF THE EUR. ETHICS NETWORK 2, 267–88 (2006).

exclusivity rights step in to offer certainty for return on investment.⁵⁵ Patented inventions are protected using legal rights and remedies, allowing the owner protections for the period of time necessary to commercially benefit from the invention.⁵⁶ By legally prohibiting others from the use of the idea, the patent owner has every opportunity to gain competitive advantage in the market place and can properly obtain return on investment.⁵⁷

These patent protection systems, domestically and globally, provide the legal framework necessary to support innovation in the market.⁵⁸ The critiques of patents are the losses in sustaining these protections, like halting market competition.⁵⁹ This problem is exacerbated when there are limited contributors in the market; a consequence of mergers of large owners of these patents.⁶⁰ In the case of seed varieties, patent owners are merging with other key competitors in the market, like the Bayer-Monsanto merger, hindering competition in the market entirely.⁶¹ As large companies like Bayer gain control of most seed variety patents, the investment costs of seed production limit other competition from entering the market, as well as, raise market costs for seeds because of limited competition.⁶²

III. INTERNATIONAL STRATEGIES OF REFORM: THE BENEFITS AND IMPLICATIONS

Reviewing the pertinent international agreements and organizations regulating patents on seed varieties will lead to a better understanding of where the world stands in sustaining food security.⁶³ Analysis on the benefits of these agreements, what implications have resulted, and how the international community should go about resolving these issues will help determine the patent agreement structure.⁶⁴ The Convention on Biological Diversity, the Trade-Related Aspects of Intellectual Property Rights Agreement, and the International Union for Protection of New Varieties of Plants all have different objectives and purposes that are carried out in different ways, none specifically catering to seed variety and the goal of food security.⁶⁵ Each agreement has a specific nature, multilateral

55. *Id.*

56. See generally Francesca Cornelli & Mark Schankerman, *Patent renewals and R&D incentives*, 30 THE RAND J. OF ECON. 197 (1999).

57. *Id.*

58. *Id.*

59. *Id.*

60. See Dana Varinsky, *The \$66 billion Bayer-Monsanto merger just got a major green light — but farmers are terrified*, BUS. INSIDER (May 29, 2018), <https://www.businessinsider.com/bayer-monsanto-merger-has-farmers-worried-2018-4>.

61. *Id.*

62. *Id.*

63. The Convention on Biological Diversity, *supra* note 11.

64. See *id.*

65. See Claudio Chiarolla, *Commodifying Agricultural Biodiversity and Development-Related Issues*, 9 THE J. OF WORLD INTELL. PROP. 25 (2006).

makeup, and objective, driven by different motivational intents.⁶⁶ However, with revisions, the agreements can protect naturally occurring seeds from being patentable and to sustain food development while protecting innovation.

A. THE CONVENTION ON BIOLOGICAL DIVERSITY (“CBD”)

The CBD was a multilateral treaty developed with three main goals in mind: (1) the conservation of biodiversity, (2) the maintainable use of biodiversity and its components, and (3) the fair and equitable distribution of benefits that come out of genetic resources.⁶⁷ The goals are to create national strategies towards sustainable use and protection of biodiversity, like seed varieties.⁶⁸ A protocol, declared the Nagoya Protocol, was created to implement a way of detailing the rules governing access and sharing of biodiversity and its benefits.⁶⁹ The CBD goal additional to conserving biodiversity is to promote shared resources for research to prosper.⁷⁰ The rules of the protocol ask for “informed consent and mutually agreed terms” granted through negotiation processes between the parties.⁷¹ With the purpose of expanding access to resources for further innovation of research, the CBD promotes innovation while sustaining necessary access of resources of biodiversity.⁷²

B. THE TRADE-RELATED ASPECTS OF INTELLECTUAL PROPERTY RIGHTS (“TRIPS”)

In the mid-1990s, the TRIPS Agreement by the World Trade Organization (“WTO”) was developed by member-states to extend patent protection and facilitate free trade.⁷³ Patents on biodiversity are believed necessary to protect private investment that drives innovation, like other patentable technological fields, in hopes of creating incentives to provide solutions for the developed and developing world.⁷⁴ With this goal in mind, the TRIPS Agreement set up an international standard for patents on seed and plant varieties, and ultimately moves beyond a national framework to uphold a system with global uniformity.⁷⁵ The Agreement

66. *Id.*

67. *See* The Convention on Biological Diversity, *supra* note 11.

68. *See generally id.*

69. *Id.*; Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, Oct. 29, 2010, UNEP/CBD/COP/DEC/X/1 of 29; COP 10 Decision X/1: X/1; Art. 1. Access to genetic resources and the fair and equitable sharing of benefits arising from their utilization, CONVENTION ON BIOLOGICAL DIVERSITY, <http://www.cbd.int/decision/cop/?id=12267> (last visited December 8, 2018).

70. *Id.*

71. *Id.*

72. *See id.*

73. *See generally* Paul Oldham, Stephen Hall & Oscar Forero, *Biological Diversity in the Patent System* 8 PLOS ONE 1 (2013).

74. *Id.*

75. *Id.*

offers limited exceptions to the extensive plant variety protections, requiring patent protection with very limited exclusions and flexibility.⁷⁶

Among the WTO Trade and Environment Committee, there was abundant support to amend the TRIPS Agreement to promote the transparency of patent applications, along with the sources of biological materials used in the invention being reviewed for patent.⁷⁷ This aimed to: (1) issue patents only for inventions that are genuinely new, and (2) ensure inventors have stayed compliant to national regulations when gaining access to biological and importantly sharing those resources.⁷⁸ Though some critics believe that limited disclosure through patent application is the better direction, and the WTO should have little interest in these kinds of purposes, the thought remains that the patent application system should be more transparent to hold inventors accountable.⁷⁹ The TRIPS Agreement, as promoted by the WTO, upholds free trade in areas like biotechnology.⁸⁰ This protects products like seed varieties through patents.⁸¹ Using the TRIPS Agreement, a patent owner can stop anyone from, “making, using, offering for sale or importing without . . . consent.”⁸²

Article 27.3(b) of the TRIPS Agreement allows the patenting of genetic resources, including the patenting of seeds.⁸³ Article 27.3(b) of the Agreement requires protection of patentability of seed varieties by a “*sui generis*” (unique) regime, through patents, or using a combination of both.⁸⁴ Patenting a plant production process under Article 27.3(b), gives patent owners exclusive rights over all plants produced using the patent.⁸⁵ In patent litigation, the TRIPS Agreement shifts the burden of proof to the defendant, who must prove the particular product was not produced by the protected process.⁸⁶

The TRIPS Agreement recognizes new seed varieties as patentable using these factors: novelty, inventiveness, and industrial applicability or usefulness.⁸⁷ The

76. General Agreement on Trade-Related Aspects of Intellectual Property, *supra* note 11. For example, Article 27.3(b) in TRIPs, broadly speaking, “allows governments to exclude some kinds of inventions from patenting, i.e. plants, animals and ‘essentially’ biological processes (but microorganisms, and non-biological and microbiological processes have to be eligible for patents). *Id.* However, plant varieties have to be eligible for protection either through patent protection or a system created specifically for the purpose (‘*sui generis*’), or a combination of the two.” *TRIPS: Reviews, Article 27.3(b) and Related Issues: Background and the current situation*, WTO (Nov. 2008), https://www.wto.org/english/tratop_e/trips_e/art27_3b_background_e.htm.

77. *Overview: The TRIPS Agreement*, WTO, https://www.wto.org/english/tratop_e/trips_e/intel2_e.htm (last visited Oct. 5, 2017).

78. *Id.*

79. *Id.*

80. *Id.*

81. *Id.*

82. *Id.*

83. General Agreement on Trade-Related Aspects of Intellectual Property, *supra* note 11.

84. *Id.*

85. *Id.*

86. *Id.*

87. *See id.*

patent protections on seed varieties, though promoting incentives to research and create new genetic resources, also leads to local varieties of seeds to become outdated, moving the industry towards high-tech seeds.⁸⁸ The “super” seed varieties then take out all local seeds from the market and replace them with monopolistic high-tech seeds.⁸⁹ With only a few high-tech seeds left leading the market production, farming around the globe inevitably becomes dependent on these three corporate seed producers.⁹⁰ The result is a loss of crop diversity in many nations, potentially hindering future growth and access to food. The developing and developed world both see this result because farmers tend to use seeds left from a harvest the past season.⁹¹ However, legal regulations like the Article 27.3(b) protect against this, stating that nations need to protect new seed varieties and their patents, including unauthorized reproduction or reuse of seeds.⁹² This has the potential to push farmers to begin purchasing seeds every season, and not just reuse previous harvest’s seeds.⁹³

For a product or process to be patentable under WTO standards, it has to be an invention and cannot be naturally occurring, such as genetic material.⁹⁴ What qualifies as an invention in the event that something is naturally occurring has long been debated, and many discoveries in nature have been patentable.⁹⁵ Millions of farmers every year depend on seed varieties and the seed industry for their survival, and these seed patent protections should therefore not be taken lightly.⁹⁶ Over the years, seeds varieties have been improved using researched breeding techniques, but diversity has dwindled as super seeds monopolize the market.⁹⁷ Such extreme seed variety protections lead to a market takeover by super seeds, and thus a retreat in innovation of seed diversity.⁹⁸

Because of the TRIPS Agreement’s promotion on trade liberalization, there have been many patents used to protect the creation of seed variety by corporations.⁹⁹ Though the goal of liberalizing trade has been met when it comes to WTO initiatives, there is a looming threat that this freedom to patent seed

88. Christopher Bradburn, *Thousands of Plant Breeders: Women Conserving in situ Crop Genetic Resources: A Case Study in the Medak District of Telangana, Southern India*, SWEDISH U. OF AGRIC. SCI. (2014).

89. *Id.* at 22.

90. *From Green to Gene Revolution: How Farmers Lost Control of the Seeds from Agricultural Modernization*, GRAIN, 1 (Oct. 9, 2010).

91. *Id.*

92. *Id.*

93. General Agreement on Trade-Related Aspects of Intellectual Property, *supra* note 11.

94. Gerard Downes, *TRIPS and Food Security: Implications of the WTO’s TRIPS Agreement for Food Security in the Developing World*, 160 BRIT. FOOD J. 366–79, 371 (2004).

95. *See id.*

96. *The Privatisation of Seeds*, RESET: DIGITAL FOR GOOD, <https://en.reset.org/knowledge/privatisation-seeds> (last visited Feb. 27, 2019).

97. *Id.*

98. *See id.*

99. *Id.*

varieties could grant companies the ability to monopolize the market over nature.¹⁰⁰ Not only do patents limit competitive entry into the market, but the patentability of seed varieties has effected diversity, creating concerns over future food security.¹⁰¹

The TRIPS Agreement has led to a huge increase in the number of patents taken out by the seed producing industries.¹⁰² Contrary to the WTO's aspiration for greater liberalization of trade, there is an inherent danger in the TRIPS Agreement granting corporations monopoly privileges over nature, including many seeds.¹⁰³ Patent right protection has ultimately led to "a concentration of power in the seed industries of a number of developing countries . . . while the combination of stronger patent laws and reduced competition has driven up prices."¹⁰⁴ As a result, innovative start-up seed producers face considerable barriers to entry in the market.¹⁰⁵

C. THE INTERNATIONAL UNION FOR PROTECTION OF NEW VARIETIES OF PLANTS ("UPOV")

UPOV is an independent intergovernmental organization.¹⁰⁶ Its nation-state members are required to grant twenty-year term exclusive rights for patent holders, allowing farmers the right to use the protected seed varieties under the discretion of the farmers' state government.¹⁰⁷ The organization was created to promote effective seed variety protection and development of new seed varieties for the overall societal welfare.¹⁰⁸ The UPOV views the ability for patent owners to gain protective rights of new seed varieties for efficient breeding.¹⁰⁹ The UPOV offers the most effective market with the potential to recover costs by ensuring future profits that will lead to further investment.¹¹⁰ If there was no way to ensure these protections over new seed varieties, there would be no way to prevent others from copying these varieties and releasing the same product into the market, without any benefit to the inventor.¹¹¹ As a result, the market would then lack incentives for future inventors to produce and make their innovation public for society to benefit.¹¹² The UPOV presents an attempt to protect against disruptive occurrences like this in the market.¹¹³

100. *Id.*

101. *See id.*

102. *See id.*

103. *Id.*

104. KEVIN WATKINS & PENNY FOWLER, RIGGED RULES AND DOUBLE STANDARDS: TRADE, GLOBALISATION, AND THE FIGHT AGAINST POVERTY, 224 (Oxfam Int'l 2002).

105. *See id.*

106. *See The UPOV System of Plant Variety Protection, supra* note 11.

107. *See id.*

108. *See id.*

109. *See id.*

110. *Id.*

111. *The UPOV System of Plant Variety Protection, supra* note 11.

112. *Id.*

113. *See id.*

The UPOV Report on the Impact of Plant Variety Protection of 2005, identifies the protections offered to seed varieties by the UPOV system to uphold the incentive to innovate.¹¹⁴ The report conveys how the “UPOV system of plant variety protection, and membership of UPOV, can open the door to economic development, particularly in the rural sector.”¹¹⁵ The UPOV system benefits producers, farmers, and consumers in differing ways, depending on the country of origin, but it was found access to seed varieties produced the best varieties out on the market in UPOV member territories.¹¹⁶ The system was viewed to maximize protections; sustaining efficient breeding growth of seed varieties, leading to reductions in the price of seeds, and to higher quality seed varieties.¹¹⁷ The incentives through patent protections lead to health benefits, as well as environmental and economic benefits.¹¹⁸

The necessary standards under the UPOV for protection has the potential to result in lack of competition.¹¹⁹ The UPOV provision states varieties must be new, distinct, uniform, and stable.¹²⁰ In an analysis done by the Food and Agricultural Organization, the provision is said to potentially end in the loss of genetically diverse seed varieties specifically adapted for the local conditions, to be replaced with super seeds.¹²¹ This system by the UPOV promotes scarcity in the variety of seeds available in the global market.¹²² Because patents are only granted to super seeds, the diversity of seeds that can be sold and who is able to sell them is limited by patent protection.¹²³ The system ultimately does not diversify the seed market, but actually discourages diversity, leading to general and limited seed varieties.¹²⁴ Thus, local communities with environmentally unique

114. UPOV REPORT ON THE IMPACT OF PLANT VARIETY PROTECTION OF 2005, 3 (International Union for the Protection of New Varieties of Plants (UPOV) 2005).

115. *Id.*

116. *Id.*

117. *Id.*

118. *The UPOV System of Plant Variety Protection*, *supra* note 11.

119. *Id.*

120. *Id.* at ch. III, art. 5(1)(i-iv).

121. Johannes Engels, Stefano Diulgheroff & Javier Sanz Alvarez, *Management of Crop Diversity: Key Practices for DRR Implementers*, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO) (2014). “Under the UPOV 1991 Act, the ‘farmers’ privilege’ has been put at the discretion of Contracting Parties and its scope has been narrowed down: farmers may re-use only seed and other propagating material planted on their own holdings for planting them on their own holdings. The non-commercial exchange of seeds ‘over the fence’ that is quite common among farmers in many regions is no longer permissible. In addition, governments granting a ‘farmers’ privilege’ have to ensure that it applies ‘within reasonable limits’ (e.g. to limited size of holding/crop area/crop value) and that the legitimate interests of the breeder are safeguarded (e.g. through measures, such as reseeding fees). Moreover, the ‘farmers’ privilege’ does usually not apply, if seeds or other propagating material are subject to patent protection.” *Id.* at 35.

122. *See id.*

123. Council for Trade-Related Aspects of Intellectual Property Rights, *Note by the Secretariat: Available Information on the Existence of Patents in Regard to the Diseases Referred to in the Declaration on the TRIPS Agreement and Public Health*, WTO Doc. IP/C/W/348 (June 11, 2002).

124. *See id.*

soil are unable to benefit from the market because of limited diversity due to the fact that super seeds cannot flourish in some of these environments.¹²⁵ In the future, this could threaten agricultural efficiency and food security if the seed varieties offered are not compatible with the particular environment.¹²⁶

IV. CURRENT PRACTICES: ANTI-TRUST DISCUSSIONS IN THE GLOBAL SEED PRODUCTION INDUSTRY

Food security and the challenges to farming as climate change begins to take effect is a growing concern.¹²⁷ As seed diversity becomes a necessity to ensure proper food security, the consolidation of the primary players in the seed industry is noticeably affecting price and diversity of seeds.¹²⁸ Large multinational corporations are monopolizing the seed industry, making it impossible for other companies to compete in the global market.¹²⁹ With diversity at a standstill, because of patent control of most seed varieties, governments have moved to properly modernize farming to ensure food security, specifically China.¹³⁰ The Chinese government has made countless efforts to gain seed patents through government run seed industries, and has recently faced serious challenges of food security.¹³¹ The quick economic growth in China along with urban development has led to an anticipated food shortage.¹³²

Based on the costs of seeds rising, there is a growing concern on the control these few seed producers have over the market.¹³³ Agricultural efficiency is being threatened by the lack of resources and support for farmers.¹³⁴ Though patents protect the livelihood of the seed producers, the farmers, who supposedly benefit from these seeds, are at a loss.¹³⁵ The rise in seed costs from a lack of market competitors has led farmers to have no other available options, and thus threatening the farmers' ability to stay afloat.¹³⁶ Not only does this hinder agricultural productivity, but the patent protections enforced by these large companies are so strong, lawsuits are frequent against farmers who infringe on these patents.¹³⁷

125. *Id.*

126. Emsden, *supra* note 3.

127. *See id.*

128. *See* Chen, *supra* note 4.

129. *See id.*

130. *Id.*

131. *Id.*

132. *See* Feng Wang, *China's Population Destiny: The Looming Crisis*, THE BROOKINGS INSTITUTION (Sept. 30, 2010), www.brookings.edu/articles/chinas-population-destiny-the-looming-crisis/.

133. Christopher Leonard, *Monsanto Squeezes Out Seed Business Competition*, AP (Dec. 4, 2009), available at <https://perma.cc/93QK-83WE>.

134. *Id.*

135. *See Why Does Monsanto Sue Farmers Who Save Seeds?*, MONSANTO (Apr. 11, 2017), <https://monsanto.com/company/media/statements/saving-seeds/>.

136. *See id.*

137. *Id.*

With the combination of costs of production sky-rocketing as the profits are remaining low in recent years, there has been a large wave of consolidation between seed production companies.¹³⁸ This should become one of the most significant ecological and trade-related issues of the twenty-first century.¹³⁹

Additionally, these large mergers combine both seed production companies and chemical/pesticide producing industries.¹⁴⁰ For example, the merger between Bayer, mainly focused on developing pesticides, and Monsanto, a dominant seed production industry, involved two of the global economy's top farm suppliers.¹⁴¹ This, along with other mergers of competitive industries, may threaten to reduce global supplier competition in a \$100 billion international industry.¹⁴²

As companies like Bayer gain control over the licensing of not only seeds but the necessary tools of seed production, like pesticides, they grow to become controlling players in the industry.¹⁴³ Even successful companies are attempting to buy out and merge with other successful production companies, leaving the industry with the few providing for the many.¹⁴⁴ The mergers of Dow-DuPont, Bayer-Monsanto, along with Syngenta-ChemChina, have many in a justifiable panic.¹⁴⁵ Previously, the seed production industry was split to these few large multinational corporations: Dow, DuPont, Bayer, Monsanto, Syngenta, and ChemChina.¹⁴⁶ Today, these six leading companies have merged to only three.¹⁴⁷ In the end, there is a hopeless goal that mergers will create a foundation for innovation and lower pricing for food.¹⁴⁸ Instead, these mergers of large industry giants have the complete opposite effect, because no one has the ability to compete or even enter the market, large companies are drawn to actually raise prices and lower the drive for innovation.¹⁴⁹ Competition drives innovation and price balance, and without it, consumers undoubtedly lose.¹⁵⁰

The most recent example of seed industry mergers is Bayer and Monsanto, and this particular merger will likely be the most impactful for the world food

138. *See id.*

139. Leonard, *supra* note 133.

140. *Id.*

141. Dian Bartz & Greg Roumeliotis, *Bayer's Monsanto acquisition to face politically charged scrutiny*, REUTERS (Sept. 14, 2016), <https://www.reuters.com/article/us-monsanto-m-a-bayer-antitrust/bayers-monsanto-acquisition-to-face-politically-charged-scrutiny-idUSKCN11K2LG>.

142. *Id.*

143. Ioannis Lianos & Dmitry Katalevsky, *Merger Activity in the Factors of Production Segments of the Food Value Chain: –A Critical Assessment of the Bayer/Monsanto Merger*, 1 CTR FOR L., ECON. & Soc'y UCL (2017).

144. *Id.*

145. *Id.*

146. *See* Chen, *supra* note 4.

147. Brianna M. Schonenberg, *Twenty Years In the Making: Transitioning Patented Seed Traits Into the Generic Market*, 97 MARQ. L. REV. 1039, 1083 (2014).

148. *Id.*

149. *Id.*

150. *See id.*

supply.¹⁵¹ The merger has also been subject to criticism, as it arguably violates the U.S. anti-trust merger statute, the Clayton Act.¹⁵² The large push for consolidation by these large companies has the potential to drive seed prices up to a new high.¹⁵³ A study at Texas A&M suggests seed prices will climb from the mergers of Dow-Dupont and Monsanto-Bayer, by “2.3 percent for corn and 1.9 percent for soybeans.”¹⁵⁴ As agricultural production income for farmers continues to plummet, these small increases in seed prices will create an imbalance of production costs to profit margins.¹⁵⁵

With this merger, Bayer is set to own a quarter of the world’s seeds and pesticides.¹⁵⁶ The merger essentially eliminates the previous competition between two large companies, Bayer and Monsanto, who have claim as the largest companies in the production of farm supply and seeds and own all the associated patents.¹⁵⁷ This grants Bayer price control over seeds as the market is now controlled by the few.¹⁵⁸ This merger directly affects seed production, the underlying chemical markets for pesticides and other useful tools for farming, and most importantly, would hinder innovation of research and development.¹⁵⁹

Three companies are now the face of an industry that feeds and fuels the world, and everyone should be concerned of the outcome.¹⁶⁰ If these mergers continue to monopolize the seed industry, there will ultimately be less choices for farmers at higher prices.¹⁶¹ Anti-trust regulations have not stopped these companies, even with the anti-trust concerns being so severe.¹⁶²

The future need for food is inevitable, and “[b]y the time 2050 rolls around, the world will have 10 billion people, and the demand for food will double.”¹⁶³ Robb Fraley, Monsanto’s outgoing chief technology officer, argues for the company and its merger explaining that “[t]he whole point here is that the business combination between Monsanto and Bayer will allow the companies to invest in and create more innovation, and it’s going to take a huge amount of innovation in

151. *Id.*

152. Aleah Douglas, *Agribusiness and Antitrust: The Bayer-Monsanto Merger, Its Legality, and Its Effect on the United States and European Union*, 7 GLOBAL BUS. L. REV. 156, 166 (2018).

153. *Id.*

154. Phillip Brasher, *Economists See 18% Grain Increase with Mergers*, AGRIPULSE (Sept. 28, 2016, 11:24 AM), <https://www.agri-pulse.com/articles/7532-economists-see-18-percent-cotton-seed-increase-with-mergers>.

155. *See id.*

156. Douglas, *supra* note 152, at 178.

157. *Id.* at 166.

158. *See id.*

159. *Id.*

160. *See generally id.*

161. *Id.* at 166.

162. *Id.*

163. Dana Varinsky, *The 66-Billion Dollar Bayer-Monsanto Merger Just Got a Major Green Light, But Farmers are Terrified*, BUS. INSIDER (May 29, 2018, 1:27 PM), <https://www.businessinsider.com/bayer-monsanto-merger-has-farmers-worried-2018-4>.

order to double the world's food supply."¹⁶⁴ However, these mergers seem to have caused the opposite effect, as the large companies begin locking in profit and taking over the market, competition disappears, and companies begin to lose the drive to innovate or create new products.¹⁶⁵

When seed production industry executives met with President Trump, they unveiled a plan, promising to spend \$16 billion on R&D globally over the next six years.¹⁶⁶ However, the R&D budget illustrates a different story, as the two companies have spent about \$2.59 billion a year, leading the R&D funding spent to be less than \$500 million over the six-year period.¹⁶⁷ It seems as though the "best" is not necessary due to lack of competition, and the company will thus settle for "good enough."¹⁶⁸

CONCLUSION

The hope for the future is for these mergers to benefit society, by offering a utility of food production at reasonable costs and easy access. The research could provide long term solutions to food concerns. However, the international community must reinvent the regulations on these multibillion-dollar industries. Proper protective measures need to be put into law to guarantee access to seeds.

Enacting specific international legislation, such as imposing new restrictions on the subject matter eligible for excessive protection, could help guide nation-states to err on the side of caution when embracing innovation. The key purpose for these legislative enactments needs to be oriented to address the underlying problem involved, the risks to the global environment, beneficial resources, and food security. Additionally, establishing patent protection exemptions for particular seed varieties protects certain seeds from infringement, sustains seed access, and allows some reuse of seeds by farmers. Finally, the international legal system could set out guidelines for permissible costs for licensing of seed property, erring on the side of accessibility to farmers, and to ensure profits for the seed production industry. Sustaining current anti-trust regulation that protects from abuse of patent licensing, along with limiting patent protections for large seed industries, can help ensure international agricultural access, low costs, and plentiful diversity; to promote food security for our future world.

164. *Id.*

165. *See id.*

166. *See id.*

167. *Id.*

168. *See id.*