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## Poverty via Monopolization: The Impact that Intellectual Property Rights and Federal Subsidies Have on Farm Poverty

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## Poverty via Monopolization: The Impact that Intellectual Property Rights and Federal Subsidies Have on Farm Poverty

### Cover Page Footnote

J.D. Candidate, 2022, University of Georgia School of Law. I dedicate this note to Dr. Marianne Shockley, who cultivated my love for insects, agriculture, and our wonderfully diverse environment. I also thank all the family, friends, and pets who have supported me throughout law school.

**POVERTY VIA MONOPOLIZATION: THE IMPACT  
THAT INTELLECTUAL PROPERTY RIGHTS AND  
FEDERAL SUBSIDIES HAVE ON FARM POVERTY**

*Elizabeth Slater\**

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\* J.D. Candidate, 2022, University of Georgia School of Law. I dedicate this note to Dr. Marianne Shockley, who cultivated my love for insects, agriculture, and our wonderfully diverse environment. I also thank all the family, friends, and pets who have supported me throughout law school.

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## I. INTRODUCTION

In 1970, the Nobel Committee awarded the Nobel Peace Prize to Norman Ernest Borlaug for inventing new cereal crop strains that reduce the “environmental and social ills that too often lead to conflict between men and between nations.”<sup>1</sup> In his acceptance speech, Borlaug warned that those attempting to solve poverty and hunger would not be successful unless they work together “to provide food and other amenities of a progressive civilization for the benefit of all mankind.”<sup>2</sup> Since then, the estimated prevalence of undernourishment in developing countries has decreased from 34.75% in 1970 to less than 13% in 2015.<sup>3</sup> However, the Green Revolution also rapidly altered the profitability of farming.<sup>4</sup> For American farmers who supply the world with \$118.3 billion of agricultural exports annually,<sup>5</sup> farming contributed an average of only \$296 to each household’s income in 2019.<sup>6</sup>

These economic burdens on American farmers have become oppressive, partially due to increased input costs with corn and soy seed ranging between \$25 and \$70 per acre depending on variety and planting density.<sup>7</sup> For these farmers, artificially heightened seed prices afforded to inventors are a substantial financial burden. A 2019 survey indicated that “the nonmetro poverty rate was 15.4 percent . . . compared with 11.9 percent for metro areas.”<sup>8</sup>

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<sup>1</sup> *Norman Borlaug Biographical*, NOBEL PRIZE, <https://www.nobelprize.org/prizes/peace/1970/borlaug/biographical/> (last visited Jan. 07, 2021).

<sup>2</sup> *Norman Borlaug Acceptance Speech*, THE NOBEL PRIZE, <https://www.nobelprize.org/prizes/peace/1970/borlaug/acceptance-speech/> (last visited Jan. 07, 2021).

<sup>3</sup> Max Rosner & Hannah Ritchie, *Hunger and Undernourishment*, OUR WORLD IN DATA (2019), <https://ourworldindata.org/hunger-and-overnourishment>.

<sup>4</sup> See generally Prabhu L. Pingali, *Green Revolution: Impacts, Limits, and the Path Ahead*, 109(31) PNAS 12302 (2012) (providing an overview of the Green Revolution in the context of what a “Green Revolution 2.0” should prioritize).

<sup>5</sup> Stephen D. Simpson, *Top Agricultural Producing Countries*, INVESTOPEDIA, <https://www.investopedia.com/financial-edge/0712/top-agricultural-producing-countries.aspx> (last updated July 22, 2021).

<sup>6</sup> *Highlights from the September 2021 Farm Income Forecast*, ECON. RES. SERV. U.S. DEP’T AGRICULTURE, <https://www.ers.usda.gov/topics/farm-economy/farm-sector-income-finances/highlights-from-the-farm-income-forecast/> (last updated Sept. 2, 2021).

<sup>7</sup> Sam McNeill, *Control Seed Costs to Manage Profits*, UNIV. KY. DEP’T BIOSYSTEMS AND AGRIC. ENG’G, [https://www.uky.edu/bae/sites/www.uky.edu/bae/files/Seed%20Cost%20Calculator\\_0.pdf](https://www.uky.edu/bae/sites/www.uky.edu/bae/files/Seed%20Cost%20Calculator_0.pdf) (last visited Jan. 17, 2021).

<sup>8</sup> *Rural Poverty and Well-Being*, ECON. RES. SERV. U.S. DEP’T AGRICULTURE, <https://www.ers.usda.gov/topics/rural-economy-population/rural-poverty-well-being/> (last updated Sept. 17, 2021).

In the agricultural product market, four companies dominate the sale of seeds and agricultural chemicals: BASF, Bayer, Dow-Dupont, and Syngenta.<sup>9</sup> Despite seed prices increasing more than 30 percent annually,<sup>10</sup> these companies justify high prices by pointing to the \$136 million per new variety spent on research and development from 2008-2012 alone.<sup>11</sup> Changing the scheme surrounding agricultural subsidies would help shift the high costs of biotech development off of farmers without chilling new seed varieties' innovation by agricultural product firms.

Producers of new seed varieties are “protected by utility patents, plant patents, certification under the Plant Variety Protection Act, and trade secrets.”<sup>12</sup> Makers of genetically modified seeds find the highest degree of protection from the Plant Variety Protection Act (PVPA), which awards twenty years of exclusive control over newly propagated plant varieties.<sup>13</sup> The exorbitant cost and the degree of luck involved in developing a successful seed variety limit smaller companies' ability to price compete against the big four agri-tech firms in a particular seed market, especially without infringing on another company's intellectual property rights.<sup>14</sup> Increasing federal research subsidies to public agricultural research organizations would help mitigate the trend of agricultural research becoming profit-oriented instead of need-oriented while not discouraging private inventors by reducing patent regime protections.

This Note serves to (1) provide background on new seed development and wealth concentration in the agriculture markets; (2) describe the current intellectual property regime surrounding agricultural products produced through

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<sup>9</sup> See *Segment Profile*, BASF, <https://report.basf.com/2019/en/managements-report/segments/agricultural-solutions/segment-profile.html> (last updated Feb. 28, 2020) (reporting € 7.81 billion in agricultural product sales in 2019); Christopher Walljasper, *DowDupont Split Off Its Agriculture Business; Here's What to Know About Corteva Agriscience*, MIDWEST CTR. FOR INVESTIGATIVE REPORTING (June 12, 2019), <https://investigatamidwest.org/2019/06/12/dowdupont-split-off-its-agriculture-business-heres-what-to-know-about-corteva-agriscience/> (predicting the wholly-owned agricultural product subsidiary of the Dow-DuPont merger to make \$14.3 billion in agricultural sales in 2019); *Annual Report 2018*, BAYER, [https://www.bayer.com/sites/default/files/2020-04/bayer\\_ar18\\_entire.pdf](https://www.bayer.com/sites/default/files/2020-04/bayer_ar18_entire.pdf) (last visited Jan. 17, 2021) (reporting € 14.6 billion in net sales from Bayer AG in 2018); *2019 Full Year Results*, SYNGENTA GLOBAL (Feb. 14, 2020), <https://www.syngenta.com/company/media/syngenta-news/year/2020/2019-full-year-results> (reporting \$13.6 billion in agricultural product sales).

<sup>10</sup> Aleksandre Maisahvili et al., *Seed Prices, Proposed Mergers and Acquisitions Among Biotech Firms*, 31(4) CHOICES 1, 4th Quarter 2016, at 1, 4.

<sup>11</sup> *Cost of Bringing a New Biotech Crop to Market*, CROPLIFE INT'L, <https://croplife.org/plant-biotechnology/regulatory-2/cost-of-bringing-a-biotech-crop-to-market/> (last visited Jan. 17, 2021).

<sup>12</sup> Keith A. Zullo & Raivo A. Karmas, *Protecting Intellectual Property in Plants and Seeds*, 53 CEREAL FOODS WORLD 319, 319 (2008).

<sup>13</sup> See 7 U.S.C. § 2483(b)(1) (stating that “the term of plant variety protection shall expire 20 years from the date of issue of the certificate”).

<sup>14</sup> Maisahvili et al., *supra* note 10, at 2.

biotechnology; (3) describe how the government distributes agricultural subsidies pre-market to research initiatives and post-market to farmers; and (4) argue that increasing federal spending towards public agricultural research would be more effective at reducing the cost of new seed varieties than relaxing current patent protection and would occur without curbing innovation in the seed development market.

## II. BACKGROUND

The following section provides background information on the development of new seed varieties. This section describes how seed monopolization affects farmers' income to highlight the importance of reducing price barriers in new seed development. This section also discusses why biotechnology companies sell genetically modified seeds under single-use licenses and how it has upended traditional farming practices.

### A. SEED VARIETY DEVELOPMENT

Developing higher yield, better tasting, and more resource-efficient crops has been a priority in the United States since its founding. As President Washington wrote, "I know of no pursuit in which more zeal [and] important service can be rendered to any Country than by improving its agriculture. . . ."<sup>15</sup> Growing significantly from a nation of low-technology subsistence farmers,<sup>16</sup> the North American seed market has become a massive industry worth \$24 billion in 2019.<sup>17</sup>

There are two methods commonly used to create new plant varieties. The first is by inducing mutations in a plant's genotype and then cross-breeding it with another plant to achieve specific phenotypic characteristics.<sup>18</sup> This method is an extension of how farmers have traditionally domesticated crops for thousands of years, by selecting to plant seeds from organisms with desirable traits or by combining traits between two closely related species through cross-breeding.<sup>19</sup> The second method uses recombinant DNA technology, which

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<sup>15</sup> Letter from George Washington to John Sinclair (July 20, 1794), in 16 THE PAPERS OF GEORGE WASHINGTON PRESIDENTIAL SERIES, 1 May – 30 September 1794, 394, 394 (David R. Hoth & Carol S. Ebel eds., 2011).

<sup>16</sup> R. DOUGLAS HURT, AMERICAN AGRICULTURE: A BRIEF HISTORY, 112 (2002).

<sup>17</sup> *North America Seeds Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026*, IMARC, <https://www.imarcgroup.com/north-america-seeds-market> (last visited Jan. 17, 2021).

<sup>18</sup> Inger B. Holme et al., *Induced Genetic Variation in Crop Plants by Random or Targeted Mutagenesis: Convergence and Differences*, FRONTIERS IN PLANT SCIENCE, (Nov. 14, 2019), <https://www.frontiersin.org/articles/10.3389/fpls.2019.01468/full>.

<sup>19</sup> Wicczorek Ania & Wright Mark, *History of Agricultural Biotechnology: How Crop Development Has Evolved*, NATURE EDUC. KNOWLEDGE PROJECT,

introduces characteristics from another species by isolating the desired gene, cloning it in a host bacteria, and then introducing the new trait into the target species.<sup>20</sup> In food crops, recombinant DNA is used to increase resistance to chemical treatments, diseases, environmental conditions, and pests, along with reducing spoilage and improving the plant's nutrient profile.<sup>21</sup> In non-food crops, many different industries use the technology in bioremediation (using microorganisms to convert hazardous materials into non-toxic or less toxic substances<sup>22</sup>), the production of pharmaceutical agents, and the creation of biofuels.<sup>23</sup>

Genetically modified foods are prevalent in the United States. Over 93 percent of the country's soy and corn is grown from genetically modified seeds.<sup>24</sup> Currently, the federal government has approved ten transgenic crops for human and animal consumption.<sup>25</sup> Some varieties of genetically modified crops have established a more robust market hold than others. Even though it was released only ten years ago, the genetically modified sugar beet has grown to dominate the market. It represents 95 percent of all American-grown sugar beets in 2019.<sup>26</sup> In contrast, only 0.07% of all apples harvested and sold in the United States are genetically modified.<sup>27</sup>

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<https://www.nature.com/scitable/knowledge/library/history-of-agricultural-biotechnology-how-crop-development-25885295/> (last visited Jan. 17, 2021).

<sup>20</sup> AFJ Griffiths et al., *Making Recombinant DNA*, MODERN GENETIC ANALYSIS (1999), <https://www.ncbi.nlm.nih.gov/books/NBK21407/>.

<sup>21</sup> *ISAAA Brief 46-2013: Executive Summary*, INT'L SERV. ACQUISITION AGRI-BIOTECH APPLICATIONS, <http://www.isaaa.org/resources/publications/briefs/46/executivesummary/> (last visited Jan. 17, 2021).

<sup>22</sup> *What Is Bioremediation?*, UNIV. HAWAII, <http://www.hawaii.edu/abrp/biordef.html> (last visited Jan. 17, 2021).

<sup>23</sup> *ISAAA Brief 46-2013: Executive Summary*, *supra* note 21.

<sup>24</sup> Brad Plumer, *How Widespread are GM Foods?*, VOX (July 22, 2015, 12:24 PM), <https://www.vox.com/2014/11/3/18092748/how-widespread-are-gm-foods>.

<sup>25</sup> *GMO Crops, Animal Food, and Beyond*, U.S. FOOD AND DRUG ADMIN., <https://www.fda.gov/food/agricultural-biotechnology/gmo-crops-animal-food-and-beyond> (last updated Sept. 28, 2020) (listing alfalfa, apple, canola, corn, cotton, papaya, potato, soybean, sugar beet, and summer squash as the approved genetically modified crops).

<sup>26</sup> Esther Honig, *Sugar Beet Farmers Caught in GMO Debate, Wait for USDA Labeling Decision*, HARVEST PUB. MEDIA (May 18, 2018), <https://www.harvestpublicmedia.org/post/sugar-beet-farmers-caught-gmo-debate-wait-usda-labeling-decision>.

<sup>27</sup> *Statistics by Subject*, U.S. DEP'T AGRIC. NAT'L AGRIC. STAT. SERV., [https://www.nass.usda.gov/Statistics\\_by\\_Subject/result.php?BD31E5E3-CF06-3ACC-85CB-E95901EDC358](https://www.nass.usda.gov/Statistics_by_Subject/result.php?BD31E5E3-CF06-3ACC-85CB-E95901EDC358) (last updated May 4, 2018) (listing the total apple crop yield for 2020 as 10.253 billion pounds); U.S.: *GM Non-Browning Arctic Apple Expands into Foodservice*, FRESH FRUIT PORTAL (Aug. 13, 2019), <https://www.freshfruitportal.com/news/2019/08/13/u-s-gm-non-browning-arctic-apple-expands-into-foodservice/> (listing the genetically modified apple yield at an estimated eight million pounds for the 2019-2020 season).

Developing new seed varieties is a costly venture borne by biotechnology companies in the hopes of discovering an incredibly profitable variety.<sup>28</sup> In 2010, the total market value for genetically grown crops worldwide was estimated at \$14.8 billion, with one-third of the benefit, or roughly \$4.93 billion, directly benefiting the chemical and seed industry.<sup>29</sup> Another third of the benefit is split between farms<sup>30</sup>, of which there was an estimated 2.02 million in the United States in 2020,<sup>31</sup> drastically diluting the per farm benefit of genetically modified crops.

The widespread incorporation of genetically modified seed varieties into farming practices has paved the way for a 22 percent yield increase, despite reducing chemical pesticide applications by 37 percent.<sup>32</sup> One study indicated that yield increases from growing genetically engineered crops in the European Union could result in a reduction of greenhouse gas emissions by 33 million metric tons of carbon dioxide equivalents per year, due to a reduction in the total land needed to grow crops and the land's ability to store carbon when not used for agriculture.<sup>33</sup> However, the debate over transgenic crops' environmental effect is incredibly polarized, with skeptics of the practice warning of potentially damaging long-term results.<sup>34</sup> One concern surrounding genetically modified crops is the potential for "genetic pollution" of traits from the modified crop into native and invasive plants, creating "super-weeds" that carry herbicide-resistant traits.<sup>35</sup> This concern is already present considering the vast number of insect species resistant to many conventional pesticides used in tandem with genetically modified crops.<sup>36</sup>

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<sup>28</sup> *What Does It Take to Bring a New GM Product to Market?*, GENETIC LITERACY PROJECT, <https://geneticliteracyproject.org/gmo-faq/what-does-it-take-to-bring-a-new-gm-product-to-market/> (last visited Jan. 17, 2021) (listing the mean cost of developing a new seed trait and bringing it through the regulatory process at \$135 million).

<sup>29</sup> Brad Plumer, *Who Profits from GMO Technology?*, VOX (July 22, 2015, 12:24 PM), <https://www.vox.com/2014/11/3/18092770/who-profits-from-gmo-technology>.

<sup>30</sup> *Id.*

<sup>31</sup> *Id.*; Kathleen Kassel, *Farming and Farm Income*, ECON. RES. SERV. U.S. DEP'T AGRICULTURE, <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income> (last updated Sept. 2, 2020).

<sup>32</sup> Wilhelm Klumper & Martin Qaim, *A Meta-Analysis of the Impacts of Genetically Modified Crops*, PLOS ONE (Nov. 3, 2014), <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111629#abstract0>.

<sup>33</sup> Emma Kovak et al., *The Climate Benefits of Yield Increases in Genetically Engineered Crops*, BIORXIV (Feb. 10, 2021), <https://www.biorxiv.org/content/biorxiv/early/2021/02/10/2021.02.10.430488.full.pdf>.

<sup>34</sup> Amy W. Ando & Madhu Khanna, *Environmental Costs and Benefits of Genetically Modified Crops: Implications for Regulatory Strategies*, 44(3) AM. BEHAVIORAL SCIENTIST 435, 435–36 (2000).

<sup>35</sup> *Id.* at 437-438.

<sup>36</sup> LARRY J. GUT ET AL., *Chapter 2: Managing the Community of Pests and Beneficials*, in FRUIT CROP ECOLOGY AND MANAGEMENT (2002), as reprinted in *How Pesticide Resistance Develops*, MICH. STATE UNIV. EXTENSION, [https://www.canr.msu.edu/grapes/integrated\\_pest\\_management/how-pesticide-resistance-](https://www.canr.msu.edu/grapes/integrated_pest_management/how-pesticide-resistance-)

## B. TRANSGENIC SEED MARKETING

1. *How Seed Monopolization Affects Farmers' Income*

As mentioned previously, four companies dominate the seed industry (Bayer, BASF, Dow-DuPont, and ChemChina).<sup>37</sup> This combined 60 percent market share<sup>38</sup> has led to worries that the industry is anti-competitive, as illustrated in Bayer's massive selloffs before purchasing Monsanto<sup>39</sup> and in the spin-off of Corteva after the merging of Dow-DuPont<sup>40</sup>, all to appease antitrust regulators. The consolidation of the seed industry is not the only monopolizing force at play. In addition to regulators turning a blind eye to the industry's anti-competitiveness, the federal government also grants temporary monopolies to developers of new seed varieties to incentivize the often enormously expensive research and development process.<sup>41</sup> Sexually reproducing plant varieties (those that have seeds) are not protected under traditional patent law.<sup>42</sup> Since 1970, however, the Plant Variety Protection Act (PVPA) has granted patent-like protections for up to twenty years.<sup>43</sup> The Supreme Court has also confirmed that the government can award utility patents for advancements in the technology of

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develops (last visited Jan. 17, 2021) ("Worldwide, more than 500 species of insects, mites, and spiders have developed some level of pesticide resistance.").

<sup>37</sup> Kristina Hubbard, *The Sobering Details Behind the Latest Seed Monopoly Chart*, CIV. EATS (Jan. 11, 2019), <https://civileats.com/2019/01/11/the-sobering-details-behind-the-latest-seed-monopoly-chart/>.

<sup>38</sup> *Id.*

<sup>39</sup> Dan Mangan, *US Forces Germany's Bayer to Shed \$9 Billion in Ag Business in Biggest Ever Anti-Trust Sell-Off*, CNBC (May 30, 2018, 5:11 PM), <https://www.cnbc.com/2018/05/29/bayer-will-sell-basf-9-billion-in-assets-to-allow-monsanto-purchase.html> (describing the required sell-off of \$9 billion of agricultural products to BASF for the Justice Department to approve the \$66 billion purchase of Monsanto).

<sup>40</sup> Diane Bartz, *Dow, DuPont Merger Wins U.S. Antitrust Approval with Conditions*, REUTERS (June 15, 2017, 4:15 PM), <https://www.reuters.com/article/us-du-pont-m-a-dow/dow-dupont-merger-wins-u-s-antitrust-approval-with-conditions-idUSKBN1962SN> (noting that Assistant Attorney General Finch approved of the merger because the settlement agreed upon with the planned split into three companies—Dow, DuPont, and Corteva—"preserve[s] rigorous competition").

<sup>41</sup> See *Why We Patent Seeds*, BAYER VEGETABLES U.S., <https://www.vegetables.bayer.com/us/en-us/about/why-we-patent-seeds.html> (last visited Sept. 17, 2021) (stating that as a seed developer, it is essential to obtain patent protection in order "to protect our time, ideas and investment spent to develop those products.").

<sup>42</sup> 35 U.S.C. § 161 (granting patents for plants only to those who, among other requirements, asexually reproduces the plant).

<sup>43</sup> David Bennett, *U.S. Seed Law History: A Primer*, FARM PROGRESS, (Mar. 02, 2006), <https://www.farmprogress.com/us-seed-law-history-primer>.

living organisms such as plants.<sup>44</sup> This protection also grants twenty years of economic exclusivity to holders.<sup>45</sup>

In general, net farm income has continued to increase in the past few years.<sup>46</sup> The Economic Research Service branch of the Department of Agriculture has projected that it will reach a total of \$113 billion at the end of 2021, over \$15 billion more than in 2020.<sup>47</sup> In the same period, however, national farm debt is expected to decrease by \$1.0 billion to a total of \$443.9 billion.<sup>48</sup> The estimated average median farm income has sunk to -\$1,387 for 2021, continuing the trend of negative farm income being negative since 1996, with only one year, 2019, breaking the trend and recording positive income values.<sup>49</sup>

A large contributor to the increase in farm debt has been the double threat of increased agricultural input costs<sup>50</sup> alongside the weakness in domestic commodity markets.<sup>51</sup> Between 1995 and 2017, the corn seed price has increased by approximately 300 percent, with crop yield only increasing 35 percent.<sup>52</sup> Seed prices have increased at a disproportionate rate compared to other farm expenses; purchasing seeds has increased from eight to almost 15 percent of a corn farmer's production expenses between 2000 and 2017.<sup>53</sup>

## 2. *Single-Use Licenses in the Seed Market*

Seed manufacturing giant, Monsanto (now Bayer), has gained a litigious reputation for aggressively pursuing farmers who violated their RoundUp Ready® cotton and soybean seeds single-use license.<sup>54</sup> For example, in *Monsanto*

<sup>44</sup> *Diamond v. Chakrabarty*, 447 U.S. 303, 313 (1980).

<sup>45</sup> *How Long Does Patent, Trademark or Copyright Protection Last?*, STOPFAKES.GOV, <https://www.stopfakes.gov/article?id=How-Long-Does-Patent-Trademark-or-Copyright-Protection-Last> (last updated Feb. 25, 2021).

<sup>46</sup> *Highlights from the September 2021 Farm Income Forecast*, *supra* note 6.

<sup>47</sup> *Id.*

<sup>48</sup> *Id.*

<sup>49</sup> *Id.*

<sup>50</sup> Tony Dreibus, *Ag Census: Input Costs Rise, Farm Income Declines Amid Low Commodity Prices*, SUCCESSFUL FARMING (Apr. 18, 2019), <https://www.agriculture.com/news/business/ag-census-input-costs-rise-farm-income-declines-amid-low-commodity-prices>.

<sup>51</sup> Humeyra Pamuk, *U.S. Farm Debt Soars to Levels Seen During 1980s Farm Crisis: Agriculture Secretary*, REUTERS (Feb. 27, 2019, 10:39 AM), <https://www.reuters.com/article/us-usa-farms-perdue/u-s-farm-debt-soars-to-levels-seen-during-1980s-farm-crisis-agriculture-secretary-idUSKCN1QG24Y>.

<sup>52</sup> *Seed Price Triples Over Last 20 Years*, THE SCOOP: SOLUTIONS FOR THE FARMER'S ADVISOR (July 21, 2017), <https://www.thedailyscoop.com/news/seed-price-triples-over-last-20-years>.

<sup>53</sup> David Widmar, *U.S. Seed Costs Drop, Remain Historically High*, SUCCESSFUL FARMING (Oct. 24, 2018), <https://www.agriculture.com/news/business/us-seed-costs-drop-remain-historically-high>.

<sup>54</sup> *See generally Monsanto Co. v. McFarling*, 363 F.3d 1336, 1338 (Fed. Cir. 2004) (suing McFarling for replanting patented soybeans saved from the prior year's yield); *Monsanto Co. v. Ralph*, 382 F.3d 1374, 1377–78 (Fed. Cir. 2004) (suing Ralph for saving 904 unused bags of modified seeds for the next growing season); *Monsanto Co. v. David*, 516 F.3d 1009, 1012

*Co. v. McFarling*, McFarling signed a technology agreement that restricted the use of purchased genetically modified seeds to “planting a commercial crop only in a single season” and specified that purchasers could not save the seeds for another season’s use.<sup>55</sup> McFarling kept the seeds and then replanted them the next year.<sup>56</sup> The appellate court upheld a jury verdict finding that McFarling willingly infringed upon Monsanto’s patented technology.<sup>57</sup> However, damages based on the liquidated damages clause (which would have held McFarling liable for \$780,000) were invalid because the clause itself was invalid and unenforceable.<sup>58</sup>

Biotechnology companies’ utilization of the single-use license forces farmers to purchase expensive new seeds annually or risk legal liability.<sup>59</sup> Farmers switching to herbicide-tolerant genetically modified seeds see a more effective and economical method of weed control than what prior methods could provide.<sup>60</sup> A 26 percent increase in farm herbicide use due to increasing weed resistance and stagnating yields has helped offset the benefit of herbicide-resistant crops.<sup>61</sup>

Single use licenses were created by software vendors in the 1980s to limit access to easily replicated products, such as computer programs.<sup>62</sup> Seed companies began using the technique soon after, as seeds are another easily replicated commodity, to preserve market and quality control over their product.<sup>63</sup> Such contracts usually require signing to purchase the seed and restrict a grower from using the seeds multiple seasons.<sup>64</sup> Manufacturers of genetically modified seeds that use the single-use license justify the practice by pointing to

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(Fed. Cir. 2008) (suing David for replanting seeds from the previous year because he did not purchase enough modified seeds to cover his entire field and for purchased enough glyphosate to apply to his entire field, which would kill non-modified seeds); *Bowman v. Monsanto Co.*, 569 U.S. 278, 278 (2013) (suing Bowman for purchasing modified soybeans meant for consumption, planting them and taking advantage of glyphosate resistance).

<sup>55</sup> *McFarling*, 302 F.3d at 1293.

<sup>56</sup> *Id.*

<sup>57</sup> *McFarling*, 363 F.3d at 1338.

<sup>58</sup> *Id.*

<sup>59</sup> *GMOs – Top Five Concerns for Family Farmers*, FARM AID, <https://www.farmaid.org/issues/gmos/gmos-top-5-concerns-for-family-farmers/> (last updated March 17, 2016).

<sup>60</sup> Jerry M Green, *The Benefits of Herbicide-Resistant Crops*, 68(10) PEST MGMT. SCI. 1323, 1323 (May 21, 2012).

<sup>61</sup> Elizabeth Royte, *The Post-GMO Economy*, MODERN FARMER (Dec. 06, 2013), <https://modernfarmer.com/2013/12/post-gmo-economy/>.

<sup>62</sup> Tim Templeton, *A Brief History of Software Production and Licensing*, TEMPLETON INTERACTIVE (Nov. 08, 2013), <http://www.templeton-interactive.com/blog/a-brief-history-of-software-protection-and-licensing/>.

<sup>63</sup> *Commentary on Single Use Seed Transactions*, SEED INNOVATION, <https://seedinnovation.ca/wp-content/uploads/2015/07/1491992-Single-Use-Seed-Agreement-Commentary-v2-REGINA.pdf>, (last visited Jan. 17, 2021).

<sup>64</sup> *Id.*

diminished efficacy of the trait in subsequent generations of the seed.<sup>65</sup> However, such practices have upended the traditional practice among farmers of saving seeds from one growing season to another.<sup>66</sup>

Despite the universality of single-use licenses on genetically modified seeds, many farmers still take the risk and attempt to save their seeds from season to season.<sup>67</sup> This is partly because

the funds required to purchase seed are typically needed at the same time that farmers are likely to have a negative cash flow. And while the price of seed is a small percentage of the overall cost of production when compared with the cost of equipment, fuel, fertilisers, lime, herbicides and insecticides, certified seed is consistently more expensive than farmer-saved seed. As such, farmers who saved seed could generally reduce principal and interest that would otherwise be paid on farm loans.<sup>68</sup>

Seed saving is also an essential practice for many farmers culturally and is as old as agriculture itself.<sup>69</sup> Economically, the practice makes sense, as farmers would save the seed from that season's highest-yielding plants to replant the next season to replicate that year's economic successes.<sup>70</sup> Some opponents of single-use patents have compared the restriction as turning them into "virtual sharecroppers."<sup>71</sup> In short, the use of single-use licenses is deeply contested and heavily litigated in the courts.<sup>72</sup> A primary contributor to the seed pricing issue is

<sup>65</sup> *Id.*

<sup>66</sup> La Via Campesina, *Seed Laws That Criminalise Farmers: Resistance and Fightback*, GRAIN (Apr. 8, 2015), <https://grain.org/article/entries/5142-seed-laws-that-criminalise-farmers-resistance-and-fightback>.

<sup>67</sup> *Does Monsanto Sue Farmers Who Save Patented Seeds or Mistakenly Grow GMOs?*, GENETIC LITERACY PROJECT, <https://geneticliteracyproject.org/gmo-faq/does-monsanto-sue-farmers-who-save-patented-seeds-or-mistakenly-grow-gmos/> (last visited Oct. 11, 2021) (stating that just one company, Monsanto, "has filed 147 suits against farmers since 1997 . . . who have knowingly violated patent rights by saving seeds").

<sup>68</sup> Michael Mascarenhas & Lawrence Busch, *Seeds of Change: Intellectual Property Rights, Genetically Modified Soybeans and Seed Saving in the United States*, 46 SOCIOLOGIA RURALIS 122, 124 (2006) (citation omitted).

<sup>69</sup> Sue Senger, *Save a Seed to Save Yourself: The Importance of Seed Saving in 2020*, MEDIUM (Dec. 31, 2019), <https://medium.com/age-of-awareness/save-a-seed-to-save-yourself-the-importance-of-seed-saving-in-2020-e15d22127ffc>.

<sup>70</sup> Elizabeth I. Winston, *A Patent Misperception*, 16 LEWIS & CLARK L. REV. 289, 296 (2012).

<sup>71</sup> *A Preliminary Report on Seeds & Seed Practices Across the United States*, U.S. FOOD SOVEREIGNTY ALLIANCE, <http://grassrootsonline.org/sites/default/files/usfsaseedreportapril2014final.pdf> (last visited Jan. 17, 2021).

<sup>72</sup> *See, e.g.*, *Monsanto Co. v. Bowman*, 657 F.3d 1341 (Fed. Cir. 2011) (holding in favor of patent owner); *Monsanto Co. v. David*, 516 F.3d 1009 (Fed. Cir. 2008) (holding in favor of patent

the intellectual property protections available to manufacturers of biotech crops, which the next sections explore in detail.

### III. INTELLECTUAL PROPERTY PROTECTION FOR SEEDS

Intellectual property law is designed to protect the creations of the human mind.<sup>73</sup> The evolution of intellectual property law surrounding new seed varieties is fascinating as traditional patent law does not protect seeds.<sup>74</sup> While in the 1840s, the United States Patent and Trademark Office freely distributed high-performing seeds to farmers and afforded no ownership rights to those who developed a new variety, statutes and other mechanisms were quickly utilized during the Green Revolution<sup>75</sup> to grant researchers protection over their scientific advancements.<sup>76</sup>

Exclusivity laws were designed to adequately incentivize innovation without over-burdening the average purchaser of such products; manufacturers of new seed varieties have instead been accused of using them to limit competition, which has resulted in antitrust investigations in companies like Monsanto.<sup>77</sup> The following sections discuss three protections commonly used with modified seeds: (a) Plant Variety Protection Act, (b) utility patents, and (c) trade secrets.

#### A. PLANT VARIETY PROTECTION ACT

The Plant Variety Protection Act (PVPA) gives inventors up to 25 years of exclusive control over the stable, new, uniform, and distinct varieties of tuber or

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owner); *Monsanto Co. v. McFarling*, 488 F.3d 973 (Fed. Cir. 2007) (holding in favor of patent owner); *Monsanto Co. v. Ralph*, 382 F.3d 1374 (Fed. Cir. 2004) (holding in favor of patent owner); *Monsanto Co. v. Strickland*, 604 F.Supp.2d 805 (D. S.C. 2009) (holding in favor of patent owner); *Monsanto Co. v. Parr*, 545 F.Supp.2d 836 (N.D. Ind. 2008) (granting permanent injunction against farmer using seeds); *Monsanto Co. v. Scruggs*, 342 F.Supp.2d 584 (N.D. Miss. 2004) (holding in favor of patent owner); *Monsanto Co. v. Swann*, 308 F.Supp.2d 937 (E.D. Mo. 2003) (holding in favor of patent owner); *Monsanto Co. v. Trantham*, 156 F.Supp.2d 855 (W.D. Tenn. 2001) (holding in favor of patent owner).

<sup>73</sup> *What is Intellectual Property?*, WORLD INTEL. PROP. ORG., <https://www.wipo.int/about-ip/en/> (last visited Jan. 17, 2021).

<sup>74</sup> Claire Luby et al., *A Primer on Plant Breeding and Intellectual Property Rights in Organic Seed Systems*, EORGANIC, (Apr. 17, 2019), <https://eorganic.org/node/27215>.

<sup>75</sup> See Raymond C. Offenheiser, *The Green Revolution: Norman Borlaug and the Race to Fight Global Hunger*, PBS, (Apr. 3, 2020), <https://www.pbs.org/wgbh/americanexperience/features/green-revolution-norman-borlaug-race-to-fight-global-hunger/> (“The Green Revolution was the emergence of new varieties of crops, specifically wheat and rice varieties, that were able to double if not triple production of those crops in two countries.”).

<sup>76</sup> *Id.*

<sup>77</sup> Jack Kaskey & William McQuillen, *Monsanto Patents May Protect Its Monopolies*, THE WICHITA EAGLE (Aug. 08, 2014, 9:56 AM), <https://www.kansas.com/news/business/agriculture/article1027761.html>.

sexually reproducing plant varieties.<sup>78</sup> Exclusivity runs 20 years from the certificate's date of issue generally, except for vines and trees, which receive protection for 25 years.<sup>79</sup> The PVPA grants similar protections as provided by utility patents but differs in that the PVPA does not have strict standards of usefulness or non-obviousness.<sup>80</sup> Plant Variety Protections also differ from grants under the Plant Patent Act, as PVPA does not limit protections only to asexually reproducing plants.<sup>81</sup>

To receive the period of exclusivity, the certificate holder must prove that the developed plant meets four requirements. The PVPA requires that the variety be:

- (1) new, in the sense that, on the date of filing of the application for plant variety protection, propagating or harvested material of the variety has not been sold or otherwise disposed of to other persons. . .
- (2) distinct, in the sense that the variety is clearly distinguishable from any other variety the existence of which is publicly known or a matter of common knowledge at the time of the filing of the application;
- (3) uniform, in the sense that any variations are describable, predictable, and commercially acceptable; and
- (4) stable, in the sense that the variety, when reproduced, will remain unchanged with regard to the essential and distinctive characteristics of the variety with a reasonable degree of reliability commensurate with that of varieties of the same category in which the same breeding method is employed.<sup>82</sup>

The PVPA is not without criticism. One issue with the system is the exorbitant profits that seed manufacturers can make.<sup>83</sup> Too strong of intellectual property rights may restrict the product unnecessarily by making it too expensive

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<sup>78</sup> 7 U.S.C. §§ 2321-2582 (2020).

<sup>79</sup> *Id.*

<sup>80</sup> Ashley J. (Clever) Earle, *Planting Innovation: A Look into Plant Patent Protection and the Deficiencies of the Plant Protection Act and Plant Variety Protection Act*, UNIV. CIN. L. REV. (May 26, 2015), <https://uclawreview.org/2015/05/26/planting-innovation-a-look-into-plant-patent-protection-and-the-deficiencies-of-the-plant-protection-act-and-plant-variety-protection-act/>.

<sup>81</sup> *Id.*

<sup>82</sup> *Id.* at §2402(a).

<sup>83</sup> Kristina Hubbard, *The Recent GE Supreme Court Case and Why It Matters*, FARM AID (June 03, 2013), <https://www.farmaid.org/blog/the-recent-ge-supreme-court-case-and-why-it-matters/>.

for those who need it.<sup>84</sup> On the other hand, proponents of the high margins afforded through exclusivity argue that it allows manufacturers to devote more significant capital to the next research product.<sup>85</sup>

#### B. UTILITY PATENTS

Another form of intellectual property protection available to seed manufacturers is utility patents, which can protect all the research and development pipeline steps from the techniques to create the plants to the physical plant itself.<sup>86</sup> There are two requirements for a seed to qualify for protection under the utility patent framework:

[A] plant breeder must show that the plant he has developed is new, useful, and nonobvious . . . In addition, the plant must meet the specifications of § 112, which require a written description of the plant and a deposit of seed that is publicly accessible.<sup>87</sup>

The ability for a new plant variety to receive intellectual property protections under the Plant Protection Act (PPA) or the PVPA does not foreclose a manufacturer from receiving protections under the utility patent regime.<sup>88</sup> This is because utility patents grant greater protections than either the PVPA or PPA.<sup>89</sup> Utility patent protection begins on the date that the patent is issued and extends for twenty years.<sup>90</sup>

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<sup>84</sup> GianCarlo Moschini & Oleg Yerokhin, *The Economic Incentive to Innovate in Plants: Patents and Plant Breeders' Rights*, in AGRICULTURAL BIOTECHNOLOGY AND INTELLECTUAL PROPERTY: SEEDS OF CHANGE 2 (2007), [https://www.card.iastate.edu/faculty/profiles/giancarlo\\_moschini/Moschini-Yerokhin-Kesan-book-preprint.pdf](https://www.card.iastate.edu/faculty/profiles/giancarlo_moschini/Moschini-Yerokhin-Kesan-book-preprint.pdf).

<sup>85</sup> *Id.*

<sup>86</sup> Marriam Lin, *Growth Through Intellectual Property - Plant Protection through Utility Patents, Certificates, and Plant Patents*, JD SUPRA (Oct. 12, 2018), <https://www.jdsupra.com/legalnews/growth-through-intellectual-property-14166/>.

<sup>87</sup> JEM Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124, 131 (2001) (citation omitted).

<sup>88</sup> *Id.* at 132.

<sup>89</sup> Earle, *supra* note 80 (“While the PPA and PVPA require less disclosure, they also offer less protection in return. A plant utility patent covers the plant, the methods of making or using the plant, and methods of breeding the plant, the PPA and PVPA only cover the exact plant and its clones, or in the case of PVPA’s, the plant and its clones or the plant and its homozygous seed.”).

<sup>90</sup> Gene Quinn, *What is a Utility Patent?*, IPWATCHDOG (Apr. 22, 2017), <https://www.ipwatchdog.com/2017/04/22/utility-patent/id=82498/>.

## C. TRADE SECRET

A trade secret is information that: (1) has an economic value from being unknown, (2) has value to those who cannot access it, and (3) takes reasonable efforts to maintain secrecy.<sup>91</sup> In general, trade secret law acts in complement to patent law.<sup>92</sup> There is a wide variety of information protected under trade secret law and applies to a broader range of information than patent law.<sup>93</sup>

While patent law is designed to protect inventors and encourage innovation, trade secrets are exclusively designed to protect existing information and are not designed to inspire new technological developments.<sup>94</sup> Strong trade secrecy protections have been criticized for hurting long-term innovation and limiting the productivity of contemporary inventors.<sup>95</sup> Additionally, because trade secret protections have no expiration date, there will be no eventual public benefit from information sharing.<sup>96</sup>

Protecting trade secrets is incredibly important to the agricultural industry. For example, in 2019, a former agricultural engineer for Monsanto was indicted for attempting to distribute protected predictive algorithms to a Chinese government-sponsored research institute.<sup>97</sup> The value of trade secret protection is exceptionally high in crops that rely on two secret inbred parent lines to create the hybrid seed, such as corn.<sup>98</sup> This protection, however, does little for manufacturers of self or open-pollinated crops such as soybeans.<sup>99</sup>

In the following sections, this Note explores how agricultural subsidies are distributed and how increasing federal agricultural research spending would be a more effective solution to high seed costs than altering the current intellectual property framework.

## IV. AGRICULTURAL SUBSIDIES

As discussed previously, the production of new seed varieties using an intentional selection of desirable traits (either through cross-breeding or

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<sup>91</sup> *Trade Secret Policy*, U.S. PAT. AND TRADEMARK OFF., <https://www.uspto.gov/ip-policy/trade-secret-policy> (last visited Jan. 17, 2021).

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*

<sup>94</sup> Andrea Contigiani & David H. Hsu, *How Trade Secrets Hurt Innovation*, HARV. BUS. REV. (Jan. 29, 2019), <https://hbr.org/2019/01/how-trade-secrets-hurt-innovation>.

<sup>95</sup> *Id.*

<sup>96</sup> Michael Risch, *Why Do We Have Trade Secrets?*, 11 MARQ. INTELL. PROP. L. REV. 1, 11 (2007).

<sup>97</sup> Marc S. Reisch, *Ex-Monsanto Scientist Indicted for Trade Secret Theft*, C&EN (Nov. 27, 2019), <https://cen.acs.org/food/agriculture/Ex-Monsanto-scientist-indicted-trade-secret-theft/97/web/2019/11>.

<sup>98</sup> Debra L. Blair, *Intellectual Property Protection and Its Impact on the U.S. Seed Industry*, 4 DRAKE J. AGRIC. L. 297, 307 (1999).

<sup>99</sup> *Id.*

biotechnology) has existed almost as long as agriculture.<sup>100</sup> While seed manufacturers have become increasingly wealthy from incorporating biotechnology into the seed manufacturing process, American farmers do not match profit increases. They are instead facing four percent higher poverty rates than non-rural areas.<sup>101</sup> The following sections discuss how agricultural subsidies are distributed pre-market to seed developers and post-market to farmers.

#### A. POST-MARKET SUBSIDIES TO FARMERS

In 2019, farmers received over \$22 billion in agricultural subsidies to supplement farm income and influence commodity supplies.<sup>102</sup> This section provides an overview of how and why agricultural subsidies are distributed and how seed manufacturers impact their needs.

Agricultural subsidies are appropriated every five years through a comprehensive omnibus bill called the Farm Bill.<sup>103</sup> Subsidies to farmers have been an integral part of all farm bills and even prompted its inception to encourage conservation and raise farm incomes during the Great Depression.<sup>104</sup> However, since the 1980s, the proportion of crops covered by agricultural subsidies has dropped significantly.<sup>105</sup> The oldest form of crop subsidy takes the form of direct to farmer commodity program payments, which “are triggered when the annual market price for an eligible crop drops below a statutory minimum or when revenue is below a guaranteed level.”<sup>106</sup> Introduced in 2000, the other most common form of subsidy is the Crop Insurance Program, which is a federally subsidized program that indemnifies policy holders against below-

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<sup>100</sup> Ania & Mark, *supra* note 19.

<sup>101</sup> *Rural Poverty and Well-Being*, *supra* note 8.

<sup>102</sup> Dan Charles, *Farmers Got Billions From Taxpayers in 2019, and Hardly Anyone Objected*, NPR (Dec. 31, 2019, 4:13 PM), <https://www.npr.org/sections/thesalt/2019/12/31/790261705/farmers-got-billions-from-taxpayers-in-2019-and-hardly-anyone-objected>.

<sup>103</sup> *What is the Farm Bill?*, NAT'L. SUSTAINABLE AGRIC. COAL., <https://sustainableagriculture.net/our-work/campaigns/fbcampaign/what-is-the-farm-bill/> (last visited Jan. 17, 2021).

<sup>104</sup> *What is the Farm Bill?*, CONG. RES. SERV. (Sept. 26, 2020), <https://fas.org/sgp/crs/misc/RS22131.pdf>.

<sup>105</sup> Daniel Griswold, *Should the United States Cut Its Farm Subsidies?*, CATO INST. (Apr. 27, 2007), <https://www.cato.org/publications/commentary/should-united-states-cut-its-farm-subsidies>.

<sup>106</sup> Sahar Angadjivand, *U.S. Farm Commodity Support: An Overview of Selected Programs*, CONG. RES. SERV. (Apr. 17, 2018), <https://sgp.fas.org/crs/misc/R45165.pdf>.

average yields or revenue.<sup>107</sup> Farm payments as a percent of net farm income have increased significantly, growing from 25% in 2010 to 56% in 2019.<sup>108</sup>

Farm subsidies are also paid out through the Commodity Credit Corporation (CCC).<sup>109</sup> The CCC “is a wholly-owned Government corporation created in 1933 under a Delaware charter and reincorporated June 30, 1948, as a Federal corporation within the Department of Agriculture by the Commodity Credit Corporation Charter Act.”<sup>110</sup> In 2019, \$14.34 billion were distributed through the CCC to compensate farmers for losses due to the ongoing trade war with China.<sup>111</sup> However, unlike subsidies through the Farm Bill, these funds were not allocated explicitly by Congress.<sup>112</sup>

Crops that are eligible for direct payments are traditional commodity crops such as corn, seed cotton, and soybeans.<sup>113</sup> While majorly tailored to these traditional field crops, federal crop insurance programs have begun slowly expanding insurance to some 300 specialty crops.<sup>114</sup> Because farm subsidies are only limited to these commodity crops, the number of farmers growing these crops has surged.<sup>115</sup> Because many of these crops are also large-profit drivers for genetically modified seed sellers, manufacturers have profited handsomely from the agricultural subsidy systems.<sup>116</sup> The next section will focus on government subsidies allocated to the development of new seed varieties.

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<sup>107</sup> *Crop Insurance Program Provisions – Title XI*, ECON. RES. SERV. U.S. DEP’T AGRICULTURE, <https://www.ers.usda.gov/topics/farm-economy/farm-commodity-policy/crop-insurance-program-provisions-title-xi/> (last updated Sept. 27, 2021).

<sup>108</sup> Jerry Pierce, *Government Payments 2010-2019*, U. KY. COLLEGE AGRIC., FOOD AND ENV’T, (Aug. 25, 2020), <https://agecon.ca.uky.edu/government-payments-2010-2019>.

<sup>109</sup> *Commodity Credit Corporation*, U.S. DEP’T AGRICULTURE, <https://www.usda.gov/ccc> (last visited Jan. 17, 2021).

<sup>110</sup> *Id.*

<sup>111</sup> Charles, *supra* note 102.

<sup>112</sup> *Id.*

<sup>113</sup> *Crop Commodity Programs*, ECON. RES. SERV. U.S. DEPT AGRICULTURE, <https://www.ers.usda.gov/agriculture-improvement-act-of-2018-highlights-and-implications/crop-commodity-programs/> (last updated Aug. 20, 2019).

<sup>114</sup> Isabel Rosa & Renée Johnson, *Federal Crop Insurance: Specialty Crops*, CONG. RES. SERV., <https://sgp.fas.org/crs/misc/R45459.pdf> (last updated Jan. 14, 2019).

<sup>115</sup> Brian Barth, *Congress Finally Passed a New Farm Bill and It Continues to Pay Homage to the Cult of Corn and Soy*, MODERN FARMER (Jan. 07, 2019), <https://modernfarmer.com/2019/01/congress-finally-passed-a-new-farm-bill-and-it-continues-to-pay-homage-to-the-cult-of-corn-and-soy/>.

<sup>116</sup> Daniel Imhoff, *Overhauling the Farm Bill: The Real Beneficiaries of Subsidies*, THE ATLANTIC (Mar. 21, 2012), <https://www.theatlantic.com/health/archive/2012/03/overhauling-the-farm-bill-the-real-beneficiaries-of-subsidies/254422/>.

## B. THE BLURRING OF PUBLIC AND PRIVATE RESEARCH INITIATIVES

In 2015, \$4.523 billion of public money was spent on agricultural research and development.<sup>117</sup> This is compared to the \$12.263 billion spent in 2014 on agricultural research and development in the private sector.<sup>118</sup> For comparison, only €10 billion in the European Union was allocated for agricultural research between 2021 and 2027, coming out to around €1.4 billion per year.<sup>119</sup> Subsidies aimed at incentivizing research are often praised for being effective policies that benefit the welfare of everyone;<sup>120</sup> however, when corporations can take advantage of public resources to benefit their market dominance, the close public-private research relationship begins to seem more predatory.<sup>121</sup>

The blurred lines between public and private money with regards to agricultural research are perpetrated in two ways. First, for-profit entities routinely receive research funding through the United States Department of Agriculture.<sup>122</sup> Second, private corporations fund research at public universities, leading to questionable results and research that does not benefit the public.<sup>123</sup>

Through sub-agencies such as the Small Business Innovation Research Program, the USDA makes millions of dollars of grant money available to support agricultural research initiatives.<sup>124</sup> For instance, the Specialty Crop Research Initiative estimates that it will grant up to \$80 million for projects that

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<sup>117</sup> *Agricultural Research Funding in the Public and Private Sectors*, ECON. RES. SERV. U.S. DEP'T AGRICULTURE (Feb. 2019), <https://www.ers.usda.gov/data-products/agricultural-research-funding-in-the-public-and-private-sectors/>.

<sup>118</sup> *Id.*

<sup>119</sup> James McEldowney, *EU Agricultural Research and Innovation*, MEMBERS' RES. SERV. (Jan. 2019), [https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/630358/EPRS\\_BRI\(2019\)630358\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/630358/EPRS_BRI(2019)630358_EN.pdf).

<sup>120</sup> Harry de Gorter et al., *Productive and Predatory Public Policies: Research Expenditures and Producer Subsidies in Agriculture*, 74(1) AM. J. OF AGRIC. ECON. 27, 27 (1992).

<sup>121</sup> *Public Research, Private Gain Corporate Research Over University Agricultural Research*, FOOD & WATER WATCH (Apr. 2012), <https://foodandwaterwatch.org/wp-content/uploads/2021/03/Public-Research-Private-Gain-Report-April-2012.pdf>.

<sup>122</sup> See, e.g., *USDA Awards \$8.3 Million in Small Business Research Grants to Support Agricultural Research and Development*, NAT'L INST. OF FOOD AND AGRIC., <https://nifa.usda.gov/press-release/usda-awards-83-million-small-business-research-grants-support-agricultural-research> (last visited Oct. 12, 2021) (providing examples of private research projects that receive funding through the National Institute of Food and Agriculture).

<sup>123</sup> Molly McCluskey, *Public Universities Get an Education in Private Industry*, THE ATLANTIC, (Apr. 3, 2017), <https://www.theatlantic.com/education/archive/2017/04/public-universities-get-an-education-in-private-industry/521379/>.

<sup>124</sup> *NIFA Awards Over \$16M for Small Business Innovation Research Program Phase II*, NAT'L INST. OF FOOD AND AGRIC., (NOV. 19, 2020), <https://nifa.usda.gov/press-release/sbir-ii>.

improve crop characteristics or address pest threats.<sup>125</sup> Despite having sales of €43.5 billion in 2019,<sup>126</sup> Bayer and other large agricultural manufacturers qualify for these grants as they are open to for-profit organizations that are not small businesses.<sup>127</sup>

Private corporations fund most of the research in the United States.<sup>128</sup> In research conducted by public universities, the fear is that corporate funding leads to published data biased towards the sponsor and is not truly neutral.<sup>129</sup> This fear has become a reality, as research consulting agreements, a type of non-disclosure agreement, limit researchers' ability to publish data that is not favorable to the industry.<sup>130</sup> Industry sponsors have been shown to influence studies' design, so the results are favorable to their products.<sup>131</sup> The following section describes the issue with the blurred public and private agricultural research spending in the context of intellectual property rights.

#### C. THE PROBLEM WITH PUBLIC-PRIVATE RESEARCH MERGING AND THE INTELLECTUAL PROPERTY REGIME

Public agricultural funding has been highly successful in reducing the effects of various disruptions on the agricultural market.<sup>132</sup> Despite the United States Department of Agriculture (USDA) spending \$24.5 billion on farm support programs,<sup>133</sup> the median farm income is only \$296.<sup>134</sup> The median income is so low despite the farm support programs because farming commodity crops are

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<sup>125</sup> *Specialty Crop Research Initiative*, NAT'L INST. FOOD AND AGRIC., <https://nifa.usda.gov/funding-opportunity/specialty-crop-research-initiative-scri>, (last visited Jan. 17, 2021).

<sup>126</sup> Matej Mikulic, *Bayer Group's Total Sales from 1995-2020*, STATISTA (Mar. 10, 2020), <https://www.statista.com/statistics/263778/revenue-of-bayer-ag-since-1995/>.

<sup>127</sup> U.S. DEP'T AGRICULTURE, *supra* note 113.

<sup>128</sup> Beethika Khan et al., *The State of U.S. Science and Engineering 2020*, NATL. CTR. FOR SCI. & ENG'G STAT., (Jan. 2020), <https://ncses.nsf.gov/pubs/nsb20201/u-s-r-d-performance-and-funding>.

<sup>129</sup> Alice Fabbri et al., *The Influence of Industry Sponsorship on the Research Agenda: A Scoping Review*, 108(11) AM. J. OF PUB. HEALTH e9, e9 (Nov. 2018).

<sup>130</sup> McCluskey, *supra* note 123.

<sup>131</sup> Lisa Bero, *When Big Companies Fund Academic Research, the Truth Often Comes Last*, THE CONVERSATION (Oct. 02, 2019, 4:04 PM), <https://theconversation.com/when-big-companies-fund-academic-research-the-truth-often-comes-last-119164>.

<sup>132</sup> Kimberly Amadeo, *Farm Subsidies with Pros, Cons, and Impact*, THE BALANCE (Nov. 9, 2020), <https://www.thebalance.com/farm-subsidies-4173885>.

<sup>133</sup> *Farm Programs*, U.S. GOV'T ACCOUNTABILITY OFF., [https://www.gao.gov/key\\_issues/farm\\_programs/issue\\_summary](https://www.gao.gov/key_issues/farm_programs/issue_summary), (last visited Jan. 17, 2021).

<sup>134</sup> U.S. DEP'T AGRIC. ECON. RES. SERV., *supra* note 6.

increasingly costly.<sup>135</sup> Farming inputs, such as seeds, have increased dramatically in price because of the intellectual property protections that manufacturers can take advantage of.<sup>136</sup> Industry supporters state that the increased cost of seed is mitigated by a more profitable harvest<sup>137</sup>; however, when the market price is artificially sustained through crop subsidies, farmers benefit little from increased yields.<sup>138</sup>

As previously mentioned, the lines between public and private in the agricultural world are further blurred by private funding of public research.<sup>139</sup> In fact, as federal funding of public land grant universities has dried up, these universities have turned to private entities to receive up to a quarter of agricultural research funds.<sup>140</sup> Many of these funds go towards research to develop new seed varieties patented and profited by the sponsoring corporation.<sup>141</sup> Therefore, public resources are being used to bring benefit only to private industry. Industry research also limits the quality and transparency of public research. Having a majority of research be privately funded keeps research from going in the most needed, as corporate desires constrain it.<sup>142</sup> Additionally, nondisclosure agreements between researchers and industry funders are becoming increasingly common, where harmful data, or any data at all, about a corporate product, is blocked from being published.<sup>143</sup> Since universities require publishable research for graduate students and professors, these industry-forced vows of silence are especially disconcerting.<sup>144</sup>

Public research and funding subsidies are designed to increase food security sustainably and stabilize market price and availability.<sup>145</sup> The mechanisms funding these ventures were created before seeds were extended patent rights.<sup>146</sup>

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<sup>135</sup> Tony Dreibus, *Ag Census: Input Costs Rise, Farm Income Declines Amid Low Commodity Prices*, SUCCESSFUL FARMING (Apr. 18, 2019) <https://www.agriculture.com/news/business/ag-census-input-costs-rise-farm-income-declines-amid-low-commodity-prices>.

<sup>136</sup> Haley Stein, Note, *Intellectual Property and Genetically Modified Seeds: The United States, Trade, and the Developing World*, 3 NW. J. TECH & INTELL. PROP. 151, 168-169 (2005).

<sup>137</sup> Royte, *supra* note 61.

<sup>138</sup> Chuck Abbott, *As Crop Prices Sink, Farm Subsidies Soar*, SUCCESSFUL FARMING (Jan. 28, 2016), [https://www.agriculture.com/news/policy/as-crop-prices-sink-farm-subsidies-soar\\_4-ar52084](https://www.agriculture.com/news/policy/as-crop-prices-sink-farm-subsidies-soar_4-ar52084).

<sup>139</sup> FOOD & WATER WATCH, *supra* note 121.

<sup>140</sup> *Id.*

<sup>141</sup> *Id.*

<sup>142</sup> McCluskey, *supra* note 123.

<sup>143</sup> *Id.*

<sup>144</sup> *Id.*

<sup>145</sup> *History of Agricultural Subsidies in the US and EU*, COMP. FOOD POL., <https://food-studies.net/foodpolitics/agricultural-subsidies/jades-sample-page/> (last visited Jan. 17, 2021).

<sup>146</sup> *The Birthplace of Public Higher Education*, UNIV. OF GA. (Jan. 22, 2017), <https://news.uga.edu/birthplace-public-higher-education-america/> (stating that the first public university was chartered in 1785); Daniel A. Sumner, *Agricultural Subsidy Programs*, LIBR. ECON. AND LIBERTY, <https://www.econlib.org/library/Enc/AgriculturalSubsidyPrograms.html> (last visited Jan.

Given the difficulties in merging public assistance funding with corporate intellectual property rights, it seems likely that farmers will continue to suffer at the junction of these incompatible systems. The final part of this Note argues that pre-market research funding and post-market agricultural subsidies need to be altered to better respond to a world with patentable seeds.

#### V. FINDING A SOLUTION TO THE SEED PRICING PROBLEMS

The discussion above paints a grim picture. The current intellectual property framework has not achieved its goal of balancing innovation and public knowledge. Additionally, federal funding of agricultural programs has not successfully raised crop prices nor disseminated widespread public research.

It should be noted that both corporations and governments have taken some steps to solve these issues. For example, agricultural product giant Bayer has a sustainability target to support 100 million smallholder farms by 2030.<sup>147</sup> Furthermore, many large production agriculture leaders pride themselves on developing technologies that contribute to the fight against hunger and poverty.<sup>148</sup> Colorado passed legislation in 2017 that reimburses farmers 50% of the costs associated with hiring an apprentice, reducing agricultural production's input costs.<sup>149</sup>

These efforts have one thing in common: they illustrate that attention is being drawn to farm poverty. Unfortunately, this attention increase has not corresponded with the alleviation of the problem, and all the initiatives above do not serve as a complete solution. Corporate efforts are primarily aimed at reducing farm poverty in developing countries, but little is done to reduce the impact of strict intellectual property protections on farm income in the United States. The Colorado statute is a good start, but it only addresses a partial contributor to the larger issue. Therefore, the federal government should step in to correct this issue.

As discussed earlier, farm income is negatively impacted by high seed prices. Temporary monopolies given to seed manufacturers limit competition necessary

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17, 2021) (stating that current agricultural subsidies started in 1933 with the Agricultural Adjustment Act); *Variety Protection Regulations*, UNIV. MINN. EXTENSION, <https://extension.umn.edu/small-grains-crop-and-variety-selection/variety-protection-regulations> (last visited Jan. 17, 2021) (stating that the PVPA extended patent rights to seeds in 1970).

<sup>147</sup> *Our Targets to Be Met by 2030*, BAYER, <https://www.bayer.com/en/sustainability/targets> (last visited Sept. 12, 2021).

<sup>148</sup> Betsy Freese, *How Seed Company Leaders Are Addressing Ag Challenges*, SUCCESSFUL FARMING (Oct. 23, 2019), <https://www.agriculture.com/crops/how-seed-company-leaders-are-addressing-ag-challenges>.

<sup>149</sup> Debbie Weingarten, *Farming's Next Generation Has Nowhere to Grow*, TALK POVERTY (Feb. 8, 2019), <https://talkpoverty.org/2019/02/08/farming-generation-nowhere-grow/>.

to drive down prices. Single-use licenses force farmers to purchase new seed every season instead of participating in traditional seed-saving programs.<sup>150</sup>

Seed developers aggressively enforce their intellectual property protections, even in situations where the breaching party did so unintentionally. For instance, Monsanto had sued 56 small businesses and 410 farmers for patent infringement as of 2013, only winning, on average, \$49,356 per suit.<sup>151</sup> Efforts to raise farmer income through farm subsidies have been hindered on both sides of harvest. Rising input costs from increased seed and equipment prices have been exacerbated by lowered crop prices caused by market consolidation.<sup>152</sup> The funding difficulty is despite a large amount of public money and resources directed towards research that helps agricultural manufacturers develop new technologies protected through the intellectual property system.

While the introduction of intellectual property protection into the seed market has produced the problems discussed above, the solution is not dismantling protections. Before the PVPA was passed, the seed market was one of the last remaining markets that did not have patent protection, as utility, design, and plant patents covered almost everything else.<sup>153</sup> Patent protection for new seed varieties is essential because of the cost and time requirements of developing new seeds.<sup>154</sup> On average, it takes eight years and \$135 million to bring a new genetically modified seed variety to market.<sup>155</sup>

Since developing new seed varieties is incredibly expensive, companies could not justify developing new varieties without a promised exclusivity period.<sup>156</sup> New seed development and patent protections are necessary if we continue to address food insecurity issues.<sup>157</sup> Therefore, the solution to the adverse effects of intellectual property protection must not outweigh its benefits. Federal funding should ultimately be redirected from farm subsidies to public agricultural

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<sup>150</sup> See *supra* Part II(b)(2) (explaining how single use licenses function in the seed market).

<sup>151</sup> Paul Harris, *Monsanto Sued Small Farmers to Protect Seed Patents, Report Says*, GUARDIAN (Feb. 12, 2013), <https://www.theguardian.com/environment/2013/feb/12/monsanto-sues-farmers-seed-patents>.

<sup>152</sup> Kevin Carty, *USDA Reports on Farm Consolidation but Ignores the Cause*, FOOD & POWER (Mar. 29, 2019), <https://www.foodandpower.net/latest/2018/03/29/usda-reports-on-farm-consolidation-but-ignores-the-cause>.

<sup>153</sup> See *Types of Patents*, U.S. PAT. & TRADEMARK OFF. (Mar. 31, 2016), <https://www.uspto.gov/web/offices/ac/ido/oeip/taf/data/patdesc.htm> (describing the six types of patents that the U.S. Patent and Trademark Office issues).

<sup>154</sup> BAYER VEGETABLES U.S., *supra* note 41.

<sup>155</sup> GENETIC LITERACY PROJECT, *supra* note 28.

<sup>156</sup> BAYER VEGETABLES U.S., *supra* note 41.

<sup>157</sup> See Abubakar Ibrahim, *Improved Seeds Key to Sustainable Food Security, African Plant Breeders Say*, CORNELL ALL. FOR SCI. (Jan. 14, 2020), <https://allianceforscience.cornell.edu/blog/2020/01/improved-seeds-key-to-sustainable-food-security-african-plant-breeders-say/> (describing how the African Plant Breeders Association believes that improved seeds and plant breeding techniques are a better way to address food insecurity than current methods).

research. This shift would ensure that research is centered on what is in the public interest, instead of at the corporate interest, and would reduce the unintentional encouragement to grow high-input-cost genetically modified commodity crops. Ultimately, seeds developed through public funding will cost less for farmers because of the lack of profit incentive, reducing the reliance on agricultural subsidies. Additionally, the industry would have low-cost seed varieties to compete against, which would result in lower seed costs across the board. Creating a publicly funded competitor to a tiny field of large agricultural research corporations would increase competition and price reduction without discouraging seed manufacturers from developing new varieties by reducing intellectual property protections. At-risk, however, is reducing farm subsidies before the effects of publicly funded agricultural research hit the market. Therefore, until the increased publicly funded agricultural research results in lower-cost marketable products, farm subsidies must stay at the same high current rate. The solution to the battle against farm poverty is complicated and requires balancing many interests ranging from developers' intellectual property rights to the public's interest in an efficient and fair food production system.

