



## **Transgenic Seed Platforms: Competition Between a Rock and a Hard Place?**

**Diana L. Moss<sup>1</sup>**

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### **Executive Summary**

With the widespread adoption by farmers of corn, cotton, and soybean seed containing transgenic technology, the U.S. seed industry has changed rapidly in the past twenty years. The largest changes include the creation of strongholds of patented technology and the gradual elimination of the numerous regional independent seed companies through consolidation. Resulting increases in concentration in affected markets has been driven largely by the industry's dominant firm, Monsanto.

A threshold question to consider is whether Monsanto has exercised its market power to foreclose rivals from market access, harming competition and thereby slowing the pace of innovation and adversely affecting prices, quality, and choice for farmers and consumers of seed products. If the answer to this question is yes, remedying the intractable competitive situation that prevails in the transgenic seed industry may require antitrust enforcement, legislative relief, or both. The problem highlights both the importance of competition policy and the security and diversity of a key agricultural sector.

Any antitrust inquiry into the transgenic seed industry should carefully consider the three markets in which Monsanto possesses market power (innovation, genetic traits, and traited seed) and conduct that potentially stifles competition. Such conduct includes licensing restrictions on rivals' use of Monsanto traits and control of the distribution channel to create adverse incentives for seed companies and farmers to distribute or plant anything but Monsanto products. At the core of this analysis is the tension between patent law and antitrust law. Moreover, antitrust enforcement will require thoughtful approaches to remedy, particularly the goals of promoting competition between transgenic seed platforms versus easing access to Monsanto's dominant platform.

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<sup>1</sup> Vice President and Senior Fellow, American Antitrust Institute ([dmoss@antitrustinstitute.org](mailto:dmoss@antitrustinstitute.org)). The AAI is funded by contributions from a wide variety of sources, including various high technology companies among which is DuPont. A list of contributors is available on request. The publication of this White Paper was approved by the AAI Board of Directors.

## I. Overview

Organization of the transgenic seed industry has shifted fundamentally over the past two decades from separate ownership of agricultural biotechnology and seed assets to integrated platforms. These platforms comprise three major levels: (1) innovation involving genetic transformation technologies and genomics; (2) genetic traits that are expressed in plant agronomics, including insect resistance (Bt) and herbicide tolerance (Ht); and (3) state-of-the-art seeds containing genetic traits, for which seed companies are the major distribution channel for ultimate sales to farmers. Most current-generation transgenic seeds contain multiple or “stacked” genetic traits.

The motivation for creating large seed platforms is compelling. One investment analyst succinctly articulated the value chain rationale at the time transgenic seed first appeared on the market in the mid-1990s: “A new gene is worthless without a quality seed base to put it in and the infrastructure to deliver it.”<sup>2</sup> But other economic motivations are also in play. These include the creation or enhancement of market power through control of patented technology and distribution channels for delivering transgenic seeds to farmers. The prospect of economies of coordination that potentially arise from complementarities between complex research and development (R&D) assets also provides a powerful incentive for creating seed platforms.

This analysis focuses on competition in the transgenic seed industry. The shift from separate ownership of agricultural biotechnology and seed assets to the development of transgenic seed platforms has ushered in a host of competitive issues that are still relatively new to antitrust enforcement.<sup>3</sup> High levels of concentration induced by relentless and largely unchecked merger activity, coupled with a vocal contingent of rivals and farmers who have allegedly suffered competitive harm at the hands of the industry’s dominant firm, Monsanto, highlight the need for

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<sup>2</sup> “The Agbiotech and Seed Industry,” Furman Seltz LLC, Investment Report (May 1998).

<sup>3</sup> For general discussion on platforms and systems, see the presentations at the American Antitrust Institute (AAI) Symposium on Systems Competition, Washington D.C. (June 17, 2009), Online at [http://www.antitrustinstitute.org/Archives/Systems\\_Competition\\_Audio\\_and\\_Materials.ashx](http://www.antitrustinstitute.org/Archives/Systems_Competition_Audio_and_Materials.ashx).

antitrust scrutiny. Any analysis must consider several important factors, including the merits of inter-platform versus intra-platform competition; what behavior constitutes anticompetitive use of patented technology to create and maintain monopoly platforms; and the potential need for creative remedies that combine both structural and behavioral elements. The current impaired structure of the transgenic seed industry also brings into sharp focus the importance of diversity and security in a key agricultural sector.

In addressing the foregoing issues, the paper proceeds as follows. Part II provides some important background on the rapid rise of transgenic seed. Part III discusses the role of patent protection in promoting innovation. Part IV frames the competitive problem in transgenic seed. Parts V and VI analyze the relationships between M&A, patent concentration, and potentially exclusionary conduct. Part VII concludes with observations and policy recommendations.

## **II. The Meteoric Rise of Transgenic Seed**

Transgenic seed is seed that has been genetically modified to contain certain desirable input and/or output traits. Input traits affect the agronomic performance of plants. Such performance includes tolerance to herbicides such as glyphosate and resistance to certain insects such as the corn rootworm, European corn borer, and cotton bollworm through the production of the biological toxin *Bacillus Thuringiensis*. These traits are marketed by a small number of companies, including Monsanto, Pioneer (DuPont), Syngenta, Dow, and Bayer. “Value-added” traits under development affect the characteristics of a plant’s output, such as corn with superior amino acid balance and soybean oils with more shelf life.<sup>4</sup>

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<sup>4</sup> Marvin L. Hayenga, “Structural Change in the Biotech Seed and Chemical Industrial Complex,” 1 *AGBIOFORUM* (1998) 43, At 48.

The introduction of transgenic seed succeeds a number of major milestones, including the development of hybrids and introduction of fertilizers and herbicides. Penetration of transgenic seed began in earnest in the mid 1990s for corn, soybeans, and cotton. Its impact on U.S. agriculture cannot be underestimated. By 1999, just a few years after its introduction, the percentage of acres planted with transgenic seed had jumped to about 60, 40, and 20 percent for soybeans, cotton, and corn, respectively.<sup>5</sup> Acreage planted with transgenic seed has also increased rapidly over time, as shown in Figure 1. For example, the average annual rate of growth in planting of all varieties of transgenic corn, cotton, and soybeans from 2000 to 2009 is about seven percent.<sup>6</sup>

Notable is the strong increase in stacked traits--dramatic for corn (about 58 percent per year) and substantial for cotton (about 11 percent per year). With the exception of soybeans, which contain only an Ht trait, stacked traited corn and cotton seed has taken share away from single-traited varieties. In 2009, around 20 percent of corn and cotton acres contain single-traited seed and almost 50 percent of corn and cotton acres contain stacked traited seed, for total transgenic varieties on 85, 91, and 88 percent of all corn, soybeans, and cotton acres, respectively.<sup>7</sup>

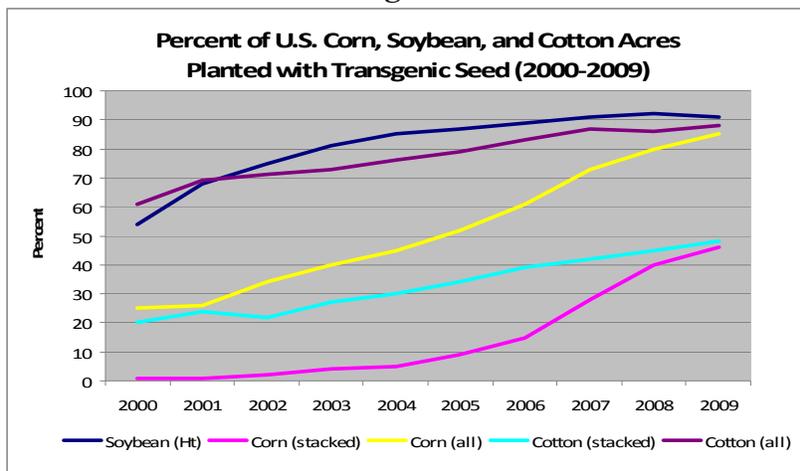
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<sup>5</sup> Jorge Fernandez-Cornejo, "The Seed Industry in U.S. Agriculture," U.S. Department of Agriculture, Economic Research Service, Agriculture Information Bulletin No. 786 (2004), at 4.

<sup>6</sup> Statistics are based on a survey of U.S. acreage, 85 percent of which are planted with transgenic corn, 87 percent with transgenic soybeans, and 93 percent with transgenic cotton. "Acreage," U.S. Department of Agriculture, National Agriculture Statistics Service, (June 30, 2000 through June 30, 2009). Online at <http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1000>.

<sup>7</sup> *Supra*, note 6.

Figure 1



### III. Patent Protection, Gains from Innovation, and the First Signs of Trouble

Innovation involving transgenic seed is protected under U.S. patent and agricultural law.<sup>8</sup> One source of protection is a Plant Variety Protection (PVP) certificate issued by the U.S. Department of Agriculture (USDA) under the 1970 Plant Variety Protection Act (PVPA, as amended in 1994).<sup>9</sup> A certificate grants a breeder exclusive rights to market a new variety of sexually reproduced plants for 20 years. The PVPA contains both a research and farmer exemption regarding use of the seed.<sup>10</sup> In *Asgrow v. Winterboer* (1995), the Supreme Court upheld the farmer's right to save and sell seeds protected under the PVPA.<sup>11</sup> Protection for asexually reproduced plant varieties is provided by a patent issued by the U.S. Patent and Trademark Office (PTO) under the Plant Patent

<sup>8</sup> Patent protection allows innovators to reap the gains from their inventions. An inability to assert property rights over innovations would provide limited (if any) incentive for innovators to undertake risky investments in new technology, leading to underinvestment in R&D.

<sup>9</sup> 7 U.S.C. 2321-2383 (2003).

<sup>10</sup> *Supra* note 5, at 20-21.

<sup>11</sup> 513 U.S. 179 (1995).

Act (PPA) of 1930.<sup>12</sup> The PPA does not confer the right of the patent-owner to control what users do with derivatives of the plant.<sup>13</sup>

The limited patent protection provided under the PPA was expanded in the seminal 1980 *Diamond v. Chakrabarty* case when the Supreme Court ruled that standard “utility” patents under the 1952 Patent Act extended to genetically engineered microorganisms.<sup>14</sup> In 1985, the court again expanded patent protection to genetically modified plants in *Ex Parte Hibberd*.<sup>15</sup> With a utility patent, therefore, patent-holders can sue farmers and rivals for patent infringement and pursue litigation to enforce licensing agreements. The court speedily resolved the inevitable questions about potential overlaps and conflicts between various forms of protection in *J.E.M. Ag. Supply v. Pioneer Hi-Bred* in 2001.<sup>16</sup> There, the court held that sexually reproduced plants eligible for protection under the PVPA are also eligible for utility patents. The court further opined that because the requirements and protections provided by the latter are more stringent than those for a PVP certificate, the two forms of protection do not conflict.

Armed with this strong protection, traits developers forged aggressively ahead to develop new varieties of transgenic seed. Traits are initially developed, introgressed into seed germplasm, grown out in developmental breeding programs, and released into the environment under a regulatory regime before being deregulated prior to commercialization. Most R&D expenditures are incurred in the first stage of production, plant breeding, and account for about 40 percent of the

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<sup>12</sup> 35 U.S.C. 161-164 (2003).

<sup>13</sup> Michael R. Taylor and Jerry Cayford, “American Patent Policy, Biotechnology, and African Agriculture: The Case for Policy Change,” 17 HARVARD JOURNAL OF LAW & TECHNOLOGY 321 (2004), at 345.

<sup>14</sup> 447 U.S. 303 (1980).

<sup>15</sup> 227 U.S.P.Q. 443 (Board of Patent Applications and Interferences, 1985).

<sup>16</sup> 534 U.S. 124 (2001).

final seed price.<sup>17</sup> Development of commercial varieties of transgenic seed can involve long lead times and regulatory approvals from the USDA, Food and Drug Administration, and Environmental Protection Agency. Overall, the process of developing new varieties can span 10-15 years.<sup>18</sup>

Welfare-based studies confirm the notion that there are substantial economic gains associated with transgenic seed. For example, one analysis of Monsanto's Roundup Ready (Ht) soybeans indicates that at 1999 adoption rates, 60 percent of total economic benefits go to innovators as profit, 26 percent to producers, and 14 percent to consumers.<sup>19</sup> This favorable risk-reward tradeoff is evident in the explosion of applications to protect agricultural biotechnology innovations and rapid advancements in seed technologies, ranging from single-traited seeds to the complex stacked-traited seeds that are the norm today.

Most innovation is now carried out by the private sector, particularly in plant technologies and molecular level agricultural biotechnology. A shift from publicly-funded R&D may reflect the heavy demands of genomics, legislative initiatives, and different motivations for patenting by private versus public institutions.<sup>20</sup> Indeed, the bulk of PVP certificates were held by the private sector in the late 1990s, ranging from about 84 percent and higher for corn, cotton, and soybeans.<sup>21</sup> About 96 percent of field release approvals for these same crops were also accounted for by private firms

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<sup>17</sup> *Supra* note 5, at 29.

<sup>18</sup> *Supra* note 5, at 51. See also *U.S. v. Monsanto and Delta and Pine Land, Complaint*, (Case No. 1:07-cv-00992, D.D.C) (May 31, 2007), at PP. 15.

<sup>19</sup> GianCarlo Moschini, "Economic Benefits and Costs of Biotechnology Innovations in Agriculture," Iowa State University, Center for Agricultural and Rural Development, Working Paper 01-WP-264 (January 2001), at 13.

<sup>20</sup> See Paul W. Heisey, John L. King, and Kelly Day Rubenstein, "Patterns of Public-Sector and Private-Sector Patenting in Agricultural Biotechnology," 8 *AGBIOFORUM* 73 (2005), at 81. In 1960, private expenditures accounted for about 18 percent of R&D on plant breeding for major field crops, increasing to about 60 percent by 1996. See Jorge Fernandez-Cornejo and David Schimmelpfenning, "Have Seed Industry Changes Affected Research Effort?" U.S. Department of Agriculture, Economic Research Service, *AMBER WAVES* (2004). The Bayh-Dole University and Trademark Act of 1980 fundamentally altered the ownership of patents developed with federal dollars, essentially transferring ownership to the private sector. See 35 U.S.C. § 200-212.

<sup>21</sup> *Supra* note 5, at 53.

from 1987 to 2000.<sup>22</sup> And about 60 percent of patents were held by U.S. companies from 1976 to 2000.<sup>23</sup>

Rapid technological advancement is likely a function of multiple forces: (1) “demand-pull,” created by higher yielding transgenic, relative to conventional seed; (2) “supply-driven” innovation resulting from the extraordinarily high returns to R&D investment; and (3) the growing problem of insect and herbicide resistance to existing transgenic plants.<sup>24</sup> Trends in innovation measures are shown in Figure 2 for the period 1987 to 2000. For example, the average annual growth rate in utility patents for plant biotechnology was about 20 percent for major field crops, higher than the average rate of growth across all innovation areas.<sup>25</sup> PVP certificates (which reflect the outcome of plant breeding R&D effort) for corn, soybeans, and cotton grew at an average annual rate of 27 percent. And field releases approvals for new genetically modified varieties of corn, soybeans, and cotton grew at an average annual rate of 116 percent.<sup>26</sup>

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<sup>22</sup> See *supra* note 5, at 60. This number has remained largely the same since 2000 based on data compiled from the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) database on field releases. Online at <http://www.aphis.usda.gov/biotechnology/status.shtml>.

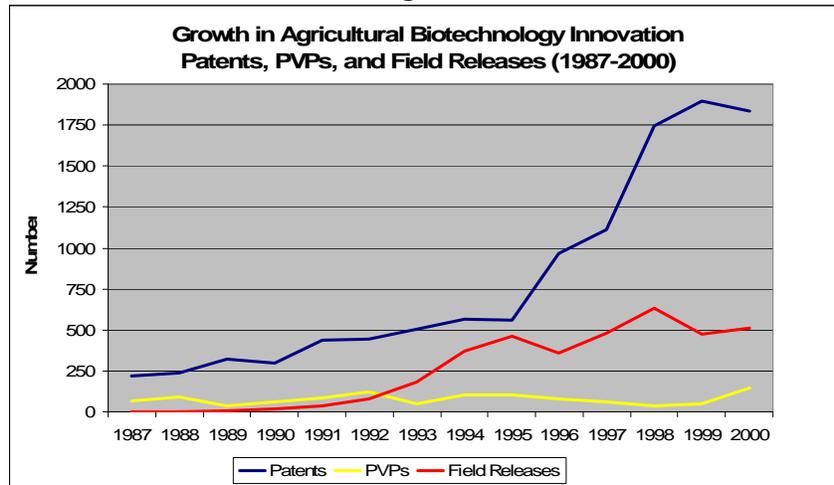
<sup>23</sup> See “Agricultural Biotechnology Intellectual Property: Standard Tables,” tables on “Utility Patents by Year” for U.S. companies, universities and nonprofits, and government (federal and state). U.S. Department of Agriculture, Economic Research Service. Online at [http://www.ers.usda.gov/data/AgBiotechIP/Data/Table15\\_UtilityUSCompByYearSummary.htm](http://www.ers.usda.gov/data/AgBiotechIP/Data/Table15_UtilityUSCompByYearSummary.htm); [http://www.ers.usda.gov/data/AgBiotechIP/Data/Table16\\_UtilityUSNonProfByYearSummary.htm](http://www.ers.usda.gov/data/AgBiotechIP/Data/Table16_UtilityUSNonProfByYearSummary.htm); and [http://www.ers.usda.gov/data/AgBiotechIP/Data/Table17\\_UtilityUSGovByYearSummary.htm](http://www.ers.usda.gov/data/AgBiotechIP/Data/Table17_UtilityUSGovByYearSummary.htm).

<sup>24</sup> This problem is reflected in refuge requirements, which allow transgenic seed only on a percentage of total acreage. Stacked-traited seeds with multiple modes of action (e.g., more than one insect-resistance trait) also address the resistance problem.

<sup>25</sup> See “Agricultural Biotechnology Intellectual Property: Standard Tables,” table on “Utility Patents by Year and Technology Class,” U.S. Department of Agriculture, Economic Research Service. Online at [http://www.ers.usda.gov/data/AgBiotechIP/Data/Table02\\_UtilityPatentsByYearTech.htm](http://www.ers.usda.gov/data/AgBiotechIP/Data/Table02_UtilityPatentsByYearTech.htm). See Heisey et al., *supra* note 20, at 1.

<sup>26</sup> See *supra* note 5, at 54-59 for data on PVPs and field releases.

Figure 2



It is generally thought that transgenic seed has contributed significantly to increased productivity of farmers in the U.S. through higher yields and the need for fewer inputs.<sup>27</sup> Some economic evidence suggests, in fact, that transgenic seed has conveyed irreversible benefits to farmers, such as reduced erosion and pesticide or fuel use. If internalized in private decision-making, these benefits increase farmers' willingness to pay and accelerate adoption of new transgenic varieties. At the same time, however, irreversible benefits increase the innovator's market power.<sup>28</sup> This is important because in competitive markets, technologies that enjoy widespread and rapid adoption typically experience precipitous declines in cost as innovators learn-by-doing and competitive pressures drive prices down. Sustained high prices for mature technologies may indicate a number of forces at work, including market power in innovation and input markets.

A look at the relative growth rates in seed costs versus productivity over time brings this issue into sharp focus. For example, from 2000 to 2008, real seed costs increased by an average

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<sup>27</sup> John L. King, "Concentration and Technology in Agricultural Input Industries," U.S. Department of Agriculture, Economic Research Service, Agriculture Information Bulletin No. 763 (March 201), at 1.

<sup>28</sup> This is particularly true when irreversible costs such as changes in farm equipment are also present. See Robert D. Weaver and Justus Wessler, "Monopolistic Pricing Power for Transgenic Crops When Technology Adopters Face Irreversible Benefits and costs," 11 APPLIED ECONOMICS LETTERS 969 (2004), at 972.

annual rate of five percent for corn, almost 11 percent for cotton, and seven percent for soybeans (Figure 3).<sup>29</sup> When compared to the value of crop yields (i.e., commodity price times yield), these increases take on more significance. For example, the difference between the annual rate of increase in yield values and seed costs is shown in Figure 3. This difference is negative for much of the period (and is, on average, negative over the period) for all three crops, supporting the notion that growth in seed costs has outstripped the growth in what farmers receive for their crops.

The data shown in Figure 3 reflect both conventional and transgenic seed. However, penetration rates for transgenic seed have increased steadily over time (Figure 1). For example, the percentage of acres planted with transgenic soybeans, corn, and cotton increased to 92, 80, and 86 percent, respectively, in 2008. The data therefore more likely than not reflect the pricing of transgenic seed, particularly during the latter part of the sample period. The “squeeze” on farmers brought about by more rapid increases in seed costs relative to crop values results, in part, from the vagaries of price dynamics in agricultural commodity markets. However, it likely reveals other forces at work, including supra-competitive price increases for transgenic seed and/or a declining rate of productivity improvement.

It is likely that changes in seed costs over time reflect the influence of underlying trait prices. As noted earlier, a large percentage of seed costs reflect R&D expenditures, of which traits development constitutes a significant part. That the markets for genetic traits are dominated by Monsanto raises concerns about supra-competitive pricing. This issue surfaced even in the formative years of transgenic seed. For example, the U.S. General Accounting Office noted the vast price

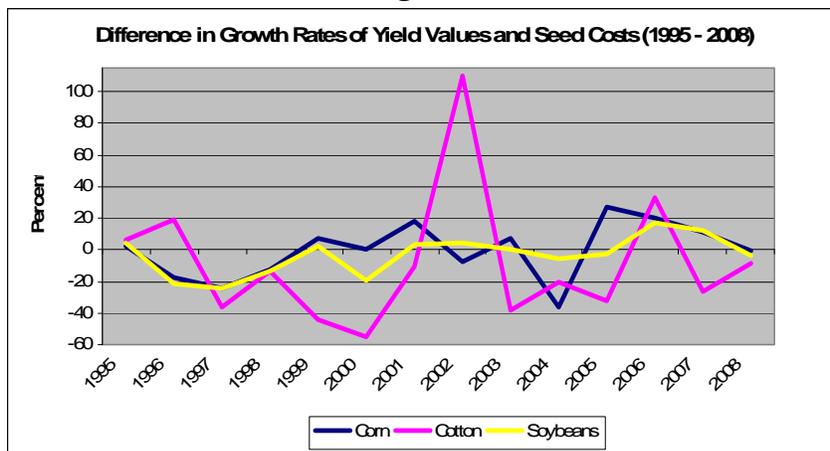
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<sup>29</sup> Seed costs, commodity prices, and yields per acre obtained from U.S. Department of Agriculture, “Commodity Costs and Returns: U.S. and Regional Cost and Return Data.” Online at <http://www.ers.usda.gov/Data/CostsAndReturns/testpick.htm>. Nominal costs and price deflated with the Consumer Price Index. Online at <ftp://ftp.bls.gov/pub/special.requests/cpi/cpi.txt>.

differentials between transgenic and conventional seed almost a decade ago, particularly in regard to Roundup Ready soybeans. The agency concluded, for example, that:

“Monsanto’s U.S. patents for Roundup Ready soybean seeds have given it and the companies to whom it has licensed the technology greater control over seed prices and has enabled them to restrict the availability and use of seeds.”<sup>30</sup>

Figure 3



#### IV. The Elephant in the Room – The Impaired State of Competition in Transgenic Seed

The foregoing analysis paints a picture of a unique industry. Patented technology is hugely valuable, gains flow largely to a very small number of innovators, and it is unclear whether farmers (and the ultimate consumers of transgenic seed products) benefit to any significant extent. Before further exploring the linkages between innovation and competition in transgenic seed, it is helpful to frame out the major competition concepts that will be explored in the rest of the paper. First, two non-mutually exclusive models of competition characterize rivalry in transgenic seed--inter-platform and intra-platform competition. In the first case, rivalry is *between* transgenic seed platforms. Seed containing traits that are exclusive to a single firm are the product of such platforms. Intra-platform competition involves rivalry *within* platforms whereby firms develop new transgenic seed products,

<sup>30</sup> See “Information on Prices of Genetically Modified Seeds in the United States and Argentina,” U.S. General Accounting Office, GOA/RCED/NSAID-00-55 (January 2000), at 12.

in part, by obtaining access to rivals' patented traits. This competitive dichotomy is increasingly observed in a number of diverse industries, including airline alliances, digital music players and downloads, and online search and advertising. What model of competition is likely to produce the greatest benefits for competition and consumers poses key a question for antitrust enforcement.

A second issue is the strategic motivation behind platform development. Linkages between complementary assets such as genetic traits and seed germplasm can be engineered and maintained to interoperate well with rival technology in an "open" system. Conversely, firms may opt to develop "closed" platforms. The tools of platform development and maintenance in different industries range widely. They include fundamental decisions to promote open source versus proprietary technologies, "plug-and-play" versus non-standardized components, and tactics that are designed to frustrate rivals' access to needed technology. Finally, competitive problems involving platforms raise new questions regarding the types of antitrust remedies that will be the most effective at restoring competition. Depending on the industry, those remedies can be complicated by the presence of powerful network effects, intellectual property issues, and a host of other considerations. In transgenic seed, the importance of access to patented technology is a central focus of antitrust remedies.

The premise of our analysis is that inter-platform rivalry in the transgenic seed industry is currently not a viable mode of competition. This is because no single agricultural biotechnology firm—with one exception--produces a full suite of their own traits suitable for stacking in a transgenic variety. Successfully commercializing new transgenic seed products under a model of intra-platform competition, however, is predicated on the ability of traits developers to obtain access to two types of technology. One is a genetic trait(s) produced by a rival that is needed for stacking with the developer's own trait(s). A second is seed germplasm in which to introgress stacked traits and breed new, potentially commercial transgenic varieties.

Impaired access, however, has undermined the benefits of intra-platform competition and arguably deterred the emergence of any viable form of inter-platform competition. One impediment is a high level of concentration in innovation, genetic traits, and seed markets, induced by significant M&A activity over the last 10 years and exacerbated by the high entry barriers posed by heavy R&D requirements. This consolidation has dramatically reduced the number of traits developers and concentrated patent holdings among only a few, disproportionately-sized rivals. At the same time, it has eliminated the numerous independent seed companies (ISCs) which have historically held the substantial base of seed germplasm that is needed for traits developers to breed new varieties.

A second roadblock is the dominance of a single firm in the industry. Monsanto has created formidable platforms of transgenic seed in cotton, soybeans, and corn through the control of a large body of patented technology and systematic acquisition of ISCs. Arguably, were it not for the early decision to broadly license its patented genetic traits technologies, Monsanto would control large, totally closed platforms in transgenic seed that could be challenged only by the unlikely emergence of rival platforms. Recent estimates indicate, for example, that Monsanto has a significant share of the innovation market for new field releases of transgenic varieties. The agricultural biotechnology giant also controls about 95 percent of the market for Bt and Ht cotton traits, 97 percent of the market for Ht soybean traits, and on average, around 75 percent of the market for Bt and Ht corn traits (although depending on the trait, shares in corn traits can range close to 90 percent).<sup>31</sup> Given the ability and incentive to exercise its substantial market power (as rivals and farmers have alleged), Monsanto's dominance in upstream markets thus raises the specter of leveraging its market power downstream to the markets for traited seed. In 2008, the firm had substantial shares of up to 65

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<sup>31</sup> Cotton shares derived from data compiled from "Cotton Varieties Planted - 2009." U.S. Department of Agriculture, Agricultural Marketing Service, Cotton Program. 2008 soybean and corn trait shares obtained from Carl Casale, "Morgan Stanley: Global Basic Materials Conference 2009," (February 18, 2009). Online at [http://www.monsanto.com/pdf/investors/2009/02\\_18\\_09.pdf](http://www.monsanto.com/pdf/investors/2009/02_18_09.pdf). See also Brett Begemann, "Goldman Sachs Agricultural Biotech Forum," (February 12, 2008). Online at <http://www.monsanto.com/pdf/investors/2008/02-12-08.pdf>.

percent for traited corn and soybeans and about 45 percent for traited cotton.<sup>32</sup> In cotton-growing regions of the U.S., however, Monsanto's shares range far higher.<sup>33</sup>

Collectively, the forgoing problems create an almost intractable situation for competition. Rivalry does not occur at the inter-platform level but high concentration, single-firm dominance, and strategic conduct forecloses rivals from the access to technology that is critical for intra-platform competition. Competition is thus between the proverbial “rock and a hard place.” A myriad of adverse effects potentially flow from this diminished state, including reduced or lower-quality innovation in transgenic seed, higher seed prices to farmers (i.e., “technology fees”), fewer transgenic seed choices, and higher commodity prices than what would have prevailed under competitive market conditions.

## **V. Uneasy Bedfellows – Developing Patent Strongholds Through M&A**

Two waves of consolidation stand out in the transgenic seed industry over the last 20 years; one in the mid-1980s and a second over the last decade. The 1980s shepherded in the first efforts to develop agricultural biotechnology and firms reorganized to achieve scale and scope economies necessary to perform costly R&D. The second wave brought a number of large mergers, including the formation of Syngenta from AstraZeneca and Novartis Seeds in 2000, Bayer's acquisition of Aventis Crop Sciences in 2002, and BASF's takeover of Cyanamid in 2000. It was during this period that seed companies such as Pioneer, DeKalb, Trojan, Northrup-King, Cargill, and Golden Harvest were acquired.

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<sup>32</sup> See “Supplemental Toolkit for Investors—Updated June 2009,” at 6, 8, and 9. Online at [http://www.monsanto.com/pdf/investors/supplemental\\_toolkit.pdf](http://www.monsanto.com/pdf/investors/supplemental_toolkit.pdf). Lower shares in traited seed markets reflect the fact that Monsanto's licensed traits can appear in any number of different seed products sold by competitors.

<sup>33</sup> See, e.g., Diana L. Moss, “Monsanto's Proposed Acquisition of Delta and Pine Land: An Antitrust White Paper,” American Antitrust Institute (November 17, 2006). Online at <http://www.antitrustinstitute.org/archives/files/552.pdf>.

Aside from the search for profits in a highly lucrative industry, there are a number of motivations for the unprecedented waves of merger activity in transgenic seed. For example, expensive R&D programs in genomics may be possible only under the relatively large scale (and scope) created by concentration.<sup>34</sup> Vertical efficiencies such as reduced transactions costs and coordination achieved by exploiting the complementarities between traits and traited seed assets can also reduce costs. Closer, more precise coordination between levels in the transgenic supply chain may result in more efficient creation of new transgenic varieties in increasingly differentiated product markets.<sup>35</sup>

There is also the compelling strategic motivation behind consolidation--access to patent-protected technologies and to distribution channels. Of particular concern has been the increase in concentration at the innovation and genetic traits level, creating firms with significant patent holdings related to transformation technology and transgenic improvements. During the late 1990s through 2000s, Monsanto acquired almost 40 companies, creating the horizontal and vertical integration that underlies the firm's platforms in cotton, corn, and soybeans.<sup>36</sup> These acquisitions included a handful of other agricultural biotechnology firms but the majority were seed companies. Monsanto's acquisitions of both rival biotechnology firms and seed companies such as Agracetus,

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<sup>34</sup> Nicholas Kalaitzandonakes, "Biotechnology and the Restructuring of the Agricultural Supply Chain," 1 AGBIOFORUM (1998), at 40.

<sup>35</sup> See, e.g., Gregory D. Graff, Gordon C. Rausser, and Arthur A. Small, "Agricultural Biotechnology's Complementary Intellectual Assets," University of California at Berkeley, mimeo (August 2001). Strong intellectual property rights affect incentives to integrate, either through M&A or contracting in a differentiated seed products model. See, e.g., Rachel E. Goodhue, Gordon C. Rausser, Suzanne Scotchmer, and Leo K. Simon, "Biotechnology, Intellectual Property, and Value Differentiation in Agriculture," Department of Agricultural and Resource Economics, University of California at Berkeley, Working Paper 901R (2002), at 15.

<sup>36</sup> Between 1995 and 1998, Monsanto accounted for about one-third of mergers and acquisitions in the industry. See *supra* note 28, at 6. For information on acquisitions, see *supra* note 5, at 32-35; Carl Pray, James F. Oehmke, and Anwar Naseem, "Innovation and Dynamic Efficiency in Plant Biotechnology: An Introduction to the Researchable Issues," 8 AGBIOFORUM 52, at 60; and United Nations Conference on Trade and Development, "Trading the Trend Towards Market Concentration: The Case of the Agricultural Input Industry," (April 2006), at 5 and 9-10; and Organization for Competition Markets. Online at [http://www.competitivemarkets.com/index.php?option=com\\_content&task=view&id=206&Itemid=64](http://www.competitivemarkets.com/index.php?option=com_content&task=view&id=206&Itemid=64).

Calgene, Holdens, Asgrow, and Delta and Pine Land allowed it to complete patent portfolios in plant transformation technologies, genes, and germplasm.<sup>37</sup> Monsanto's successive acquisitions of seed companies have been the primary driver behind increased concentration at the traited seed level and removed from the market many of the ISCs that have historically been important as a distribution channel for rival traits developers.

Regardless of the motivation for merger, there is disagreement over whether increased concentration in transgenic seed has had beneficial or detrimental economic effects. Some theories emphasize the deconcentrating effects of innovation—on the reasoning that smaller incumbents and entrants have more incentives to innovate. However, there is some evidence that shows beginning in the late 1980s, M&A activity abruptly reversed a trend in falling concentration of patent ownership associated with the entry of new, smaller firms into the agricultural biotechnology sector.<sup>38</sup> There is also some evidence that the cost-reducing effects of increased concentration in transgenic corn and cotton seed over the last 30 years have prevailed over adverse competitive effects.<sup>39</sup> Such modeling exercises naturally attract scrutiny since they require complex assumptions about the structure of input markets, implicit changes in market structures induced by vertical integration, and the dynamics of innovation.

On the other hand, there is the view that expensive and risky R&D and rapidly moving innovation can act as an entry barrier.<sup>40</sup> Concentration can also influence incentives for rivals to innovate and, therefore, the rate and quality of innovation. For example, the exercise of market

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<sup>37</sup> See Graff et al., *supra* note 35, at 19-20.

<sup>38</sup> Margaret Brennan, Carl Pray, Anwar Naseem, and James F. Oehmke, "An Innovation Market Approach to Analyzing Impacts of Mergers and Acquisitions in the Plant Biotechnology Industry," 8 *AGBIOFORUM* 89 (2005), at 94.

<sup>39</sup> *Supra* note 5, at 40.

<sup>40</sup> See, e.g., William Lesser, "Intellectual Property Rights and Concentration in Agricultural Biotechnology," 1 *AGBIOFORUM* 56, at 58.

power in innovation markets will change both the pricing of and adoption rates of transgenic seed products, the impacts of which are felt on the size and distribution of benefits from innovative activity (i.e., farmers and consumers could be expected to gain less and innovators to gain more).<sup>41</sup> How innovation competition will ultimately affect prices, output levels, product qualities, and choices in traited seed markets are key questions for antitrust policy. Given these issues in transgenic seed, there is a good case to be made that static analysis of input and/or output markets may not fully capture the dimensions of competition and market outcomes over time. Assessing the effects of innovation competition on stimulating (or retarding) the pace of R&D in these particular markets may be of important additional value.<sup>42</sup>

A look at measures of innovative activity brings this issue into sharper focus. As shown in Figure 4, for example, Monsanto accounts for the majority of field releases for corn and soybeans over the last decade, with shares ranging to almost 80 percent at their peak in 2002, hovering around 70 for much of the 2000s and drifting down somewhat after 2005.<sup>43</sup> The remaining players are relatively small (Syngenta, Pioneer, Dow, and Bayer) and each have shares of less than 10 percent for the bulk of the time period.<sup>44</sup> During this time, Monsanto's high market shares drove concentration levels to almost 6,000 HHI at their peak and maintained them in the 4,000 to 5,000 HHI range for much of the period. Concentration of patent ownership tells a slightly different story. Since patents cover far more micro-level technologies, we would expect to see less concentrated patent markets than those markets that reflect later-stage innovations. To confirm this, we developed a count of

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<sup>41</sup> *Supra* note 19, at 24.

<sup>42</sup> See, e.g., U.S. Department of Justice and Federal Trade Commission, "Antitrust Guidelines for the Licensing of Intellectual Property," (April 6, 1995), at § 3.2.3.

<sup>43</sup> See *supra* note 22.

<sup>44</sup> These results generally hold from crop-to-crop. However, in cotton, Monsanto's shares are smaller and Bayer has a significant market presence (with shares exceeding 30 percent).

annual patent grants in plant biotechnology for the top 25 firms, universities, and the U.S. government from PTO data for the period 2000 to 2008.<sup>45</sup> HHI concentration increased from the mid- to high 2,000s over the period. As shown in Figure 5, Monsanto and DuPont are the two largest patent-holders, followed closely by Syngenta, and then by the smaller shares of the University of California and Bayer.

Figure 4

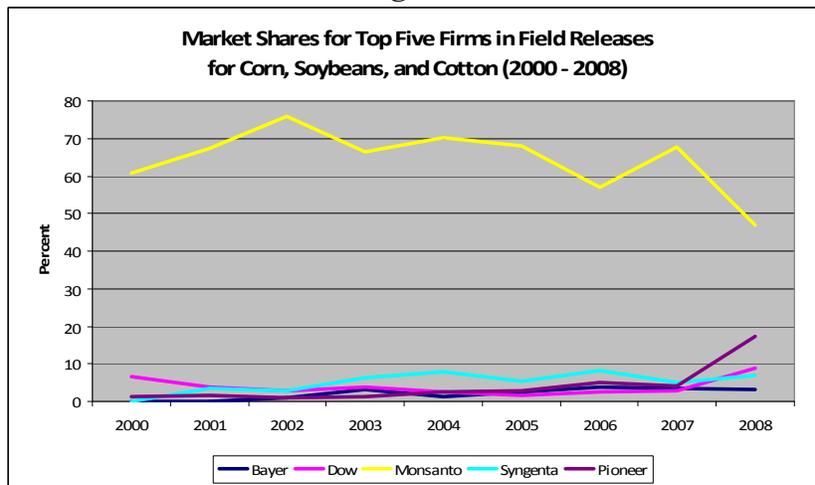
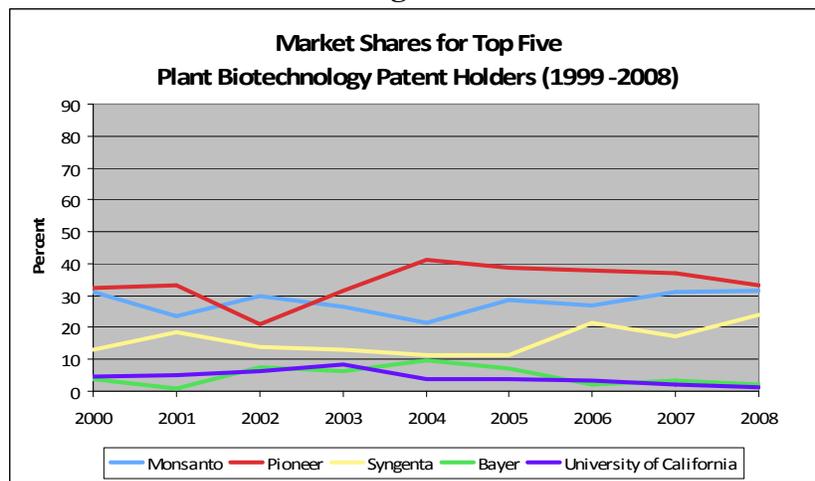


Figure 5



<sup>45</sup> Patent data from the USDA (see *supra* note 23) were used as a starting point for this analysis. Based on the top 25 patent-holders in 1999, the number of plant-related patents granted to each of the patent-holders from 2000-2008 was retrieved from the PTO database. Data were adjusted for mergers. The patent count does not include any new firms participating in the area of agricultural biotechnology. If there was significant new entry during the 2000s, then market concentration levels would be lower than reported here. However, it is unlikely that such new entry would substantially alter the shares of the top five firms.

The foregoing look at concentration in innovation markets reveals that only a few firms compete (albeit disproportionately) and concentration has increased in tandem with a period of vigorous merger activity in the 2000s. This seemingly cramped state of competition, however, is at odds with the surge in *quantity* of innovative activity in the late 1990s that we see in Figure 2. One explanation for this dichotomy is that the loss of competition in innovation may have both weakened incentives to innovate and lowered the quality of innovation. Control of information likely plays a key role in this process. With high market concentration comes more control--not only over technology--but information. It is well known, for example, that over time agricultural biotechnology firms have exerted more control over field trials performed at research institutions (e.g., land-grant universities). Trials are generally performed with company approval and direct comparisons between transgenic seed platforms or between transgenic and conventional platforms are scarce.

Empirical measures also support the notion that the quality of innovation has deteriorated with impaired market structure. For example, growing concentration in the seed industry in the 1990s is correlated with a fall in private research intensity, as measured by numbers of field trails or by lower sponsorship of R&D.<sup>46</sup> A key measure of the output of R&D has also declined over time. For example, the number of transgenic research products deregulated by the USDA (and thus available for commercial use) has trended steadily downward since the mid 1990s, falling by about 80 percent between 1995 and 2008.<sup>47</sup> Finally, some analysis indicates that the average quality of agricultural biotechnology patents declined over the period 1985 to 2000.<sup>48</sup>

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<sup>46</sup> See David E. Schimmelpennig, Carl E. Pray, and Margaret F. Brennan, "The Impact of Seed Industry Concentration on Innovation: A Study of U.S. Biotech Market Leaders," 30 AGRICULTURAL ECONOMICS 157 (2004). See also *supra* note 20.

<sup>47</sup> See "Petitions of Nonregulated Status Granted or Pending by APHIS," U.S. Department of Agriculture. Online at <http://www.aphis.usda.gov/brs/status/petday.html>.

A second possible explanation for the observed dichotomy between the quality and quantity of innovation is the dominant role of Monsanto in the agricultural biotechnology industry. A single firm with control of an enormous stock of patented technology serves as gatekeeper for rivals seeking the access necessary for intra-platform competition. This gatekeeper role may extend far into the future, even if entry were to occur. Because innovations are protected for long periods of time, and patents are often extended based on very small changes to the original patent design, the effects of high market share and concentration will be felt for some significant time to come.<sup>49</sup> Indeed, the “mobility index” developed by Cable provides some crucial insight into the dynamic structure of innovation markets.<sup>50</sup> Based on total field releases for corn, soybeans, and cotton from 2000 to 2008, mobility values are extremely low, indicating little change in firm leadership or movement of firms in the industry. This supports the notion that firms are unable or unwilling to challenge Monsanto’s dominant position in innovation markets.<sup>51</sup>

## **VI. Patent Protection - Strategy for Creating and Maintaining Platforms?**

The contradiction between apparently robust advancement in agricultural biotechnology and evidence that innovation is struggling during a period of significant consolidation and dominance by a single firm reveals a darker side to innovative activity. This includes deterioration in innovative

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<sup>48</sup> Quality is measured by the average per-patent number of patent citations observed in research work. See Steven Buccola and Yin Xia, “The Rate of Progress in Agricultural Biotechnology,” 26 *REVIEW OF AGRICULTURAL ECONOMICS* 3 (2004), at 1 and 7.

<sup>49</sup> For further discussion on the cumulative innovation and blocking patents, see e.g., Carl Shapiro, “Navigating the Patent Thicket: Cross License, Patent Pools, and Standard-Setting,” in 1 *INNOVATION POLY & THE ECON.* 119, at 120.

<sup>50</sup> J. R. Cable, “Market Share Behavior and Mobility: An Analysis and Time-Series Applications Note,” 79 *REVIEW OF ECONOMICS AND STATISTICS* 136 (1997). The mobility index is computed by squaring the year-to-year difference between markets shares and then summing them over all participants. The possible value of the index ranges from 0 (no change in leadership) to 2 (wholesale replacement of one monopoly with another).

<sup>51</sup> *Supra* note 38, at 96.

quality, reduced incentives to innovate, and fewer new transgenic products brought successfully to market. The explanation for this is likely to be a function of two factors. One is a flawed patent review process implemented by the U.S. Patent and Trademark Office, a problem that has been exhaustively explored elsewhere.<sup>52</sup> A second is the strong motivation to use patented technology as a tool to stymie competition through delay or prevention of new commercial technologies.<sup>53</sup>

The second of these questions defines the difficult and unresolved area in which concerns over anticompetitive practices under antitrust law come into direct contact with the goal of protecting innovation under patent law. U.S. antitrust agencies and courts are increasingly grappling with the dual problem of general abuse of the patent system to the narrower question of what constitutes an anticompetitive licensing restriction on the use of patented technology. In the first case, one systemic problem is excessively broad rights of ownership granted through liberal or overbroad patenting, especially on research tools or fundamental technologies.<sup>54</sup> Such technologies can generally be applied to a number of different research areas and lead to a diverse set of innovations.<sup>55</sup> For example, there is some evidence to suggest that the difficulty associated with

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<sup>52</sup> See, e.g., U.S. "To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy," U.S. Federal Trade Commission (October 2003).

<sup>53</sup> See, e.g., F. M. Scherer, "The Political Economy of Patent Policy Reform in the United States," 7 JOURNAL ON TELECOMMUNICATIONS & HIGH TECHNOLOGY LAW 167 (2009).

<sup>54</sup> In this regard, the U.S. Supreme Court set the bar for the utility patent requirement some years ago. "The basic *quid pro quo* . . . for granting a patent monopoly is the benefit derived by the public from an invention with substantial utility. Unless and until a process is refined and developed to this point--where specific benefit exists in currently available form--there is insufficient justification for permitting an applicant to engross what may prove to be a broad field." See *Brenner v. Manson*, 383 U.S. 519, 534 (1966). However, the *Brenner* terms are vague and as the Federal Circuit noted in *In re Fisher*, 421 F.3d 1365, 1371 (Fed. Cir. 2005) "[t]he Supreme Court has not defined what the terms 'specific' and 'substantial' means per se. . .").

<sup>55</sup> *Supra* note 28, at 4. See also Carl E. Pray and Anwar Naseem, "Intellectual Property Rights on Research Tools: Incentives or Barriers to Innovation? Case Studies of Rice Genomics and Plant Transformation Technologies," 8 *AGBIOFORUM* (2005), at 108.

accessing an entire package of plant transformation technologies necessary to develop transgenic seed products has prevented entry into genetic engineering.<sup>56</sup>

It is instructive to note that Monsanto holds four of the 13 major, patented plant transformation techniques and technologies used in the agrobacterium-mediated transformation of plants. Those patents include the “agrobacterium co-transformation method” (divested to the University of California, Berkeley in the merger of Monsanto and DeKalb), the “particle gun electric discharge,” the “antibiotic resistance gene under control of plant promoter,” and “the CaMV 35S promoter.”<sup>57</sup> Syngenta is the patent-holder on two techniques. Bayer, CAMBIA, Zeneca, and DuPont each hold one patent or an exclusive license, and universities account for the remaining two patents.

A second issue is the patent “thicket” and associated “hold-up” problem, observed particularly in areas with complex R&D and where firms hold large patent suites. In this situation, rival innovators must seek permissions to use multiple patented technologies, resolve patent conflicts, and sustain challenges to the validity of their own patents. Thickets created by patents on small innovations, for example, can be used as “bargaining chips or decoys if the firm’s major patents are challenged in court.”<sup>58</sup> There is substantial anecdotal evidence pointing to delays in commercialization resulting from hold-up.<sup>59</sup>

A third potential problem involves patent extensions that reflect inconsequential changes to the original technology. This strategy can needlessly advance the onset of obsolescence for the previous technology, at great cost to consumers. Patent extension can also delay the introduction of

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<sup>56</sup> See Pray and Naseem, *supra* note 55, at 116.

<sup>57</sup> See Pray and Naseem, *supra* note 55, at 109-110.

<sup>58</sup> *Supra* note 48, at 9.

<sup>59</sup> Pray and Naseem, *supra* note 55, at 111.

competing branded or generic products and prolong a period of supracompetitive pricing for the patented technology-- an approach best known in the pharmaceutical industry. As some writers suggest, however, the problem could surface in agricultural biotechnology.<sup>60</sup> For example, Monsanto's Roundup Ready soybean goes off-patent in 2014. In 2006, the company filed a petition for determination of non-regulated status with the USDA for its Roundup RReady2Yield™ soybean. The petition indicates similarities in the coding sequence (CP4 EPSPS) between the first-generation Roundup Ready soybean and the second-generation technology.<sup>61</sup> Whether patent extension in this situation poses a competitive problem remains to be seen, but it is likely that rival stakeholders will offer it up as part of Monsanto's broader strategy to retain dominance in a key transgenic seed market.

The patent thicket, hold-up, and extension problems may go far to explain the underlying relationship between the proliferation of patents we observe over the last 10 years and the decline in quality of new innovation. Many of the concerns underlying highly concentrated innovation and genetic traits markets are revealed in patent infringement and antitrust litigation involving transgenic seed. In *Monsanto Co. vs. E.I. DuPont de Nemours* (2009), for example, Monsanto alleges that DuPont violates their soybean and corn license agreements by stacking its Optimum GAT gene with Monsanto's Roundup Ready gene.<sup>62</sup> Infringement cases revolving around seed-saving by farmers include the controversial *Monsanto vs. McFarling* and *Monsanto vs. Scruggs*.<sup>63</sup> Such prohibitions can

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<sup>60</sup> See, e.g., Michael Stumo, "Anticompetitive Tactics in Ag Biotech Could Stifle Entrance of Generic Traits," presentation at the American Agricultural Law Association, 2009 Annual Agricultural Law Symposium, (September 26, 2009).

<sup>61</sup> Monsanto Company, "Petition for the Determination of Nonregulated Status for Roundup RReady2Yield™ Soybean MON 89788," U.S. Department of Agriculture, Animal and Plant Health Inspection Service (submitted June 27, 2006). Online at [http://www.aphis.usda.gov/brs/aphisdocs/06\\_17801p.pdf](http://www.aphis.usda.gov/brs/aphisdocs/06_17801p.pdf).

<sup>62</sup> For the most recent of these types of claims see, e.g., *Monsanto Co. vs. E.I. DuPont de Nemours and Co.*, 4:09-cv-00686 (E.D. Mo., May 4, 2009).

<sup>63</sup> See *Monsanto Co. vs. McFarling*, 488 F.3d 973 (Fed. Cir. 2007) and *Monsanto Co. v. Scruggs*, 459 F.3d 1328 (Fed. Cir. 2006).

adversely affect competition because they create incentives to “standardize” on one seed product. That standardization, in turn, creates disincentives to shop around for alternatives.

Antitrust complaints revolve around claims that biotechnology developers’ practices have harmed competition, either through anticompetitive agreements or monopolization of the markets for genetic traits and/or traited seed.<sup>64</sup> In the latter case, various plaintiffs allege that Monsanto has monopolized markets for genetic traits by engaging in a variety of exclusionary practices, including exclusive dealing arrangements that penalize seed companies for licensing traits other than Monsanto’s. Also suspect are bundling agreements that financially penalize seed companies for selling less than a minimum percentage of seed containing Monsanto traits. These tactics include the use of contractual provisions that allow Monsanto to terminate an ISC’s trait license, thereby requiring the ISC to destroy its inventory of seeds containing Monsanto traits upon a change in ownership. Because the ISC’s lack of inventory would render the company worthless to a competitor of Monsanto’s, such provisions make it difficult for rivals to acquire ISCs and obtain economically valuable germplasm for introgressing traits to breed out new competing varieties.

Other alleged anticompetitive tactics include anti-stacking restrictions in licenses, which are described in the antitrust counterclaim in *Monsanto Co. vs. E.I. DuPont de Nemours and Co.* Also cited are joint venture agreements that restrict the licensing of one partner’s technology outside the agreement, thus impeding rivals’ access to that technology for the purposes of developing competing products. In its counterclaim regarding the recent agreement between Monsanto and Dow to create a stacked, 8-gene corn seed, DuPont alleges that Dow is prohibited from permitting

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<sup>64</sup> The preponderance of these antitrust suits address monopolization issues. See, e.g., *American Seed Co., Inc. v. Monsanto Co.*, 238 F.R.D. 394 (D. Del. 2006) and antitrust counterclaims articulated in *Monsanto Co. v. Syngenta Seeds, Inc.*, 443 F.Supp.2d 648 (D. Del. 2006).

Pioneer to sub-license its Herculex insect resistant trait to ISCs.<sup>65</sup> Such exclusive licensing arrangements could act to delay the entry of alternative transgenic varieties. The result of such alleged exclusionary conduct is to restrict competitors' ability to license traits from companies other than Monsanto or its affiliates and limit competitors' ability to distribute seeds with competing traits.

A compilation of court cases involving agricultural biotechnology from 2002 to 2009 indicates almost 60 patent infringement and antitrust cases in federal district and appeals courts.<sup>66</sup> About 55 percent of those cases involved Monsanto as the plaintiff and about 20 percent as the defendant. This means that the company has been involved in about three-quarters of all agricultural biotechnology litigation over the last ten years. Monsanto's disproportionate share of involvement in litigation raises a number of issues. Among the more benign is that the share of litigation activity is positively correlated with the firm's presence in innovation and genetic traits markets. This makes sense when we observe Monsanto's substantial shares in the markets for field releases and genetic traits. What is troubling, however, is that Monsanto does not exhibit the same dominance in patents. As noted earlier, the patent market contains not one, but two or even three larger players--Monsanto and Pioneer--followed closely by Syngenta. Yet we do not observe the same level of litigation activity involving Pioneer or Syngenta as that which involves Monsanto. This could lend some support to the notion that Monsanto has protected its dominance through a vigorous program of patent infringement litigation. Or, perhaps it could indicate that Monsanto's patents are more critical to Monsanto than the others are to their owners, or that the others are unusually aggressive in their testing of Monsanto's willingness to defend its patents.

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<sup>65</sup> Monsanto Co. vs. E.I. DuPont de Nemours and Co., Defendants Answer and Counterclaim, 4:09-cv-00686 (E.D. Mo. June 16, 2009), at p. 39, p. 75.

<sup>66</sup> See "Case Law Index: Biotechnology," Online at <http://www.nationalaglawcenter.org/assets/caseindexes/biotechnology.html>. Data include 2009 cases to date.

The foregoing concerns have not escaped the notice of the antitrust agencies.<sup>67</sup> Indeed, it is instructive to look back at enforcement in the area of agricultural biotechnology and the remedies sought in each case. Two major actions in the last ten years by the U.S. Department of Justice include Monsanto's mergers with *DeKalb* and cotton giant *Delta and Pine Land*. These transactions arguably created the Monsanto platforms in corn and cotton. While the effectiveness of the remedies generated substantial controversy, it is clear that the DOJ recognized both the importance of innovation markets and rival access to Monsanto's patented technology to competition.<sup>68</sup> For example, in *DeKalb*, the agency required the divestiture of Monsanto's agrobacterium-mediated transformation technology for corn and required the company to enter into binding commitments to license corn germplasm to seed company customers for the purpose of introducing new transgenic traits in corn.<sup>69</sup> In *Delta and PineLand*, the DOJ had similar concerns, requiring the divestiture of cotton seed assets, divestiture of several lines of cotton germplasm, and the removal of restrictive provisions in Monsanto technology licenses that would prohibit rivals biotech developers from stacking Monsanto with non-Monsanto traits.<sup>70</sup>

## VII. Policy Implications for Competition in Transgenic Seed

A number of major observations that could potentially inform policy options and alternatives flow from the preceding analysis. First, the intractable competitive situation that prevails

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<sup>67</sup> On October 8, 2009, it was reported that the U.S. Department of Justice was investigating Monsanto's practices. See, e.g., Lauren Etter, "Monsanto Says Justice Raises Antitrust Questions," WALL STREET JOURNAL (October 9, 2009).

<sup>68</sup> See, e.g., comments filed under the Tunney Act in *Delta and Pine Land* by: the American Antitrust Institute, International Center for Technology Assessment—Center for Food Safety, Organization of Competitive Markets, various state Attorney Generals, and DuPont.

<sup>69</sup> See U.S. Department of Justice, "Justice Department Approves Monsanto's Acquisition of DeKalb Genetics Corporation: Divestiture of Transformation Technology Rights And Licensing of Corn Germplasm Implemented," (November 30, 1998). Online at [http://www.usdoj.gov/atr/public/press\\_releases/1998/2103.htm](http://www.usdoj.gov/atr/public/press_releases/1998/2103.htm).

<sup>70</sup> *U.S. v. Monsanto and Delta and Pine Land*, "Competitive Impact Statement" (Case No. 1:07-cv-00992, D.D.C) (May 31, 2007), at 12-21.

in transgenic seed requires antitrust enforcement and/or legislative relief. It is indisputable that Monsanto possesses market power in innovation markets, in markets for genetic traits, and traited seed. What would likely be the centerpiece of any antitrust investigation into Monsanto's practices is whether the agricultural biotechnology giant has exercised its market power to foreclose rivals from market access, thereby slowing innovation and adversely affecting prices, quality, and choice for farmers and ultimate consumers of seed products. Efficiency defenses, such as a quality control rationale for prohibiting the stacking of Monsanto traits with non-Monsanto traits, are unlikely to provide an effective counterbalance to anticompetitive conduct.

At the same time, it is important to note that agricultural biotechnology and pharmaceutical innovation markets share much in common. Legislative approaches to the issue of generic drug entry (e.g., the Hatch-Waxman Act) have, in some part, eased competitive concerns, while at the same time unintentionally opening new ways for branded drugs to game the system. Whether a comparable legislative approach on the agricultural biotechnology side is possible remains to be seen. But legislative action could be motivated by the key role of the agricultural sector in the U.S. and world economies and the importance of agricultural products to the American consumer.

Second, any antitrust investigation of merger transactions or conduct in the transgenic seed industry should focus on the three tiers that comprise seed platforms—innovation, genetic traits, and traited seed—and the interfaces that link them. Those interfaces essentially comprise points in the supply chain at which rivals obtain market access to genetic traits and germplasm. However, such access under an intra-platform model of competition is only a starting point. Truly getting into the game also requires a level playing field at the distribution level, which means addressing tactics that are designed to create adverse incentives for seed companies and farmers to distribute or plant anything but Monsanto products.

Third, the current crisis in transgenic seed will require a resolution of the tension between patent law and antitrust law. In addressing complaints involving competitive conduct, patent infringement, and merger cases, both the courts and the DOJ have been faced with critical questions of whether restrictions on the use of technology (e.g., anti-stacking provisions) exceed the scope of the patent. While the judicial record on this issue in transgenic seed is murky at best, there are some signs of progress. For example, relief sought by the DOJ in *DeKalb* and *Delta and Pine Land* clearly recognized the importance of access to patented technology to competition and required the removal of offending restrictive measures.

Some progress may also be evident in the possible application of the recent Supreme Court decision in *Quanta Computer, Inc. V. LG Electronics, Inc.* to transgenic seed.<sup>71</sup> The court concluded that the patent owner (LG Electronics) had exhausted its enforceable patent rights against Quanta by an intermediate seller's (Intel) sale to Quanta of goods covered by LG Electronic's patents. Applied in the transgenic seed context, Quanta could potentially offer some restraint on the ability of patent holders to prevent rival biotechnology developers from modifying or stacking their genes.<sup>72</sup>

Fourth, remedies for competitive harm involving seed platforms must recognize a number of important considerations that have been highlighted in the preceding analysis. For example, given the long lead times associated with the development of transgenic seed products, divestiture of assets such as experimental lines of germplasm that are still in the developmental stage will not ensure that competition is immediately restored. Moreover, patented technologies that are candidates for divestiture should be fundamental enough to allow the prospective buyer(s) to innovate without encountering hold-up problems later in the innovative process. Some technologies

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<sup>71</sup> 128 S. Ct. 2109 (2008).

<sup>72</sup> This has been attempted in the case of seed saving but not stacking. See, e.g., *Monsanto Co. v. Scruggs*, 2009 U.S. App. LEXIS 11700. For further discussion see, e.g., Peter Carstensen, "Post-Sale Restraints via Patent Licensing: A "Seedcentric" Perspective," 16 *FORDHAM INTEL PROP. MEDIA & ENTERTAINMENT L.J.* 1053 (2006).

may, in fact, be broad enough that compulsory licensing without restrictions is the only approach to ensuring that rivals obtain the access needed to successfully innovate.

Any remedy would also need to consider what size package of assets would be necessary to divest in order to create an *effective* competing platform (if that is the goal of the remedy), the potential buyer of such assets, and the speed with which such a platform could become a viable competitor. In *Delta and Pine Land*, for example, a package of divestitures to a smaller incumbent (Bayer) in traited cotton seed could be interpreted as an attempt to create an “alternative” cotton platform. However, whether that platform has replaced the competition lost in the merger is an open question. Finally, remedies should not give short shrift to the problems encountered in downstream distribution. Practices that create adverse incentives for seed companies to promote products other than Monsanto’s, or that lock farmers into Monsanto products, should be the focus of remedial action.

Fifth, there is an as-yet undeveloped international component to the situation involving transgenic seed. While food from genetically modified plants is controversial and not well-accepted in some parts of the world, the companies engaged in the businesses discussed herein are global in scope. Antitrust authorities in foreign jurisdictions, especially the European Union, will likely watch developments in the U.S. with care and may at some point initiate their own investigations, which could reflect not only their concern for their farmers and consumers, but varying cultural attitudes relating to agricultural biotechnology. Reports that the U.S. DOJ is investigating the transgenic seed industry likely represent only the beginning of a major, on-going, international examination of policies relating to patents, innovation, and competitive strategies of dominant firms, taken in the emerging context of global systems competition and evolving policies toward technological approaches to supplying the world with food.