

ARTICLE

U.S. PLANT VARIETY PROTECTION: SOUND AND FURY . . . ?

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I. INTRODUCTION

This Article offers a critical reassessment of U.S. approaches to intellectual property protection for plant innovation.¹ Three developments make this reassessment timely.

First, the Supreme Court has finally confirmed that utility patent claims to plants and seeds satisfy the 35 U.S.C. § 101 subject matter eligibility requirement.² Plant innovation in the United States is now subject to utility patent protection, as well as concurrent protection under the Plant Variety Protection Act (PVPA).³ This development might presage a significant realignment in the seed industry's intellectual property portfolio strategy, as seed industry lawyers rethink the desirability of maintaining both PVPA protection and utility patent protection for proprietary varieties. However, little work has been done to explain the role of PVPA protection in a system of concurrent protection, or to develop a coherent policy vision within which the utility patent and PVP systems might operate.

1. This Article is one in a series of studies on optimizing intellectual property regimes for plant innovation. This research is being conducted under the auspices of the Intellectual Property & Plant Innovation (IPPI) Project. The IPPI Project is supported by the U.S. Department of Agriculture through the Illinois-Missouri Biotechnology Alliance (IMBA) Program and the University of Iowa Faculty Scholar Program.

2. *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc.*, 534 U.S. 124, 127 (2001).

3. 7 U.S.C. §§ 2321–2583 (2000). Plant innovation may be protectable under a variety of other arrangements as well, including the plant patent statute, 35 U.S.C. §§ 161–164, state trade secret law, contracts (via the use of “seedwrap” license agreements), and, in some instances, biological limitations such as hybridization. For an overview, see Jay P. Kesan, *Intellectual Property Protection and Agricultural Biotechnology—A Multidisciplinary Perspective*, 44 AM. BEHAVIORAL SCIENTIST 464, 486–87 (2000).

Second, technological advancements, particularly in plant biotechnology, are making clear the value of germplasm. U.S. patent and PVPA regimes must be optimized to encourage private sector investment in germplasm development while retaining reasonable access to germplasm to accommodate farming practices and public sector activities.⁴

Third, intellectual property protection for plant innovation is a key international intellectual property issue. The TRIPS Agreement⁵ expressly allows World Trade Organization (WTO) countries the option of adopting *sui generis* plant variety protection systems as an alternative to—or in combination with—utility patent protection for plant innovation.⁶

This Article focuses on one facet of the reassessment project: the role of plant variety protection in the U.S. intellectual property system.⁷ In *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred International, Inc.*, the Supreme Court characterized the PVPA as providing “limited patent-like protection for certain sexually reproduced plants,”⁸ echoing earlier statements in which the Court described the PVPA as supplying “patent-like protection to novel varieties of sexually reproduced plants (that is, plants grown from seed) which parallels the protection afforded asexually reproduced plant varieties (that is, varieties

4. Research expenditures in the agricultural sector are not trivial. The Economic Research Service of the U.S. Department of Agriculture reported that private sector investments in overall agricultural research amounted to some \$4 billion for 1996, with an additional \$3.1 million of public sector funds expended that same year. See Ann M. Thayer, *Owning Agbiotech*, 79 CHEM. & ENG'G NEWS, Sept. 17, 2001, at 25, 28.

The three major seed industry companies (Monsanto, DuPont, and Syngenta, respectively) all have multi-billion-dollar operations. *Id.* at 26 (reporting that Monsanto's seed unit had sales of \$935 million in the first half of 2001; Pioneer Hi-Bred (DuPont) had first quarter 2001 sales of \$929 million; and Syngenta had first half 2001 sales of \$407 million).

In addition, because the seed industry constitutes the first link in a tightly interlocked agricultural supply chain, decisions about intellectual property incentives for the seed industry are certain to have economic implications for all participants in the supply chain: distributors of agricultural commodities, the food industry, the farming community, and others.

5. Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, LEGAL INSTRUMENTS—RESULTS OF THE URUGUAY ROUND vol. 31, 33 I.L.M. 81 (1994).

6. *Id.* art. 27(3)(b).

7. In other works, we focus on the role of the utility patent system and on the broader question of dealing with interfaces between intellectual property regimes. See Mark D. Janis & Jay P. Kesan, *Weed-Free I.P.: The Supreme Court, Intellectual Property Interfaces, and the Problem of Plants* (forthcoming) (on file with the Authors); Mark D. Janis, *Sustainable Agriculture, Patent Rights, and Plant Innovation*, 9 IND. J. GLOBAL LEG. STUD. 91 (2001) [hereinafter Janis, *Sustainable Agriculture*].

8. *J.E.M. AG Supply, Inc. v. Pioneer High-Bred Int'l, Inc.*, 534 U.S. 124, 138 (2001).

reproduced by propagation or grafting) under [the plant patent provisions].”⁹ One of our tasks in this study is to demonstrate that these characterizations of the PVPA as “patent-like” are largely inapt.

We first assess U.S. plant variety protection from an historical and comparative perspective, analyzing the emergence of the concept of “breeders’ rights” in Europe and its eventual appearance in the United States. We then delineate the “essential traits” of the modern PVPA and note its points of divergence from a patent-like model. We next turn to an analysis of the modern PVPA from an empirical perspective, in which we present the results of statistical PVP data and anecdotal studies of PVPA acquisition, licensing, and enforcement activity for corn and soybean crops. We conclude that experience with the PVPA does not support the claim that it provides patent-like incentives for plant innovation and that the PVPA serves primarily as a vehicle by which to satisfy international obligations.

II. THE EMERGENCE OF *SUI GENERIS* SYSTEMS FOR PLANT VARIETY PROTECTION

The problem of providing adequate *ex ante* incentives for innovations in plant breeding has vexed the intellectual property community for at least a hundred years. On the one hand, the case can be made that the need for intellectual property protection is especially acute for plant innovation. Plant innovation is borne in seeds, and, at least in the case of self-pollinating plants (such as soybeans), seeds make hundreds of copies of themselves in the natural growth process. From the standpoint of a producer of innovation, the notion of a self-replicating invention presents as compelling a case for intellectual property intervention as can be imagined.¹⁰

On the other hand, policymakers have long perceived a lack of fit between plant innovation and traditional intellectual property regimes. Thus, the history of intellectual property

9. *Asgrow Seed Co. v. Winterboer*, 513 U.S. 179, 181 (1995).

10. It is as if Columbia Pictures, having invested over \$130 million to produce the movie “Spider-Man,” suddenly discovered that each “Spider-Man” DVD spontaneously produced a hundred near-identical copies of itself after a few weeks under proper care. Compared to this, Internet proliferation of unauthorized copies might appear positively benign. See, e.g., Andrew Buncombe, “*Spiderman*” Swings its Way to Box Office Record, INDEP. (London) May 6, 2002, at 4 (reporting the \$130 million figure); Kevin Featherly, “*Spider-Man*” Creeps Around Web, But *Obi-Wan’s MIA*, at <http://www.washingtonpost.com/ac2/wp-dyn/A52086-2002May21.html> (last visited July 12, 2002) (reporting that “Spider-Man,” released to U.S. theatres on May 3, 2002, was appearing in unauthorized incarnations on the Internet by May 12, 2002).

protection for plant innovation is characterized by a variety of efforts to fit plant innovation into traditional regimes—trademark/unfair competition regimes as well as patent regimes—followed by a gradual shift towards *sui generis* “plant variety” regimes. The *sui generis* regimes can best be analyzed against this mosaic of predecessor trademark and patent proposals.

A. *Trademark/Unfair Competition Approach*

One might approach the problem of providing incentives for plant breeding as one of product differentiation. That is, one might conclude that the source of the problem is the inability of growers to distinguish one plant breeder’s products from competitors’ products—or, more precisely, one plant breeder’s seeds from those of competitors. The competitors might then be able to free-ride on the goodwill that the plant breeder has built up in popular varieties. If this is a correct characterization of the problem, then the solution might appear to be straightforward under modern intellectual property law: extend trademark protection to seed brands.

One of the earliest U.S. intellectual property measures devoted specifically to plants took a trademark approach. The legislative proposal, introduced by Representative Allen in 1906,¹¹ would have afforded to “any person who has discovered, originated, or introduced any new variety of plant, . . . and gives and applies thereto a name,”¹² the opportunity to register the name, thereby securing for a twenty-year term “the exclusive right to propagate for sale and vend such variety of horticultural product under the name so registered.”¹³

As legislative debate quickly revealed, the proposal was flawed on several levels. First, it was ill-timed; by 1906, the United States had little experience with successful trademark legislation at the federal level.¹⁴ Second, the comments of one of

11. A Bill to Amend the Laws of the United States Relating to the Registration of Trademarks, H.R. 13570, 59th Cong. (1906), *quoted in Arguments Before the House Comm. on Patents on H.R. 13570, Authorizing the Registration of the Names of Horticultural Products and to Protect the Same*, 59th Cong. 3–19 (1906) [hereinafter *Argument on H.R. 13570*].

12. H.R. 13570 § 28a, *quoted in Argument on H.R. 13570, supra* note 11, at 3.

13. H.R. 13570 § 28b, *quoted in Argument on H.R. 13570, supra* note 11, at 5. Anticipating future debates over the clash between intellectual property rights and farming practices, the legislation specifically limited the exclusive grant of rights, specifying that “the flowers, fruits, or food products produced from such registered variety may be sold by any person whatsoever for any purpose other than that of propagation.” *Id.*

14. The Supreme Court had struck down the federal trademark statute on

the bill's proponents reflected a theme that has continued in U.S. plant intellectual property to the present day—a fundamental mismatch between aspirations and legislative implementation. Whereas the legislation provided only trademark protection, its sponsor attributed to it a patent-like goal: to “encourage [U.S. citizens] in the propagation of new varieties.”¹⁵ The legislative record reflects confusion over whether the legislation would afford patent-like protection,¹⁶ leaving legislators ultimately to observe that the proposal “seems to be more under the patent law than under the trade-mark law.”¹⁷

Third, it is not clear that the characterization of the problem as one of product differentiation is quite accurate. The problem, then and now, extends beyond the erosion of the breeder's incentive to invest in building up reputational value, to the erosion of the breeder's very incentive to invest in innovation. Even under the modern Lanham Act regime, it is not clear that trademark and unfair competition law could adequately secure the plant breeder's business goodwill, much less encourage innovation in plant breeding.¹⁸

The United States was not alone in experimenting with a trademark/unfair competition solution to the problem of adequate breeders' incentives. France, the Netherlands, and

constitutional grounds in the *Trademark Cases*, 100 U.S. 82, 97–98 (1879). A new federal trademark regime had just been introduced in 1905. See GRAEME B. DINWOODIE & MARK D. JANIS, *TRADEMARK & UNFAIR COMPETITION: LAW & POLICY* ch. 1 (forthcoming) (on file with the Authors). Much of the brief debate over H.R. 13570 concerned its constitutionality under the Commerce Clause. *Argument on H.R. 13570, supra* note 11, at 4–7.

15. *Argument on H.R. 13570, supra* note 11, at 6.

16. Representative Bonyng asked whether “the main purpose of this bill” was “to give a monopoly for twenty years to the man who originates the plant,” and Chairman Currier responded that the legislation gave plant breeders a “monopoly to produce and sell under a name which they give to the plants.” *Id.* at 7. Bonyng disagreed, asserting that the legislation gave producers “a monopoly to sell that particular variety under any name, no matter what name,” and Representative Kirk, one of the bill's proponents, corrected him, explaining that the “monopoly” was limited to “the name registered.” *Id.*

17. *Id.* (remarks of Representatives Hinshaw and Bonyng).

18. The breeder in a modern trademark/unfair competition action would presumably be asserting Lanham Act violations for the unauthorized multiplication of the *genuine* product and sale of that product either (1) under the originator's name, albeit not through authorized channels, or (2) under the competitor's name. See 15 U.S.C. § 1114 (2000). Neither situation lends itself to straightforward trademark analysis. The former situation might be somewhat analogous to the problem of gray market goods, while the latter might be treated as a matter of “reverse passing off” under modern trademark doctrine. See *Kmart Corp. v. Cartier, Inc.*, 486 U.S. 281, 285 (1988) (defining “gray-market good” as “a foreign-manufactured good, bearing a valid United States trademark, that is imported without the consent of the United States trademark holder”); *Web Printing Controls Co. v. Oxy-Dry Corp.*, 906 F.2d 1202, 1203 n.1 (7th Cir. 1990) (defining “reverse passing off” as a situation in which “a person removes or obliterates the original trademark, without authorization, before reselling goods produced by someone else”).

Germany all experimented with systems that combined concepts of seed registration (apparently to allow government control of trade) and trademark protection.¹⁹ It is not evident that any of these systems contributed materially to incentivizing innovation in plant breeding.

B. Patent Approach

Within weeks after the failed effort to use the U.S. trademark system to create an incentive structure for plant breeders, Representative Allen tried again, this time introducing a bill to amend the utility patent statute to accommodate plant innovation.²⁰ To the then-existing utility patent eligibility provision, R.S. § 4886, the bill would have added a new section, § 4886a, providing that:

Any person who has discovered or originated any new horticultural variety of plant, tree, or vine, not known or propagated by others in this country before his discovery or origination thereof, and not patented or described in any printed publication in this or any foreign country before his discovery or origination thereof, or more than ten years prior to his application, and which has not been on sale in this country for more than two years prior to his application, may . . . obtain a patent therefor.²¹

The bill would also have added a new provision specifying the requisites of application for plant-related patents, calling for “a written description setting forth the name of plant . . . to which such new variety belongs, . . . and a full, clear, and exact description of the characteristics of such new variety as will enable any person learned in the science of horticulture to

19. See, e.g., Andre Heitz, *The History of the UPOV Convention and the Rationale for Plant Breeders' Rights*, in 1991 SEMINAR ON THE NATURE AND RATIONALE FOR THE PROTECTION OF PLANT VARIETIES UNDER THE UPOV CONVENTION 25–26 (UPOV 1994) [hereinafter Heitz, *History of the UPOV*].

20. A Bill to Amend the Laws of the United States Relating to Patents in the Interest of the Originators of Horticultural Products, H.R. 18851, 59th Cong. (1906), quoted in *Arguments Before the House Comm. on Patents on H.R. 18851, To Amend the Laws of the United States Relating to Patents in the Interest of the Originators of Horticultural Products*, 59th Cong. 3–18 (1906) [hereinafter *Argument on H.R. 18851*]. Previous legislative proposals for patents on plants had been advanced. See, e.g., H.R. 5435, 52d Cong., 23 CONG. REC. 892 (1892) (extending patent protection to “any new and useful plant, fruit, or flower” that met standard utility patent protectability requirements).

21. H.R. 18851 § 4886a, 59th Cong. (1906), quoted in *Argument on H.R. 18851*, supra note 20, at 15.

identify such new variety and distinguish the same from other varieties.”²²

Albert H. Walker, practitioner and treatise-writer of *Walker on Patents* fame,²³ appeared in support of the proposed legislation; his testimony neatly anticipated two of the principal issues that have been debated over the course of the twentieth century and into the twenty-first on the idea of patents for plants.²⁴ First, Walker addressed the “natural products” objection to patenting living subject matter.²⁵ Clearly, Walker thought little of the objection, maintaining that there was a definite distinction between ineligible “discoveries” (such as the discovery of the anesthetic qualities of ether) and eligible “inventions,” and arguing that a plant “created by” a breeder and “never existing before” fell within the latter category.²⁶

Second, Walker spotted a key issue relating to the character of the disclosure. He noted that the enablement requirement in the proposal only called for enough disclosure to enable a skilled artisan to “identify” the new variety and distinguish it from others, whereas the standard patent law enablement requirement applied in this setting presumably would “enable anybody else to produce that new variety in the same way in which it was produced” by the patentee.²⁷ Walker was obviously troubled by the implications of extending patent law description requirements to living subject matter, and he wanted more time to consider the matter.²⁸

The proposal failed, as did a number of others in the early 1900s.²⁹ Indeed, Congress never adopted explicit legislation implementing fully the patent approach to the problem of incentives for plant breeding.³⁰ Instead, in the Townsend-Purnell

22. H.R. 18851 § 4888a, *quoted in Argument on H.R. 18851, supra* note 20, at 15.

23. *See Argument on H.R. 18851, supra* note 20, at 13 (referring to Walker as “a distinguished patent lawyer and author”).

24. *See Argument on H.R. 18851, supra* note 20, at 12–18. The document reports hearings that were held on May 9, 1906, and May 17, 1906. Walker appeared during the May 9 hearings and submitted a letter in connection with the May 17 hearings. *Id.* at 3, 12–13.

25. *Id.* at 16.

26. *Id.* However, Walker did recommend that the distinction could be reinforced in the legislation by eliminating references to “discovery” and substituting “invention.” *Id.* at 17. Walker also thought it important that the bill be limited so that it would not cover “the case where the patentee had merely gone into the woods and found a weed that nobody had seen before.” *Id.*

27. *Id.*

28. *Id.* (twice indicating that he wanted “to reflect a little” longer).

29. *See Heitz, History of the UPOV, supra* note 19, at 20 (referring to unsuccessful U.S. legislative proposals in 1907, 1908, and 1910).

30. Nor did Congress ever expressly exclude the possibility of applying the existing

Plant Patent Act of 1930,³¹ Congress created a plant patent regime limited to varieties that had been asexually reproduced.³²

The House Report accompanying the plant patent legislation acknowledged that the asexual reproduction requirement “greatly narrows the scope of the bill.”³³ The bill proposed “to give the necessary incentive to preserve new varieties” by encouraging breeders to multiply asexually the new and valuable varieties that they discovered, but the bill did not “give any patent protection to the right of propagation of the new variety by seed, irrespective of the degree to which the seedlings come true to type.”³⁴ In subsequent judicial interpretation, the Federal Circuit has placed great weight on the limiting effect of the asexual reproduction requirement, explaining that (1) the requirement “is the cornerstone of plant patent protection,”³⁵ (2) it follows that the term “variety” as used in the Plant Patent Act must be understood to encompass a single, individual plant,³⁶ and (3) infringement of a plant patent is essentially of the narrowest type conceivable in intellectual property, in that infringement of

utility patent eligibility provisions to living subject matter, including plants. The Supreme Court, of course, ultimately interpreted those provisions to cover biological subject matter. *See Diamond v. Chakrabarty*, 447 U.S. 303 (1980) (interpreting 35 U.S.C. § 101 to encompass living subject matter generally); *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc.*, 534 U.S. 124, 127 (2001) (interpreting 35 U.S.C. § 101 to encompass seed-grown plants specifically).

31. Now codified, as amended, at 35 U.S.C. §§ 161–164 (2000).

32. In addition to introducing the asexual propagation requirement, the Plant Patent Act made other doctrinal innovations. For example, perhaps recognizing Walker’s unease over the issue of adequate descriptions for living subject matter, the Act required merely that the disclosure be “as complete as is reasonably possible.” *See* 35 U.S.C. § 162.

33. H.R. REP. NO. 1129, at 4 (accompanying H.R. 11372, 71st Cong. (1930)).

34. *Id.* at 5. Congress was persuaded that human effort to undertake asexual propagation of new plant varieties deserved encouragement. *See id.* Valuable new varieties such as the McIntosh apple “could not have been reproduced true to the type by nature through seedlings,” but rather required human intervention in the form of asexual propagation. *Id.* at 4–5.

Congress did express a classic patent-like aspiration for the plant patent legislation in its hope “that the bill will afford a sound basis for investing capital in plant breeding and consequently stimulate plant development through private funds.” *Id.* at 2. But that statement must be understood as extending only to that segment of the industry where asexual propagation of new varieties was the convention for commercializing products. *Id.* at 1 (stating that the bill would provide patent protection only for new plant varieties asexually reproduced). That was (and is) true of the nursery industry, but not the seed industry.

35. *Imazio Nursery, Inc. v. Dania Greenhouses*, 69 F.3d 1560, 1568 (Fed. Cir. 1995) (clarifying that patent protection applies to asexually reproduced plants, while the PVPA applies to sexually reproduced plants).

36. *See id.* at 1567–68. This is so even if the resulting meaning of the term “variety” in the Plant Patent Act regime is different from that in the PVPA regime. *Id.* The PVPA concept extends to a plant grouping, rather than being limited to a discrete identifiable plant. *See infra* Part II.C for an explanation of the PVPA concept of “variety.”

a plant patent requires an actual physical taking from the patented plant.³⁷

For U.S. law purposes, then, the plant patent legislation created a distinction between plants propagated asexually and plants reproduced via seed. It might be tempting to view the distinction as inevitable, flowing as a matter of necessity from the intrinsic qualities of plants. By extension, the appearance of *sui generis* plant variety regimes would likewise seem to rest on a straightforward, biological rationale.

In fact, the introduction of the asexual/sexual distinction in U.S. plant intellectual property law was as much a matter of political expediency as it was a matter of biology, as a careful analysis of the history of the plant patent legislation reveals.³⁸ Major nursery operators—whose varieties were easily propagated asexually³⁹—comprised the chief lobbying influence advocating patent protection for plant innovation, and put recognition of plant breeding as “invention” on equal footing with invention in other industrial sectors.⁴⁰ By contrast, seed companies saw themselves predominantly as brokers rather than as developers of new varieties.⁴¹ In addition, the nursery operators dealt in ornamentals and fruits, while the seed companies dealt in staples of the food supply.⁴² One may assume that patent protection extending to the latter may have been politically unpalatable at the outset of the Great Depression.⁴³

In any event, the best historical study makes clear that the nursery operators persuaded seed companies to drop efforts to secure patent legislation expressly encompassing seed-grown plants.⁴⁴ Political considerations suggested that plant breeders should “get established the principle that Congress recognized the rights of the plant breeder” by lobbying for the limited

37. That is, it is not sufficient that the alleged infringing plant merely has the same essential characteristics as the patented plant. See *Imazio Nursery*, 69 F.3d at 1569–70.

38. Professor Cary Fowler has provided an insightful study of the subject. See generally Cary Fowler, *The Plant Patent Act of 1930: A Sociological History of its Creation*, 82 J. PAT. & TRADEMARK OFF. SOC'Y 621 (2000).

39. See *id.* at 625–26 (explaining a simple method for asexually reproducing a fruit tree).

40. *Id.* at 634, 636 (relating the lobbying efforts of nursery operators).

41. *Id.* at 633 (noting that members of the American Seed Trade Ass'n referred to themselves as “traders” of seed, but rarely referred to themselves as “breeders”).

42. *Id.* at 624–25.

43. See, e.g., Edwin M. Thomas, *Outline of the History of the United States Patent Office: Legislative Changes Since 1836*, 18 J. PAT. OFF. SOC'Y 103, 122 (1936) (chapter within special July 1936 centennial supplement) (asserting that the asexual reproduction limitation reflected reluctance to create “monopolies upon the cereal grains or any improvements thereof”).

44. Fowler, *supra* note 38, at 634–35.

protection afforded by the plant patent legislation. Future lobbying energies could be directed towards “get[ting] protection also for seed propagated plants which would be much easier after this fundamental principle was established.”⁴⁵ At least one early commentator shared the view that after the plant patent law had “begun to function smoothly, justice demands that it be extended to cover sexually reproduced varieties.”⁴⁶

It is tempting, in hindsight, to conclude that Congress made a carefully considered decision to direct asexually propagated plants into the patent system, leaving sexually propagated plants for later protection under *sui generis* variety protection.⁴⁷ But this plainly attributes to Congress a more coherent vision than the historical facts support. Plant variety protection in the United States owes its existence as much (or more) to expediency in the politics of plant patenting as to a clear-eyed normative vision of the appropriate range of protection for types of plant innovation.⁴⁸

As late as the 1960s, Congress was still considering the possibility of express legislation confirming that the patent regime extended to seed-grown plants.⁴⁹ In 1966, the President’s Commission on the Patent System recommended deleting from the patent statute all provisions relating to plants and providing “another form of protection,” on the grounds that the Commission “does not consider the patent system the proper vehicle for the protection of [plant] subject matter, regardless of whether the plants reproduce sexually or asexually.”⁵⁰ In subsequent hearings

45. 1909 PROC. OF THE AM. SEED TRADE ASS’N 66 (quoting Paul Stark of Stark Bros. Nurseries), *quoted in* Fowler, *supra* note 38, at 635.

46. Robert C. Cook, *Applying the Plant Patent Law*, 21 J. OF HEREDITY 361, 369 (1930), *reprinted in* Joseph Rossman, *Plant Patents*, 13 J. PAT. OFF. SOC’Y 7, 25 (1931) (observing that “this is the field most needing patent protection for no sexually reproduced variety can possibly be the result of casual hybridization, or a chance find, as are many varieties in the field covered by the present law”).

47. Indeed, the *J.E.M.* petitioners offered arguments consistent with this view. *See J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int’l, Inc.*, 534 U.S. 124, 130–36 (2001) (citing petitioners’ unsuccessful arguments); *see also supra* notes 8–9 and accompanying text (discussing *J.E.M.* in depth).

48. The plant patent legislation did contribute doctrinally to *sui generis* plant variety protection systems. The plant patent legislation introduced the notion of “distinctness,” later appropriated for use in *sui generis* systems in Germany and, ultimately, in the United States. *See infra* notes 64–66 and accompanying text.

49. *See For the Patent Law Revision Part 2: Hearings on S. 2, S. 1042, S. 1377, S. 1691, S. 2164, and S. 2597 Before the Subcomm. on Patents, Trademarks & Copyrights of the Senate Comm. on the Judiciary*, 90th Cong. 637, 639 (1968) [hereinafter *Patent Law Revision Part 2*].

50. PRESIDENT’S COMMISSION ON THE PATENT SYSTEM, “TO PROMOTE THE PROGRESS OF . . . USEFUL ARTS” IN AN AGE OF EXPLODING TECHNOLOGY 12–13 (1966) (Recommendation IV), *reprinted in General Revision of the Patent Laws Part 1: Hearings*

on legislation that would have implemented a variety of recommendations from the Commission Report, the Senate heard testimony on a proposed amendment that would have run precisely contrary to the Commission's recommendation.⁵¹ Proposed Amendment 511 to Senate Bill 1042 would have amended the asexual reproduction requirement to extend to reproduction "asexually or sexually,"⁵² thus expressly bringing seed-grown plants into the utility patent regime on equal terms with asexually propagated varieties.

Proponents of the amendment argued that when the Plant Patent Act was enacted in 1930, plant breeding "based on the scientific application of genetics, pathology, physiology, cytogenetics, and related disciplines, was still in its infancy."⁵³ However, plant breeding had evolved significantly, to a point where "the varietal identity of a sexually reproduced plant can be maintained intact over an extended period of time."⁵⁴

This argument could not overcome substantial opposition to the proposed amendment. Paul Stark, the nursery operator who had lobbied for passage of the Plant Patent Act, again played a role. He was opposed to the amendment but apparently would have supported a separate patent regime for seed-grown plants.⁵⁵ He took issue with the proposition that seed-grown plants could reliably be described and identified as discrete varieties, claiming that seed-grown plants exhibited inherent genetic variability.⁵⁶ His overriding concern, however, was preservation of the existing protection for asexually propagated plants.⁵⁷ He seemed especially concerned that the amended language would cause the entire regime of patents for plants to be scrutinized afresh, and possibly eliminated.⁵⁸

on *H.R. 5924, H.R. 13951, and Related Before Subcomm. No. 3 of the House Comm. on the Judiciary*, 90th Cong. 1, 70–71 (1968). The National Council of Commercial Plant Breeders speculated in a 1968 position paper that the Commission was unduly concerned with the Patent Office's failure to apply the nonobviousness standard in plant cases. National Council of Commercial Plant Breeders, *Legal Protection for New Plant Varieties Which Reproduce Sexually*, reprinted in *Patent Law Revision Part 2*, *supra* note 49, at 648–49 (alleging that the President's Commission failed to support its claims that new plant varieties "do not involve 'unobviousness'").

51. *Patent Law Revision Part 2*, *supra* note 49, at 639–48.

52. *Id.* at 639 (emphasis added).

53. *Id.* at 640 (statement of Floyd Ingersoll, President, American Seed Trade Ass'n).

54. *Id.*

55. *Id.* at 865 (asserting that the "best interest" of asexual plant producers would be in "much less danger" if seed-grown plants were included "in a separate additional section of the patent act").

56. *Id.* at 866.

57. *Id.* at 865.

58. *Id.* at 866 ("If whole Plant Patent Act failed as a result of the seed amendment

The 1968 proposal is plainly of significance to the ultimate introduction, only two years later, of a plant variety protection regime. It seems clear that opposition to the 1968 proposal stimulated efforts to attain protection via a *sui generis* plant variety system.⁵⁹

C. *Sui Generis Approach: "Variety" Protection*

In the United States, efforts to secure specialized trademark and patent protection for plants supply the backdrop for understanding the proposals that eventually matured into the PVPA. Outside the United States, national and international experiments with *sui generis* plant variety protection provided important antecedents for the U.S. PVPA, and supplied an additional rationale for U.S. adoption of plant variety protection: reciprocity.⁶⁰

Among the earliest predecessors of modern plant variety protection regimes, and perhaps the most important, was the 1953 German seed law.⁶¹ The 1953 Act shares several defining characteristics with many subsequent plant variety protection regimes: it articulated patent-like aspirations,⁶² but (1) exempted breeding activity from liability, thereby failing to provide patent-like scope of protection;⁶³ (2) relied on concepts of originality and

to S.1042, those interested in asexual reproduced plants in the present law would lose the benefit of a sound constructive law and the seedsmen would lose out by insisting on tying into a law in which their seed propagated plants did not qualify or fit and could not be enforced.") (original emphasis omitted). In view of subsequent Supreme Court developments, perhaps a more powerful argument would have been that such an amendment was unnecessary as seed-grown plants were already being embraced within 35 U.S.C. § 101 under a proper construction.

59. See, e.g., JACK RALPH KLOPPENBURG, JR., *FIRST THE SEED: THE POLITICAL ECONOMY OF PLANT BIOTECHNOLOGY, 1492–2000* 139 (1988) (linking the two events).

60. A full account of the international developments concerning plant variety protection is beyond the scope of this Article. The literature on plant variety rights in Europe and under international law is voluminous. Particularly rich is the literature on the European view of the proper demarcation between the utility patent system and the plant variety system. We synthesize this literature and present an analysis of future implications for U.S. law in Mark D. Janis & Jay P. Kesan, *Sui Generis Plant Variety Protection Under International and European Law* (forthcoming) (on file with the Authors).

61. For an English translation of the statutory text, see *Patents. Law Concerning Protection of the Seed of Cultivated Plants. Dated June 27, 1953*, 54 PAT. & TRADEMARK REV. 358–66 (1956) and 55 PAT. & TRADEMARK REV. 3–12 (1956) [hereinafter *1953 Act*]. A Dutch breeders' rights law appeared earlier. Heitz, *History of the UPOV*, *supra* note 19, at 28 (describing the 1941 Breeders Ordinance of the Netherlands, published July 5, 1942). The history of the 1953 German law is detailed in HANS NEUMEIER, *Sortenschutz und/oder Patentschutz für Pflanzenzüchtungen* (1990).

62. *1953 Act*, *supra* note 61, art. 1, at 358 (stating a purpose of "promoting the breeding of new high-class varieties of cultivated plants").

63. The Act afforded exclusive rights that were facially broad. *1953 Act*, *supra* note

stability as prerequisites for obtaining protection, eschewing critical patent prerequisites such as inventive step (nonobviousness);⁶⁴ and (3) left unsettled the issue of dual protection under variety regimes and patent regimes.⁶⁵

A variant of the German concept of plant variety rights subsequently became enshrined in international law in the form of the International Convention for the Protection of New Varieties of Plants (UPOV).⁶⁶ The 1961 UPOV text (1) expressly subjected plant variety rights to a breeders' exemption;⁶⁷

61, art. 6(1), at 360 (“[O]nly the holder or the variety protection license[e] . . . is entitled to produce commercially seed . . . of the protected variety for the purpose of marketing it, to offer such seed for sale or to put it into circulation.”). At the same time, the Act expressly limited these exclusive rights by an exemption for breeding new varieties. *Id.* (“Seed of the protected variety may be used for the purpose of breeding a new variety and the seed of the new variety may be used in accordance with Sentence 1 without the consent of the licensee.”).

64. Article 2(1) set forth the protection prerequisites: “Protection is granted in respect of any variety of cultivated plant which has been obtained by selective breeding provided that the variety is: (1) Original and stable. (2) Of agricultural or horticultural value. (3) Duly entered in the Register of Species.” 1953 Act, *supra* note 61, art. 2(1), at 358–59. The Act defined originality as a function of the *distinctness* of the variety’s “morphological or physiological characteristics,” a standard that may have been borrowed from U.S. plant patent law. *See Heitz, History of the UPOV, supra* note 19, at 27 (noting that the distinctness standard first appeared in Germany in a 1930 draft Seed and Seedlings law, contemporaneously with its appearance in the 1930 U.S. plant patent legislation).

65. The 1953 Act did not expressly operate to the exclusion of other intellectual property regimes, either trademark or patent—that is, it did not contain any express dual protection prohibition. However, under Article 68, rights acquired under other regimes could only be exercised to the extent that they did not vary from the provisions of the 1953 Act. *See Andre Heitz, The History of Plant Variety Protection, in THE FIRST TWENTY-FIVE YEARS OF THE INTERNATIONAL CONVENTION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS* 53, 75 (UPOV 1987) (discussing the German seed law and its impact on the UPOV Convention) [hereinafter Heitz, *Plant Variety Protection*]. According to one commentator, this meant that “cumulative protection was not actually prohibited, but simply made uninteresting.” *Id.*

66. The acronym indicates the French-language title of the treaty and its governing organization (Union Internationale pour la Protection des Obtentions Vegetales). Delegates from several European nations met in Paris in 1957, and again in 1961, to create an international treaty for plant variety protection. For a compilation of documents circulated at the 1957 and 1961 conferences at which the UPOV was conceived, see ACTES DES CONFERENCES INTERNATIONALES POUR LA PROTECTION DES OBTENTIONS VEGETALES 1957–1961 (Pub. No. 316) (UPOV 1974). A handful of European countries signed and ratified the 1961 text over the course of the 1960s and into the 1970s. Act of 1961, International Convention for the Protection of New Varieties of Plants (official English transl.) (1961), at <http://www.upov.org/eng/convntns/1961/act1961.htm> (last visited Sept. 16, 2002) [hereinafter 1961 UPOV]. The text was modified in 1972 and 1978, with further, extensive modifications in 1991. Act of 1991, International Convention for the Protection of New Varieties of Plants (official English transl.) (1991), at <http://www.upov.org/eng/convntns/1991/act1991.htm> (last visited Sept. 16, 2002) [hereinafter 1991 UPOV]. *See generally* Barry Greengrass, *The 1991 Act of the UPOV Convention*, 12 EUR. INTELL. PROP. REV. 466 (1991).

67. *See 1961 UPOV, supra* note 66, art. 5(3):

Authorization by the breeder or his successor in title shall not be required either

(2) adopted distinctness and stability as protection prerequisites;⁶⁸ and (3) sent conflicting signals regarding the dual protection issue.⁶⁹

for the utilization of the new variety as an initial source of variation for the purpose of creating other new varieties or for the marketing of such varieties. Such authorization shall be required, however, when the repeated use of the new variety is necessary for the commercial production of another variety.

The 1991 UPOV text reorganized and added to the exemptions, describing three “compulsory exceptions”: a non-commercial purposes exception, an experimental purposes exception, and a breeders’ exception. *1991 UPOV*, *supra* note 66, art. 15(1)(i)–(iii). The text also set forth an optional exception relating to farmers’ saved seed. *Id.* art. 15(2). For counterpart PVPA provisions, see *supra* notes 61–64 and accompanying text.

68. The UPOV text as ultimately adopted in 1961 required that the new variety be “clearly distinguishable” and “stable.” *1961 UPOV*, *supra* note 66, art. 6(1)(a), (d). The distinctness criterion has roots in U.S. plant patent law. See Heitz, *History of the UPOV*, *supra* note 19, at 37 (pointing out that at the first session of the Diplomatic Conference of the UPOV in 1957, the negotiators adopted the criterion of distinctness, borrowed from the 1930 U.S. plant patent legislation, as one of the central protection prerequisites).

The UPOV also added requirements for uniformity and novelty. See *1961 UPOV*, *supra* note 66, art. 6(1)(c) (requiring the variety to be “sufficiently homogeneous,” corresponding to modern requirements for “uniformity”); *id.* art. 6(1)(b) (imposing a novelty requirement with no grace-period).

The current incarnation of UPOV—the 1991 text—still relies upon novelty and the distinctness/uniformity/stability (“DUS”) criteria as the substantive conditions for protection. See *1991 UPOV*, *supra* note 66, art. 5(1). The 1991 text also contains separate definitions for some concepts, such as stability (defined as being satisfied when “relevant characteristics remain unchanged after repeated propagation”), *id.* art. 9, and uniformity (defined circularly as “sufficiently uniform in its relevant characteristics”), *id.* art. 8. See *infra* notes 93–95 and accompanying text for a discussion of U.S. PVPA counterpart provisions.

69. Reportedly, the delegates to the 1957 and 1961 UPOV conventions were inclined to leave the dual protection question to the member states. See, e.g., Heitz, *History of UPOV*, *supra* note 19, at 40 (“[T]hroughout the preparatory work, the consensus among the experts was that member States should be free to choose the form of protection deemed most appropriate to their national circumstances.”). Nonetheless, parallel negotiations over utility patent law harmonization arrived at a different solution: exclude plant varieties from the utility patent system, setting up *sui generis* variety protection as the exclusive form of protection for varieties. *Id.* at 33–34 & n.62 (quoting a 1960 report from the Rapporteur-General to the Committee of Experts on Patents and concluding that the Rapporteur viewed work on a *sui generis* plant variety scheme as incidental to the work on patent harmonization). Accordingly, perhaps as a product of the *realpolitik* of international patent law harmonization, the 1961 text of the UPOV included a double protection prohibition. *Id.* at 41. Under the relevant provision:

Each member State of the Union may recognise the right of the breeder provided for in this Convention by the grant either of a special title of protection or of a patent. Nevertheless, a member State of the Union whose national law admits of protection under both these forms may provide only one of them for one and the same botanical genus or species.

1961 UPOV, *supra* note 66, art. 2(1).

The politics of plant variety protection had shifted sufficiently by 1991 so that the UPOV dual protection prohibition was eliminated. See Greengrass, *supra* note 66, at 467 (explaining that under the 1991 UPOV text, members are free to decide whether to grant patents in addition to breeders’ rights, whether to require applicants to elect between the two regimes, and how to resolve any conflicts between the regimes).

Currently, the concept of plant variety rights is firmly established in world intellectual property law, for example in the TRIPS Agreement,⁷⁰ and at the Community level in Europe.⁷¹ By December 2001, UPOV membership had swelled to fifty countries.⁷²

Plant variety protection is also now a fixture of U.S. law, the U.S. PVPA having been enacted in 1970 after only the briefest of debate.⁷³ Like its European forebears, the PVPA expresses patent-like pretensions, specifying explicitly that the “intent of Congress” in providing PVPA protection is “to afford adequate encouragement for research, and for marketing when appropriate, to yield for the public the benefits of new varieties.”⁷⁴ Other pronouncements in the legislative history promised improvements in crop quality and even increases in private sector plant breeding jobs.⁷⁵

70. The TRIPS Agreement explicitly offers plant variety protection as an acceptable means for (and substitute for, at the state’s discretion) patent protection for plant varieties. See *supra* note 6 (citing the relevant provision). For a discussion, see S.K. Verma, *TRIPS and Plant Variety Protection in Developing Countries*, 6 EUR. INTELL. PROP. REV. 281 (1995). The literature on this topic is also becoming quite large.

71. National breeders’ rights regimes in various European countries now exist concurrently with a Community-wide plant variety rights regime. Council Regulation 2100/94, arts. 1–35 1994 OJ (L227/1). See P.A.C.E. VAN DER KOOLJ, INTRODUCTION TO THE EC REGULATION ON PLANT VARIETY PROTECTION (1997) (providing a detailed commentary). See generally Timothy Millett, *The Community System of Plant Variety Rights*, 24 EUR. L. REV. 231 (1999) (providing an excellent summary). Article 3 of Regulation 2100 provides that member states can continue to provide national breeders’ rights, but Article 92(1) proscribes protection for the same variety under both systems.

72. Press Release No. 49, UPOV, Republic of Korea Accedes to the UPOV Convention (Dec. 7, 2001), at 1 (indicating that Korea become the fiftieth UPOV member), at <http://www.upov.org/eng/prssrlls/49.htm> (last visited Sept. 16, 2002).

73. This is not to suggest that the concept of breeders’ rights went unnoticed in the United States prior to the introduction of the PVPA legislation. Serious discussions on the desirability of plant breeders’ rights in seed industry circles appeared at least as early as 1964. See generally Symposium, *Plant Breeders’ Rights*, THE CROP SCI. SOC’Y OF AM., (Mar. 1964) (recording the largely negative reaction among U.S. commentators to the concept of breeders’ rights).

More directly, Congress was not without help in drafting the bill. In 1969, the American Seed Trade Ass’n drafted a plant variety protection proposal, which became the basis for the PVPA. KLOPPENBURG, *supra* note 59, at 139.

74. 7 U.S.C. § 2581 (2000) (proceeding to defend the constitutionality of the PVPA on either Commerce Clause or Intellectual Property Clause grounds); see also *Plant Variety Protection Act: Hearing on S. 3070 Before the Subcomm. on Agric. Res. & Gen. Legis. of the Senate Comm. on Agric. & Forestry*, 91st Cong. 47 (1970) [hereinafter *1970 Senate Hearing*] (statement of Hon. Jack Miller, U.S. Senator, Iowa) (“The bill under your consideration is designed to encourage the development of new varieties of sexually reproduced plants by providing protection for those who breed and develop them, thus promoting the growth and well-being of agriculture.”). See *infra* Part IV for our empirical assessment of the performance of the PVPA vis-à-vis these patent-like ambitions.

75. *1970 Senate Hearing*, *supra* note 74, at 55 (statement of Allenby L. White, Chairman, Breeders’ Rights Study Committee, American Seed Trade Ass’n) (asserting that the PVPA would enhance the nation’s soybean crop by making available more and

In more recent PVPA legislative debates, the allegation that the PVPA provides patent-like incentives has become entrenched. For example, in hearings held in 1979–80,⁷⁶ defenders of the PVPA claimed that the PVPA was stimulating investments in research because the number of new varieties had increased for various crops since the passage of the PVPA.⁷⁷ During the mid-1990s hearings, one Senator asserted that one purpose for the PVPA is “to provide economic incentives for companies to undertake the costs and risks inherent in producing new varieties,”⁷⁸ and the Senator further testified that “[t]he success of the PVPA can be judged from the increase in private sector research . . . on plant breeding and the success of modern varieties.”⁷⁹

Also reflecting the progression of European thought, the PVPA emerged *not* because it was necessarily compelling on its own merits, or because it was an inevitable complement to existing patent protection,⁸⁰ but because it appeared to be the

better varieties); *see also id.* at 73 (statement of Dr. J.W. Neely, Vice President, Coker’s Pedigree Seed Co.) (same). On predictions of job increases, *see Plant Variety Protection: Hearing on H.R. 13424, H.R. 13631, H.R. 13658, H.R. 13901, H.R. 14332, and H.R. 15226 Before the Subcomm. on Dep’t Operations of the House Comm. on Agric.*, 91st Cong. 23 (1970) [hereinafter 1970 House Hearing] (statement of John S. Rogers, Secretary-Treasurer, National Council of Commercial Plant Breeders).

76. The hearings transcripts are voluminous. *See Plant Variety Protection Act Amendments: Hearings on H.R. 999 Before the Subcomm. on Dep’t Investigations, Oversight, & Res. of the House Comm. on Agric.*, 96th Cong. iii–v (1980) [hereinafter 1980 House Hearings]; *Plant Variety Protection Act: Hearings Before the Subcomm. on Agric. Res. & Gen. Legis. of the Senate Comm. on Agric., Nutrition, & Forestry*, 96th Cong. iii–iv (1980). Coincidentally, the Senate hearings were held the day after the Supreme Court handed down its decision in *Diamond v. Chakrabarty*, 477 U.S. 303, 312–14 (1980), which interpreted the Plant Patent Act and the PVPA as not foreclosing utility patent protection for genetically-engineered microorganisms.

77. 1980 House Hearings, *supra* note 76, at 13–14. Opponents responded that the PVPA was “increasing genetic uniformity, decreasing the preservation of germ plasm, increasing the price of seed, and encouraging the formation of large monopolistic seed companies,” rhetoric that one might associate with claims of overbroad utility patent protection. *Id.* at 10. *See supra* notes 62–64 for our critique of the argument that the PVPA provides patent-like *ex ante* innovation incentives.

78. *Plant Variety Protection Act Amendments of 1993: Hearing on S. 1406 Before the Subcomm. on Agric. Res., Conservation, Forestry, & Gen. Legis. of the Senate Comm. on Agric., Nutrition, & Forestry*, 103d Cong. 2 (1993) [hereinafter 1993 Senate Hearing].

79. *Id.* (citing statistics reflecting variety numbers for various major crops). We draw different conclusions from the evidence. *See discussion infra* Part IV.

For additional hearings on the mid-1990s proposals, *see Plant Variety Protection Act Amendments of 1993: Hearing on H.R. 2927 Before the Subcomm. on Dep’t Operations & Nutrition of the House Comm. on Agric.*, 103d Cong. (1994). The 1993–94 proposed changes are detailed in H.R. REP. No. 103–699 (1994), *reprinted in* 1994 U.S.C.C.A.N. 2423, 2423–39.

80. The report accompanying the Senate PVPA proposal did, however, attempt to justify the PVPA as a complement to existing patent regimes:

Under the patent law, patent protection is limited to those varieties of plants

politically least objectionable alternative when no consensus could be found for including plants explicitly in the utility patent statute. For example, an American Seed Trade Association (ASTA) position paper indicates that ASTA enthusiasm for proposing a *sui generis* system arose only after the failed effort in 1968 to amend the utility patent statute to recognize expressly the eligibility of sexually reproduced plants.⁸¹

Finally, PVPA proponents were aware of the international shift in favor of *sui generis* variety protection⁸² and undoubtedly looked towards the prospect of eventual U.S. accession to the UPOV,⁸³ which offered the benefits of national treatment⁸⁴ and a twelve-month right of priority.⁸⁵ Subsequent legislative debates characterized the need for national treatment as one of the purposes of enacting the PVPA,⁸⁶ and generally extolled the benefits of UPOV membership:

New plant varieties grown and developed in the United States are sold around the world, and foreign varieties are well-known in the United States. UPOV's aim is facilitating international agricultural trade. UPOV is a well-known international forum for the improvement of plant breeding. Without the availability of legal protection in foreign countries, which UPOV helps provide, breeders would hesitate or refuse to export their most valuable varieties.⁸⁷

which reproduce asexually No protection is available to those varieties of plants which reproduce sexually Thus, patent protection is not available with respect to new varieties of most of the economically important agricultural crops, such as cotton or soybeans.

S. REP. NO. 91-1246, at 3 (1970) (referring to the failed effort in the 1968 legislative proposal to broaden the patent statute to apply to sexually reproduced plants, as (apparently) another justification).

81. 1970 House Hearing, *supra* note 75, at 55-56.

82. *Id.* at 44 (noting the signing of the 1961 UPOV and describing ratification status); see also 1970 Senate Hearing, *supra* note 74, at 54 (statement of Allenby L. White, Chairman, Breeders' Rights Study Committee, American Seed Trade Ass'n):

That the principle of legal protection for plant varieties is a sound one seems beyond dispute. This belief . . . seems amply supported by [U.S. law] . . . , and by the fact that the western European nations, and other nations, have accepted this principle to the extent of entering into regional conventions and enacting national laws codifying the basic principle.

83. The first ratifications of the 1961 UPOV text occurred in the mid- to late-1960s. Heitz, *Plant Variety Protection*, *supra* note 65, at 89.

84. 1961 UPOV, *supra* note 66, art. 3. For the current UPOV provision, see 1991 UPOV, *supra* note 66, art. 4.

85. 1961 UPOV, *supra* note 66, art. 12(1). For the current UPOV provision, see 1991 UPOV, *supra* note 66, art. 11(1).

86. 1993 Senate Hearing, *supra* note 78, at 2 ("The PVPA was enacted in 1970 . . . to alleviate the competitive disadvantage that American agriculture and breeders face because European countries offered protection under UPOV.").

87. H.R. REP. NO. 96-1115, 96th Cong., at 7 (1980), *reprinted in* 1980 U.S.C.C.A.N.

Predictably, when the Clinton Administration finally submitted the 1991 text of the UPOV treaty to the Senate for ratification, the Administration emphasized the benefits of the PVPA as a reciprocity vehicle.⁸⁸ The United States did eventually join the UPOV, perhaps guaranteeing the continued existence of the U.S. PVPA in some form.⁸⁹

III. ESSENTIAL TRAITS OF THE MODERN PLANT VARIETY PROTECTION ACT

We next take up an analysis of the modern PVPA, considering in this section its essential doctrinal features, and turning in the next section to an empirical analysis. Like most other intellectual property regimes, the PVPA can be understood in simplified terms as a function of four variables: (1) protectability requirements; (2) scope of rights; (3) limitations on scope; and (4) term of protection.

A. *Protectability Requirements*

The protected subject matter in a PVP certificate is a discrete plant “variety”—that is, “a plant grouping within a single botanical taxon of the lowest known rank.”⁹⁰ Any sexually

6954, 6959.

88. See S. COMM. FOR FOREIGN RELATIONS, CONVENTION FOR THE PROTECTION OF PLANTS, S. EXEC. REP. NO. 105–15, at 2 (1998) (asserting that the PVPA was enacted “to promote the development of new varieties of agricultural grain crops, without which the U.S. agriculture business would be at a disadvantage compared to its counterpart in other countries with new plant variety protection policies”). The Report proceeds to elaborate on this rationale:

In non-UPOV countries, farmers freely sell harvested grain as seed to others, in effect competing with plant breeders by taking unfair and free advantage of their efforts in developing new plant varieties. This seriously erodes the ability of firms to recoup their investment in research and development of new advanced strains. This has a chilling effect on the prospects for developing advanced varieties and on research and development of new strains for local markets. Currently, many non-UPOV countries do not have access to the latest, most productive U.S. products.

Id. at 6.

89. The United States became a party to the 1978 UPOV in 1981 by Executive Agreement. See H.R. REP. NO. 103–699, at 9 (1994) (discussing proposed amendments in 1994 to the PVPA), reprinted in 1994 U.S.C.C.A.N. 2423, 2425. The United States signed the treaty in October 1991, but did not submit the treaty to the Senate for ratification until late 1995. CONVENTION FOR THE PROTECTION OF PLANTS, S. EXEC. REP. NO. 105–15, at 1 (1998). The United States deposited its instrument of ratification on January 22, 1999, and it became effective on February 22, 1999. See Press Release No. 35, UPOV, Ratification by the United States of America of the 1991 Act of the International Convention for the Protection of New Varieties of Plants (Jan. 22, 1999), at 1, at <http://www.upov.org/eng/prssrlss/35.htm> (last visited Sept. 16, 2002).

90. 7 U.S.C. § 2401(a)(9) (2000). Under the complete statutory definition:

reproduced variety is eligible for protection, provided that the other protectability prerequisites are satisfied.⁹¹

The PVPA imposes four substantive protectability requirements. First, the variety must be “new”—which, confusingly, is actually a statutory bar provision, not a first-to-invent style novelty provision—with a one-year grace period for most varieties.⁹² The remaining three requirements are the “DUS” criteria: the variety must be distinct,⁹³ uniform,⁹⁴ and stable.⁹⁵

The term “variety” means a plant grouping within a single botanical taxon of the lowest known rank, that, without regard to whether the conditions for plant variety protection are fully met, can be defined by the expression of the characteristics resulting from a given genotype or combination of genotypes, distinguished from any other plant grouping by the expression of at least one characteristic and considered as a unit with regard to the suitability of the plant grouping for being propagated unchanged. A variety may be represented by seed, transplants, plants, tubers, tissue culture plantlets, and other matter.

Id.

91. Specifically, the statutory language provides that “any sexually reproduced or tuber propagated plant variety (other than fungi or bacteria)” that have been reproduced qualify as eligible subject matter. 7 U.S.C. § 2402(a). Language that excluded F1 hybrids from protection was deleted in 1994. H.R. REP. No. 103–699 (1994), *reprinted in* 1994 U.S.C.C.A.N. 2423, 2427. Currently, 197 crop varieties are eligible subject matters for PVP certificates. See Plant Variety Protection Office, *Plant Variety Protected Crops*, at <http://www.ars-grin.gov/cgi-bin/npgs/html/pvplist.pl> (last visited July 17, 2002).

92. 7 U.S.C. § 2402(a)(1). The variety is required to be:

[N]ew, 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, by or with the consent of the breeder, or the successor in interest of the breeder, for purposes of exploitation of the variety—

(A) in the United States, more than 1 year prior to the date of filing; or

(B) in any area outside the United States—

(i) more than 4 years prior to the date of filing . . . ; or

(ii) in the case of a tree or vine, more than 6 years prior to the date of filing.

Id.

93. Distinctness is closest to a patent law novelty requirement. *See id.* § 2402(a)(2) (providing that a variety must be “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”). The PVPA also provides a further statutory definition of distinctness. *Id.* § 2401(b)(5) (“The distinctness of one variety from another may be based on one or more identifiable morphological, physiological, or other characteristics (including any characteristics evidenced by processing or product characteristics . . .) with respect to which a difference in genealogy may contribute evidence.”).

94. *Id.* § 2402(a)(3) (providing that a variety must be “uniform, in the sense that any variations are describable, predictable, and commercially acceptable”).

95. *Id.* § 2402(a)(4) (providing that a variety must be “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”).

The PVPA is not a registration system in form.⁹⁶ The PVPA requires pre-grant examination for compliance with the novelty and DUS requirements as well as formal matters.⁹⁷ Examination is undertaken by an examiner in the PVP Office, an arm of the U.S. Department of Agriculture (USDA).⁹⁸ When the Office refuses an application, applicants have a right of administrative appeal⁹⁹ and subsequent judicial appeal (either to federal district court or to the Federal Circuit).¹⁰⁰

An application for a PVP certificate must evidence compliance with the novelty and DUS requirements. That is, it must contain a “statement of the basis of the claim of the applicant that the variety is new”¹⁰¹ and a “description of the variety setting forth its distinctiveness, uniformity, and stability.”¹⁰²

The application must also be accompanied by a seed deposit,¹⁰³ along with a declaration “that a viable sample of basic seed (including any propagating material) necessary for propagation of the variety will be deposited and replenished periodically in a public repository.”¹⁰⁴ Despite the reference to a “public” repository, seed deposited in connection with a PVP

96. Whether it operates like a registration system in practice is a question we consider in Part IV *infra* (reporting empirical studies).

97. 7 U.S.C. § 2441; *see also id.* § 2442(a) (providing for examiner refusal of applications and applicant response). For relevant regulations, see 7 C.F.R. §§ 97.100(b), 97.105–108 (2002).

98. 7 U.S.C. § 2321 (detailing statutory authority for creation of the PVP Office).

99. *Id.* § 2443 (providing that appeal is to the USDA Secretary, who shall “seek the advice of the Plant Variety Protection Board”). The Board is comprised of “individuals who are experts in various areas of varietal development,” must include “farmer representation,” and must also be drawn “approximately equally from the private or seed industry sector and from the [public] sector.” *Id.* § 2327; *see also* 7 C.F.R. § 97.3. Unlike the Board of Patent Appeals and Interferences, the Plant Variety Protection Board operates in the manner of a “Board of Directors” dispensing policy guidance to the PVP Office. *See, e.g.*, Minutes: Plant Variety Protection Board Meeting (Nov. 14–15, 2001), at <http://www.ams.usda.gov/science/pvpo/brdmin.htm> (last visited July 12, 2002).

100. 7 U.S.C. § 2461 (authorizing appeal to the U.S. Court of Appeals for the Federal Circuit); *id.* § 2462 (authorizing civil action against the USDA Secretary in the District Court for the District of Columbia). The provisions are analogous to those found in the utility patent statute. *See* 35 U.S.C. §§ 141, 146 (2000).

101. 7 U.S.C. § 2422(3).

102. *Id.* § 2422(2). The description must also include a “description of the genealogy and breeding procedure, when known.” *Id.* The PVP Office may require amplification to the extent that the description is not “as complete as is reasonably possible.” *Id.*

103. 7 C.F.R. § 97.6(d)(1) (requiring deposit of “[a]t least 2,500 seeds”). The PVP Office then transfers the seeds to the Agricultural Research Service National Seed Storage Laboratory (NSSL) in Fort Collins, Colorado, for long-term storage. *See* Plant Variety Protection Office, *Current News and Information*, at <http://www.ams.usda.gov/science/PVPO/Current%20News/currentnews.htm> (last updated May 23, 2002).

104. 7 U.S.C. § 2422(4).

application is not accessible to the public.¹⁰⁵ The purpose of the deposit is to maintain viability of the variety.¹⁰⁶

Together, the requirements present at least two major points of contrast with the requirements of utility patent law. First, the PVP regime includes no counterpart to the utility patent requirement of nonobviousness.¹⁰⁷ This is a significant difference if one accepts that the nonobviousness criterion performs the principal work of discriminating between patent-worthy and patent-unworthy inventions.

Second, the PVP regime includes no adequacy of disclosure requirements comparable to those found in utility patent law's § 112.¹⁰⁸ Specifically, the PVPA does not require applicants to provide a teaching disclosure of the type that would be required under the § 112 enablement standard.¹⁰⁹ Likewise, the PVPA does not extract a disclosure that would satisfy the § 112 written description requirement.¹¹⁰

A duly issued PVP certificate is accorded a statutory presumption of validity.¹¹¹ To our knowledge, there is no authoritative ruling on whether clear and convincing evidence is required to overcome the presumption of validity.

B. *Scope of Rights*

Like the utility patent statute,¹¹² the PVPA defines a broad range of acts that qualify as infringement when performed without authority.¹¹³ Eschewing the utility patent infringement provision's

105. Plant Variety Protection Office: Frequently Asked Questions, at <http://www.ams.usda.gov/science/PVPO/FAQ/seedsamples.htm> (last visited July 27, 2002) (indicating that only the PVP Office has access to seed samples).

106. 1980 House Hearings, *supra* note 76, at 83.

107. See 35 U.S.C. § 103 (2000) (providing that obviousness is a bar to patentability); see also *supra* notes 92–95 and accompanying text (describing the four substantive protectability requirements of the PVP regime).

108. 35 U.S.C. § 112.

109. Thus, a PVP disclosure functions more like the specification of a design patent. The PVP imposes a lesser drafting burden on applicants than does a utility patent application. On the other hand, applicants lose the benefit of drafting a disclosure that enables beyond the specifically-disclosed embodiments. See *infra* Part III.B for a discussion of the scope of rights available under a PVP certificate.

110. Compliance with the § 112 written description requirement for biological subject matter is often affected by a deposit of a viable sample of the subject matter. While the PVPA also requires a seed deposit, the PVPA-compliant deposit need never be made available to the public. See *supra* note 105 and accompanying text. Thus, the PVPA-compliant deposit is not directed towards performing the function attributed to a § 112-compliant deposit: confirming that the applicant had possession of the claimed invention.

111. 7 U.S.C. § 2562(a) (2000).

112. 35 U.S.C. § 271(a).

113. 7 U.S.C. § 2541(a).

more elegant reference to unauthorized “making, using, offering to sell, selling, and importing,”¹¹⁴ the PVPA infringement provision supplies a multiplicity of terms proscribing unauthorized transfers, transactions, offers to transact, and the like.¹¹⁵ In addition, the PVPA proscribes unauthorized propagation of *protected* varieties,¹¹⁶ as well as unauthorized conditioning of a variety for the purposes of propagation.¹¹⁷ Finally, like the utility patent statute, the PVPA prohibits indirect infringement.¹¹⁸

Unlike the utility patent scheme, however, the PVPA affords the certificate holder practically no scope of protection beyond the “disclosed embodiment”—that is, the discrete variety that is the subject of the certificate.¹¹⁹ Although the PVPA does extend protection to any variety that is “essentially derived from a protected variety,”¹²⁰ this provision does not operate analogously to a patent law doctrine of equivalents. “Essentially derived variety” is a term of relatively circumscribed statutory definition¹²¹ and may do little more than account for minor

114. See 35 U.S.C. § 271(a).

115. See 7 U.S.C. § 2541(a). Section 2541(a)(1) is so broad as to extend to any “transfer of possession” of protected seed, but the Federal Circuit has narrowed the reach of this language. In *Delta & Pine Land Co. v. Sinkers Corp.*, the Federal Circuit held that “a passive third-party to a sales transaction, such as a ginner or a delinter, can be held liable for infringement under 7 U.S.C. § 2541(1),” but only if the third party has scienter, that is, knows or should reasonably know “that its unauthorized transfer of possession is an infringing transaction, i.e., that the sale is not exempt under [§] 2543.” 177 F.3d 1343, 1348–52 (Fed. Cir. 1999).

116. 7 U.S.C. § 2541(a)(3).

117. *Id.* § 2541(a)(7).

118. *Id.* § 2541(a)(10) (declaring it an infringement to “instigate or actively induce” any of the prohibited activities).

119. The PVPA regime thus strikes a bargain that differs greatly from the bargain struck under the utility patent statute. The utility patent statute offers potentially broad rights but extracts a high-quality disclosure that is remote from the prior art to the extent required by the nonobviousness criterion. In contrast, the PVPA offers extremely limited rights in exchange for a low-quality disclosure. See Mark D. Janis & Jay P. Kesan, *Designing an Optimal Intellectual Property System for Plants: A U.S. Supreme Court Debate*, 19 NATURE/BIOTECH. 981, 982 (2001) (setting forth this argument).

120. 7 U.S.C. § 2541(c)(1). Specifically, the PVPA provides that its infringement provisions extend to: “(1) any variety that is essentially derived from a protected variety, unless the protected variety is an essentially derived variety; (2) any variety that is not clearly distinguishable from a protected variety; [and] (3) any variety whose production requires the repeated use of a protected variety.” *Id.* § 2541(c)(1)–(3).

121. The term is defined very restrictively in the PVPA to extend only to two generations of derivation:

(A) In General

The term “essentially derived variety” means a variety that—

- (i) is predominantly derived from another variety (referred to in this paragraph as the “initial variety”) or from a variety that is predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety;

genetic reshuffling, which is expected whenever a variety is sexually propagated.¹²²

The legislative history also reflects an extremely narrow conception of the scope of rights under a PVP certificate. In the course of explaining the potential for infringement liability prior to the issuance of a PVP certificate,¹²³ the Senate Report on the PVPA legislation likens the PVPA to copyright law.¹²⁴ According to the Report, PVPA infringement “is expected almost never to be by independent work, but by willful reproduction starting from the protected variety itself.”¹²⁵

These rights must be enforced by civil action.¹²⁶ Federal district courts have original, exclusive jurisdiction over civil actions arising under the PVPA,¹²⁷ and the Court of Appeals for the Federal Circuit takes exclusive appellate jurisdiction over PVPA enforcement actions.¹²⁸

(ii) is clearly distinguishable from the initial variety; and

(iii) except for differences that result from the act of derivation, conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety.

(B) Methods

An essentially derived variety may be obtained by the selection of a natural or induced mutant or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing, transformation by genetic engineering, or other method.

Id. § 2401(a)(3).

The Supreme Court observed in *J.E.M.* that “[p]ractically, this means that hybrids created from protected plant varieties are also protected.” *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int’l, Inc.*, 534 U.S. 124, 140 (2001).

The “essentially derived variety” term first appeared in the 1991 UPOV text. *See 1991 UPOV*, *supra* note 66, art. 14(5); *see also* Greengrass, *supra* note 66, at 470–71 (explaining that the essentially derived variety provision was added to the 1991 UPOV text to remedy a loophole in the 1978 UPOV text in which an existing protected variety could be used as a source of initial variation, and a variety selected from it could be exploited without any obligation to the breeder of the protected variety, as long as the selection was clearly distinguishable from the protected variety by at least one important characteristic). It was incorporated into the U.S. PVPA in 1994. Plant Variety Protection Act Amendments of 1994, Pub. L. No. 103–341, 108 Stat. 3136, 3136–37 (codified as amended in scattered sections of 7 U.S.C.).

122. *See infra* note 146 and accompanying text for additional discussion. The essentially derived variety (EDV) criterion has not yet been litigated in the United States.

123. *See infra* note 126 and accompanying text for an explanation of the relevant statutory provision.

124. S. REP. NO. 91–1138, at 11 (1970) (observing that the PVPA infringement provision “more resembles copyright law than patent law”).

125. *Id.*

126. 7 U.S.C. § 2561 (providing a remedy by civil action for infringement under the PVPA).

127. 28 U.S.C. § 1338(a) (2000). For a rare example of a civil suit to enforce a PVP certificate, *see Heart Seed Co. v. Seeds, Inc.*, 4 U.S.P.Q.2d (BNA) 1234 (E.D. Wash. 1987), available at 1987 WL 41982.

128. 28 U.S.C. § 1295(a)(8) (granting exclusive jurisdiction over “an appeal under

C. Limitations on Rights

The exclusionary rights under the PVP regime are subject to a multiplicity of limitations and exceptions that extend well beyond those found in the utility patent regime. First, the PVPA includes an explicit statutory safe harbor provision shielding from infringement “any act done privately and for noncommercial purposes.”¹²⁹ In addition, the PVPA includes a separate provision exempting from infringement “[t]he use and reproduction of a protected variety for plant breeding or other bona fide research.”¹³⁰ This surely must reach “plant breeding” and “bona fide research,” even if carried out for purely commercial purposes. The presence of a research exemption separate from the noncommercial acts exemption may suggest that a competing plant breeder can appropriate a protected variety without authority, use it in a breeding program to develop new commercial varieties (that are not “essentially derived varieties”), and be free of any PVPA liability. Further still, the PVPA contains vexing language that prohibits the use of a protected variety in “producing” a hybrid or different variety, but allows the use of a protected variety in “developing” a hybrid or different variety.¹³¹

PVP rights are also limited by a statutory “saved seed” exemption, which allows farmers who grow protected varieties (obtained through authorized sources) to save the resulting seed for the production of a subsequent crop “for use on the farm.”¹³²

section 71 of the Plant Variety Protection Act (7 U.S.C. § 2461”).

129. 7 U.S.C. § 2541(e). By contrast, the U.S. utility patent scheme includes only a weak, common-law doctrine of non-commercial experimental use. *See Janis, Sustainable Agriculture, supra* note 7, at 105–17 (discussing the experimental use doctrine).

130. 7 U.S.C. § 2544.

131. *Id.* § 2541(a)(4). According to the PVPA legislative history:

Producing (as distinguished from developing) a hybrid or different variety means that use of the protected variety in producing the commercial class of seed of a variety constitutes infringement. Use of the protected variety as one source of germ plasm to breed a novel variety is permissible. As an example, the use of a protected inbred line of corn to cross it with another inbred line to produce a hybrid for commercial use, or production of a composite variety which is repeatedly reconstituted for commercial sale by intercrossing a set of seed lines one of which is protected, shall constitute an infringement. The use of such inbred line for hybridization with other materials to develop through breeding a novel inbred line as provided in section 114 [7 U.S.C. § 2544, the experimental use provision], however, does not constitute infringement; nor does the production of such new inbred line for the general market constitute infringement.

H.R. REP. NO. 91–1605, at 11 (1970).

132. 7 U.S.C. § 2543. The saved seed exemption also allows farmers to engage in “bona fide” sales of saved seed “for other than reproductive purposes.” *Id.*; *see also id.* § 2401(b)(1) (defining the concept of bona fide sale for “nonreproductive purposes”).

The saved seed exemption is one of the few PVPA provisions to have been the subject of extended litigation.¹³³

In addition to this extensive series of exemptions, PVP rights are also subject to a compulsory licensing requirement.¹³⁴ Two-year compulsory licenses, at a reasonable royalty, may be granted where the USDA Secretary declares that such a license would serve the public interest in maintaining an adequate food supply.¹³⁵

D. Term of Protection

A PVP certificate remains in force for twenty years (for most varieties)¹³⁶ or twenty-five years (for trees and vines),¹³⁷ measured from the date of certificate issuance. The PVPA also contains an “anti-submarine” provision authorizing the USDA Secretary to shorten a PVP certificate term to the extent that the applicant has delayed prosecution.¹³⁸

Concerning the prospect of collecting damages for infringements occurring prior to certificate issuance, the PVPA is

133. See *Agrow Seed Co. v. Winterboer*, 513 U.S. 179, 183–84 (1995) (refusing to extend the saved seed exemption to certain sales of “brown-bagged” seed).

134. Under 7 U.S.C. § 2404:

The Secretary may declare a protected variety open to use on a basis of equitable remuneration to the owner, not less than a reasonable royalty, when the Secretary determines that such declaration is necessary in order to insure an adequate supply of fiber, food, or feed in this country and that the owner is unwilling or unable to supply the public needs for the variety at a price which may reasonably be deemed fair. Such declaration may be, with or without limitation, with or without designation of what the remuneration is to be; and shall be subject to review as under section 2461 or 2462 . . . (any finding that the price is not reasonable being reviewable), and shall remain in effect not more than two years. In the event litigation is required to collect such remuneration, a higher rate may be allowed by the court.

7 U.S.C. § 2404.

135. *Id.*

136. *Id.* § 2483(b)(1).

137. *Id.* § 2483(b)(1)(B).

138. *Id.* § 2483(b)(2) (“If the certificate is not issued within three years from the effective filing date, the Secretary may shorten the term by the amount of delay in the prosecution of the application attributed by the Secretary to the applicant.”). Such a provision may have been deemed necessary because the PVP term is measured from certificate issuance, and PVP applications are maintained in confidence by the PVP Office until issuance. *Id.* § 2426 (specifying confidentiality but allowing for the USDA Secretary to publish specified information about pending applications); 7 C.F.R. § 97.19 (2002) (detailing information about pending applications that may be published, including the variety name and the applicant name).

However, given the relatively benign nature of the application prerequisites, it is not clear to us that very much prosecution occurs in a typical PVP application in any event, and so it would seem that there would be little opportunity for applicant delay even if applicants were so inclined. Nevertheless, our empirical analysis suggests that certificate issuance is surprisingly slow, and our anecdotal information suggests that the delay may be attributable to the PVP Office. See *infra* Part IV.A.

equivocal.¹³⁹ On one hand, acts occurring after the variety owner distributes the variety with notice can qualify as infringing acts under the PVPA's main infringement provision.¹⁴⁰ On the other hand, as to innocent infringers whose acts precede the date of PVP certificate issuance, courts have discretion to deny any damages.¹⁴¹ In other respects, however, the available remedies closely track those available under utility patent law.¹⁴² PVP certificates are also subject to a time-limited reexamination procedure,¹⁴³ and the statute also includes an interference provision.¹⁴⁴

IV. PLANT VARIETY PROTECTION: EMPIRICAL AND ANECDOTAL STUDIES

In this section, we present an empirical study of the acquisition, licensing, and enforcement of PVPA rights, analyzing data from the last thirty years of experience with this

139. This strikes us as a significant disappointment. One advantage typically attributed to low-level, porous intellectual property regimes is that they may confer rights quickly. Indeed, under the copyright system, rights vest upon fixation in a tangible medium. 17 U.S.C. § 102(a) (2000). By contrast, the PVPA does not definitively confer rights (in terms of a guaranteed damages award) until certificate issuance, and our empirical study demonstrates that applicants may await certificate issuance for surprisingly long times. *See infra* Part IV.A (providing an empirical analysis of PVP application pendency times); *see also supra* note 124 (citing legislative history comparing PVPA protection to copyright protection).

140. 7 U.S.C. § 2541(a).

141. *Id.* § 2564(d) (“As to infringement prior to, or resulting from a planting prior to, issuance of a certificate for the infringed variety, a court finding the infringer to have established innocent intentions, shall have discretion as to awarding damages.”).

142. *See id.* § 2561 (providing remedy by civil action); *id.* § 2563 (authorizing injunctive relief); *id.* § 2564(a) (authorizing award of damages with a reasonable royalty damages floor); *id.* § 2564(b) (authorizing damages enhancement up to three times the amount determined); *id.* § 2565 (authorizing award of attorney fees in “exceptional cases”); *id.* § 2566(a) (limiting damages to no more than six years prior to filing of the complaint, and also denying recovery for infringements “known to the owner more than one year” prior to filing of the complaint); *id.* § 2567 (imposing a marking requirement). For comparable provisions under U.S. utility patent law, see 35 U.S.C. §§ 281, 283–287 (2000). For a case analyzing damages under the PVPA, see *North Star Genetics, Ltd. v. Bata*, which awarded lost profits damages and doubled the award. No. CIV.A3-00-57, 2001 WL 1820380, at *4, *6 (D.N.D. Aug. 9, 2001).

143. *See* 7 U.S.C. § 2501(a) (providing that within five years of certificate issuance, any person may notify the USDA Secretary “in writing of facts which may have a bearing on the protectability of the variety,” and the Secretary has discretion to initiate a reexamination proceeding). In the ordinary course, no third party participation in such proceedings is contemplated. *See id.* § 2501(b) (providing that reexaminations proceed “pursuant to the same procedures and with the same rights as for original examinations”). However, the Secretary “may direct that the reexamination include such interparty proceedings as the Secretary shall establish” in cases where the reexamination petitioner “makes a prima facie showing of facts needing proof.” *Id.* § 2501(c).

The implementing regulations arguably exceed this statutory authorization by providing for the possibility of pre-grant protests as well as post-grant reexaminations. *See* 7 C.F.R. §§ 97.200–.201.

144. 7 U.S.C. § 2504 (stating that a PVP certificate owner may have a civil action against an owner of a certificate of the same variety).

legislatively-created, technology-specific, intellectual property regime.¹⁴⁵ Our results indicate that the PVPA rights are burdensome to acquire, and yet the expected post-issuance licensing and enforcement activities common to any intellectual property regime are virtually non-existent under this one.

A. *Empirical Analysis of the PVP Acquisition Process for Soybeans and Corn*

This empirical section analyzes data provided by the PVP Office concerning PVP certificates issued in the last thirty years for soybean and for corn (including all three corn varieties listed by the PVP Office: field corn, popcorn corn, and sweet corn). We selected soybeans and corn as the exemplars for our study because they allow us to make some interesting comparisons. Soybeans are naturally self-pollinating and thus, are readily subject to unauthorized replication. By contrast, corn is naturally cross-pollinating and is generally sold as a hybrid and thus, is less readily subject to unauthorized replication using ordinary growing techniques.

We constructed an original data set by extracting relevant information from all the PVP corn and soybean certificates issued over a thirty-year period from February 2, 1971, to May 3, 2002.¹⁴⁶ For the issued certificates, data regarding the issue dates and the numbers of pages in the PVP certificates are provided by the PVP Office.¹⁴⁷ The data extracted from each PVP certificate, if applicable, includes the following: the type of crop, the entity applying for the PVP certificate, the date of filing, the date of issuance, the current status of the PVP certificate and the date on which the status was determined, the years of protection, and the number of pages in the PVP certificate. Next, using this constructed data set, we generated descriptive statistics and summary statistics, performed statistical survival analysis (for duration), and, finally, analyzed the results.

The objective of this part of the study is to understand specific details regarding the PVP acquisition process, such as the types and distribution of the different dispositions of PVP

145. See *infra* Part IV.A for an explanation of the methodology used in the empirical study.

146. Information on these certificates can be obtained through the PVP Office website, at <http://www.ars-grin.gov/cgi-bin/npgs/html/pvplist.pl> (last visited Sept. 21, 2002).

147. *E.g.*, Plant Variety Protection Office, *Plant Variety Protection Number: 7100016*, at <http://www.ars-grin.gov/cgi-bin/npgs/html/showpvp.pl?7100016> (last visited July 19, 2002).

applications and the issuing and pending durations for examination. In addition, we provide a brief, preliminary analysis of the corn and soybean industries by analyzing the number and character of PVP applicants for soybean and corn and the size of their PVP portfolios, including both issued certificates and pending applications. We investigate all these and other related issues by using descriptive statistics, generating summary statistics, and providing graphical representations of the data.

1. *Soybean PVPs.* The filing dates of the applications for soybean PVP certificates considered in this study range from February 2, 1971, to May 3, 2002. The applications have eight possible outcomes during and after PVP prosecution. An application may be abandoned, ineligible, withdrawn, or pending. Even if a certificate is issued, its issuee may decide to abandon, to withdraw, or not to renew the certificate. The vast majority of PVP applications survive the examination process.¹⁴⁸ Nevertheless, a significant percentage (about 12 to 15%) of the applications are either abandoned or withdrawn by the applicants during the course of prosecution.¹⁴⁹

As of May 3, 2002, 1343 applications for soybean PVP certificates had been filed. The status of the dispositions of these soybean PVP applications and issued certificates is summarized in Figure 1 and Table 1. Excluding pending applications, over 85% of the soybean applications successfully issued as PVP certificates from February 2, 1971, to May 3, 2002. Approximately 13% of the applications were ineligible, abandoned, or withdrawn at various stages in the course of examination, and 11% of the applications are currently being examined by the PVP Office.

148. See *infra* Figures 1–2 (exhibiting the proportions of applications resulting in issued PVP certificates for soybeans and corn, respectively).

149. See *infra* Figures 1–2 (exhibiting the proportions of applications for PVP certificates abandoned and withdrawn for soybeans and corn, respectively).

Figure 1: Disposition of Applications for PVP Certificates for Soybeans

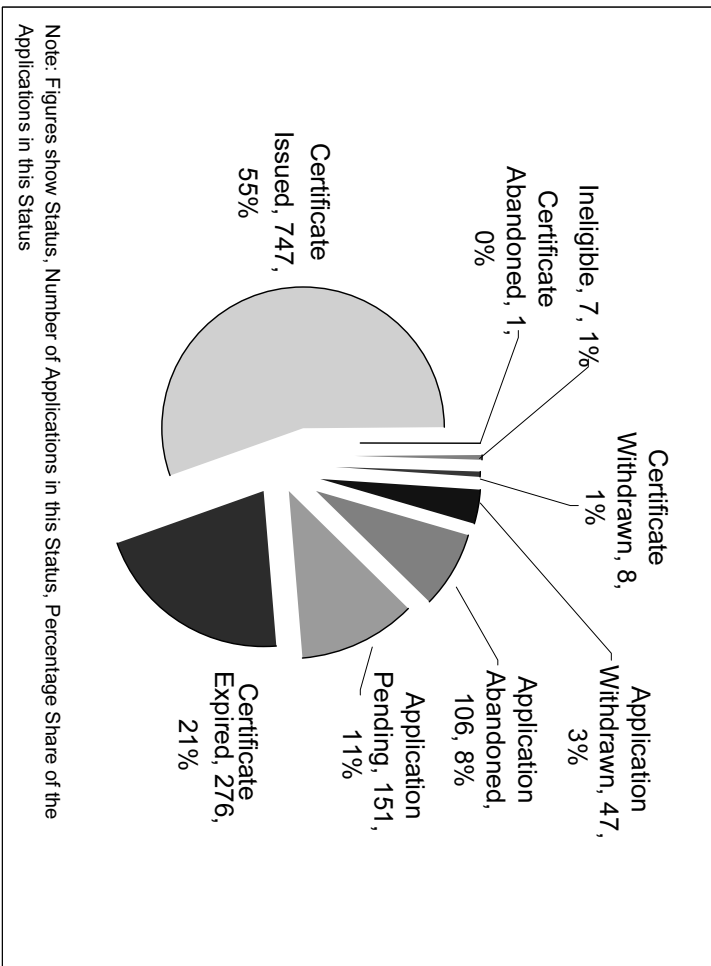


TABLE 1 DISPOSITION OF APPLICATIONS FOR PVP CERTIFICATES FOR SOYBEANS	
Status	Counts
Certificate Abandoned	1
Ineligible	7
Certificate Withdrawn	8
Application Withdrawn	47
Application Abandoned	106
Application Pending	151
Certificate Expired	276
Certificate Issued	747
Total	1343

The soybean PVP applicants consist of various organizations; 109 companies, universities, and research institutes have applied for soybean PVP certificates between February 2, 1971, and May 3, 2002. Major issuers of soybean PVP certificates with 100 or more certificates are: Pioneer Hi-Bred International, Inc. (206); Novartis Seeds, Inc. (100); and Asgrow Seed Co. (100). Thus, more than half of the issued certificates are owned by these three companies. Novartis Seeds, Inc. and Asgrow Seed Co. own a quarter each, and Pioneer Hi-Bred International, Inc. owns more than two quarters of the 55% of soybean certificates issued. The rest of the certificates are almost evenly distributed among eleven companies, universities, and research institutes. About 18% of the soybean PVP certificates are owned by organizations, each of whom owns less than ten PVP certificates.

2. *Corn PVPs.* The filing dates of the applications for corn PVP certificates considered in this study range from April 4, 1972, to May 3, 2002.¹⁵⁰ There have been 904 applications

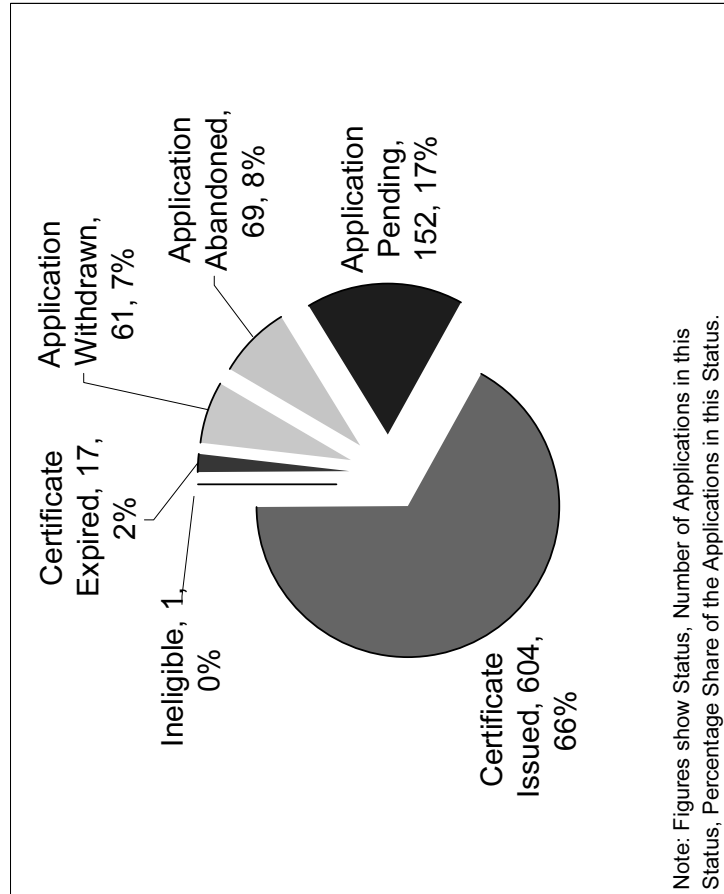
150. See Plant Variety Protection Office, *Plant Variety Protected Crops* (field corn, popcorn corn, and sweet corn crops), at <http://www.ars-grin.gov/cgi-bin/npgs/html/pvplist.pl> (last visited July 17, 2002).

filed by fifty-two companies, universities, and research institutes.¹⁵¹ The issued certificates provide dates of issuance and the numbers of pages in the certificates. As with the soybean data, applications and certificates may be abandoned, ineligible, or withdrawn. The status of the dispositions of corn PVP certificates as of May 3, 2002, is shown in Table 2 and Figure 2. Excluding pending applications, over 80% of the applications successfully issued as PVP certificates. Unlike the soybean PVP certificates, none of the corn PVP certificates had been withdrawn. About 15% of the applications had been withdrawn or abandoned as of the time of our study, while 17% of the applications were still pending before the PVP Office.

TABLE 2 DISPOSITION OF APPLICATIONS FOR PVP CERTIFICATES FOR CORN	
Status	Counts
Ineligible	1
Certificate Expired	17
Application Withdrawn	61
Application Abandoned	69
Application Pending	152
Certificate Issued	604
Total	904

151. See Table 2 and Figure 2 *infra* (showing the disposition of applications for PVP certificates for corn).

Figure 2: Disposition of Applications for PVP Certificates for Corn



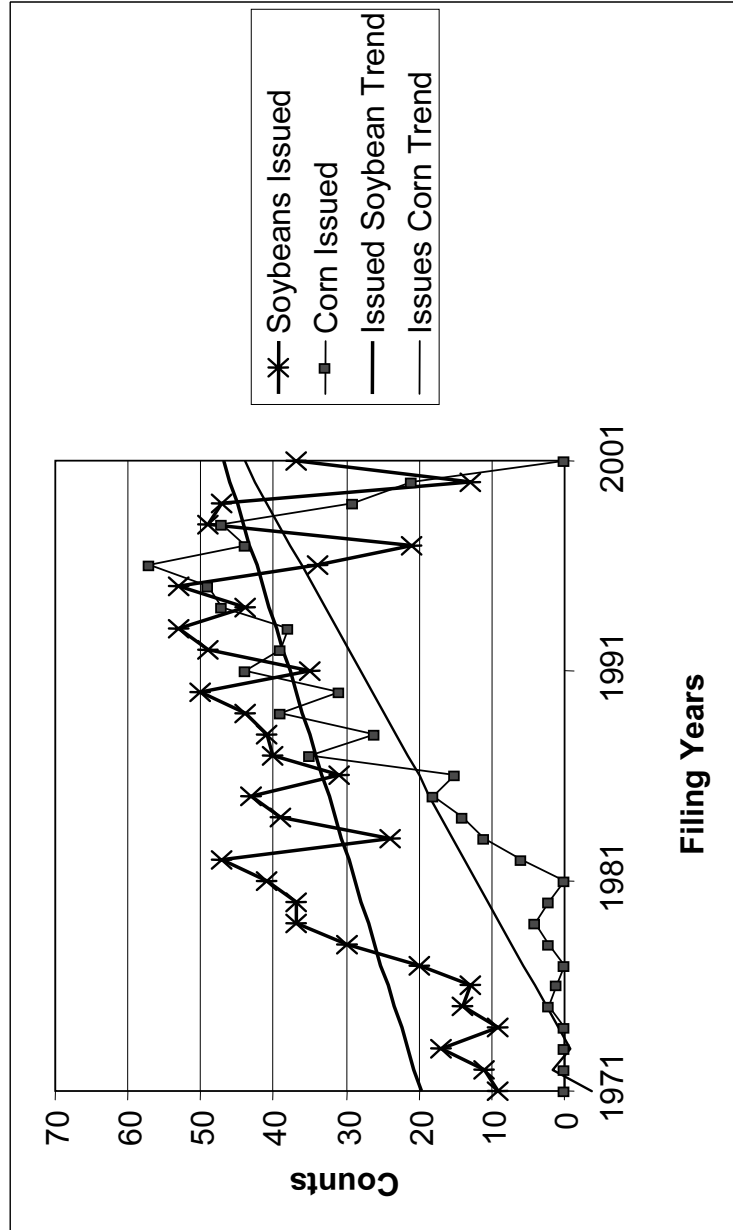
The major corn PVP certificate issuees are the following four companies: Pioneer Hi-Bred International, Inc.; Holden's Foundation Seeds L.L.C.; DEKALB Genetics Corp.; and Novartis Seeds, Inc. More than 60% of the effective corn PVP certificates belong to two companies: Pioneer Hi-Bred International, Inc., and Holden's Foundation Seeds L.L.C. Pioneer, however, overwhelmingly dominates the others in the number of corn PVP certificates obtained. Another 12% of the corn certificates are equally shared by DEKALB Genetics Corp. and Novartis Seeds, Inc., followed by DEKALB Plant Genetics, holding 4% of the certificates. The rest of the corn PVP certificates are almost equally distributed among five companies and research institutes, followed by another twenty-two companies and research institutes, each of whom owns less than ten PVP certificates.

Pending applications constitute 17% (152 applications) of the total corn PVP applications, as of May 3, 2002.¹⁵² Almost 50% of the pending applications have been filed by DEKALB Genetics Corp. Pioneer Hi-Bred International, Inc. and Holden's Foundation Seeds L.L.C. follow with 20% and 14% of the pending applications, respectively. The remaining 19% of pending applications are shared by several companies, each of whom has less than ten pending applications.

The total number of PVP applications filed has increased from around 100 applications per year in the 1970s to a high of about 440 applications in 1999. Since 1999, the total number of PVP applications has decreased steadily, and in 2001, 292 new applications were received by the PVP Office. In 2001, the PVP Office completed examination of 743 files, and by the end of 2001, there were 1043 total pending applications. As shown in Figure 3, the number of soybean and corn applications that were issued track this overall trend of increasing number of PVP applications from 1971 to the mid-1990s, with a significant decline in the number of applications since 1999.

152. See *supra* Table 2 and Figure 2.

Figure 3: Trends in the Number of PVP Corn & Soybean Applications Issued



3. *PVP Pendency Durations for Soybeans and Corn.* Once a PVP certificate is issued, the PVP Office records the issue date and the number of pages of the certificate in addition to the filing date of the application.¹⁵³ We now examine the duration between the filing dates and the issue dates (referred to as the issuing duration), along with the duration between the filing dates and the end date of this data set, May 3, 2002 (referred to as the pending duration). One objective of this analysis is to investigate whether the PVP Office's efforts to simplify the PVP acquisition process have led to shorter waiting periods for obtaining certificates of protection, at least for soybean and corn PVP applications. A comparative figure of merit to keep in mind is two to three years (730 days to 1095 days) because utility patents generally require two to three years of prosecution in the U.S. Patent and Trademark Office. Issuing durations are further examined in relation to the numbers of pages in the issued PVP certificates because the numbers of pages may be a meaningful indication of the complexity of the PVP application, which would then be reflected in the speed of the PVP application review process employed by the PVP Office.

An analysis of the soybean PVP certificate data reveals the following summary statistics of the minimum (min), the maximum (max), the mean, the mode, and the standard deviation (std. dev.) for issuing durations in days, pending durations in days, and numbers of pages, as tabulated in Table 3. Table 3 shows that the issuing durations have a wide range and their distribution is skewed to the left. The mean issuing duration is slightly less than 600 days, indicating that on average about one and a half years of examination was required for soybean PVP certificates issued before May 3, 2002.

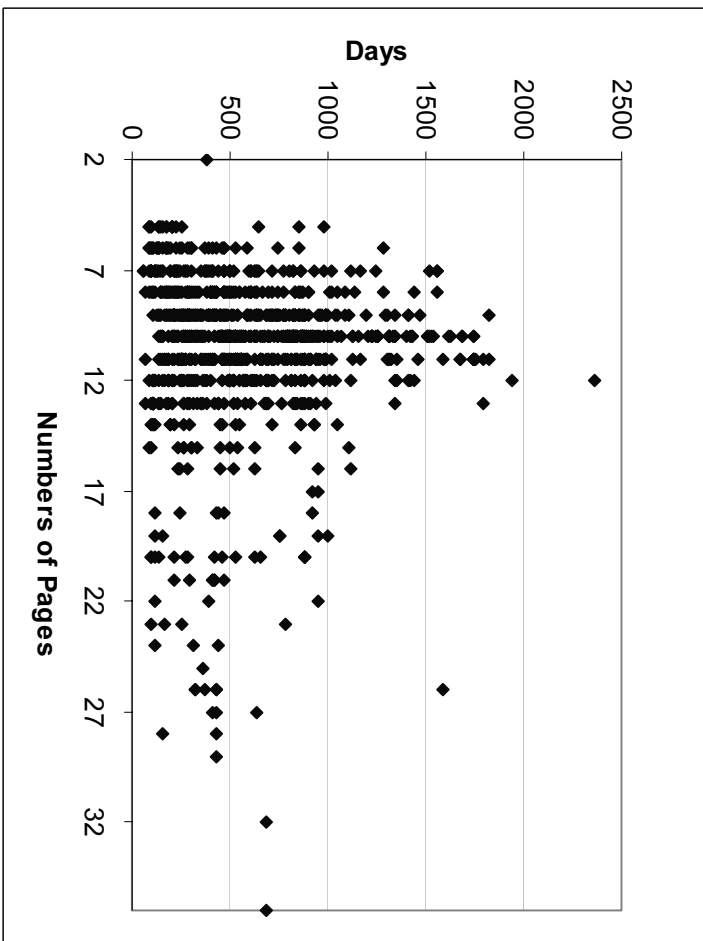
153. *E.g.*, Plant Variety Protection Office, *Plant Variety Protection Number: 7100016*, at <http://www.ars-grin.gov/cgi-bin/npgs/html/showpvp.pl?7100016> (last visited July 19, 2002).

TABLE 3 SUMMARY STATISTICS OF DURATION DATA AND TOTAL NUMBER OF PAGES FOR SOYBEAN PVP CERTIFICATES			
	Issuing Durations in Days	Pending Durations in Days	Numbers of Pages
Min	58	74	2
Max	2359	2237	36
Mean	577.72	1196.35	10.60
Mode	502	1802	10
Std. Dev.	374.08	682.75	3.65

Pending durations have as wide a range as the issuing durations for soybean PVP certificates, with an average pending duration of almost 1200 days. Further, the distribution of pending durations is skewed to the right, instead of to the left as seen for the issuing durations. This result indicates that, as of May 3, 2002, the duration of the examination process for soybean applications has been increasing significantly. The numbers of pages in the issued soybean PVP certificates show a symmetric distribution, and most of them are within a range of 7 to 14 pages.

Figure 4 reveals the correlation between the issuing durations and the numbers of pages in the soybean PVP certificates. This figure depicts a cluster of issuing durations for certificates between 7 and 13 pages. The other issuing durations are evenly dispersed among the rest of the numbers of pages both below 7 pages and above 13 pages. This result indicates a weak correlation between the issuing durations and the numbers of pages in the PVP certificates for soybeans. This indication is confirmed by their low Pearson's correlation coefficient, which was found to be 0.004119.

Figure 4: Issuing Durations as a Function of Total Number of Pages for Soybean PVP Certificates

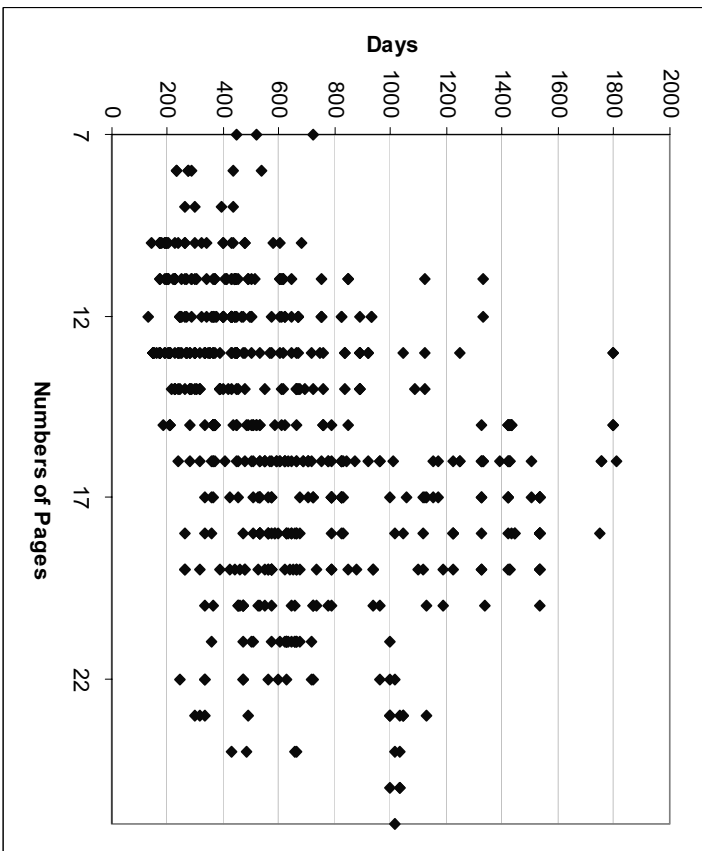


An analysis of the corn PVP certificate data indicates the following summary statistics regarding issuing durations in days, pending durations in days, and numbers of pages in the certificates, as tabulated in Table 4. Issuing durations for corn PVP certificates vary in a wide range, similar to what was seen with soybean PVP certificates. Issuing durations for corn PVP certificates are, however, a subset of those for soybean PVP certificates, as the minimum issuing durations for corn PVP certificates are longer, and the maximum issuing durations shorter, than those for soybean PVP certificates. The distribution of the issuing durations for corn PVP certificates is skewed to the right, which is the opposite of what was seen for soybean PVP certificates. Because the mean of the issuing durations for corn PVP certificates is around 625 days and the mode is above 1500 days, streamlining the PVP examination process for corn varieties does not appear to have succeeded in speeding up the overall issuing duration.

TABLE 4 SUMMARY STATISTICS OF DURATION DATA AND TOTAL NUMBER OF PAGES FOR CORN PVP CERTIFICATES			
	Issuing Durations in Days	Pending Durations in Days	Numbers of Pages
Min	134	39	7
Max	1810	1506	26
Mean	625	713.45	15
Mode	1536	1439	13
Std. Dev.	376.87	460.35	3.59

Pending durations for applications for corn PVP certificates as of May 3, 2002, are shorter than those for soybean PVP certificates. The minimum and maximum pending durations for applications for corn PVP certificates are shorter than those for soybean PVP certificates. The mean of the pending durations for the corn PVP applications is slightly less than 714 days, while the mode is above 1400 days. The distribution of the pending durations is also skewed to the right, as were the pending applications for soybean PVP certificates.

Figure 5: Issuing Durations as a Function of Total Number of Pages for Corn PVP Certificates



The total numbers of pages in the corn PVP certificates exhibit almost a symmetric distribution and indicate that most certificates have total numbers of pages ranging from 12 to 19. A correlation between the issuing durations and numbers of pages for corn PVP certificates is shown in Figure 5. This figure depicts a concentration of issuing durations for applications between 10 to 22 pages, and fewer dispersed issuing durations both less than 10 pages and greater than 22 pages. This indicates a weak correlation between the issuing durations and the total numbers of pages for corn PVP certificates. This implication is consistent with a Pearson's correlation coefficient of 0.385014. As seen for the soybean PVP certificates, these data do not support including the total number of pages in a PVP certificate as a statistically significant covariate in a model for the analysis of issuing and pending durations for PVP certificates.

Figure 6 and Figure 7 show the median and mean issuing durations for soybeans and corn PVP certificates, respectively, as a function of their year of issuance. The overall trends for both corn and soybean appear to track each other. The issuing durations increased steadily from the early 1970s to the mid-1990s and then, as the number of applications decreased in the recent past, the issuing durations appear to have caught up and started decreasing in the last couple of years. These data suggest that the issuing duration may be systematically skewed year to year based on the overall workload at the PVP Office in terms of the number of new PVP applications filed each year. In addition, for each year, the mean and median issuing durations for both corn and soybean are quite close to each other, suggesting a normal distribution of issuing durations for any particular year.

We can also estimate how long applications for soybean or corn PVP certificates are likely to remain in examination in the PVP Office. Assuming that the sample of durations in this study is reasonably homogenous—that is, individual effects of the applicants are negligible—Figure 8 shows the results from a computation of the Kaplan-Meier survival (duration) estimators for soybean and corn. The y-axis is a probability of obtaining a particular duration for corn and soybean, and the x-axis is the duration in days. From Figure 8, we can see that there is a higher probability of obtaining a corn PVP certificate in less than 1000 days (approximately three years) compared to a soybean PVP certificate. The probability of a soybean PVP certificate taking more than 1000 days in examination is also higher than that of a corn PVP certificate. Moreover, soybean PVPs tend to have longer issuing and pending durations than those

Figure 6: Trends in Median and Mean Issuing Durations for PVP Soybean Certificates

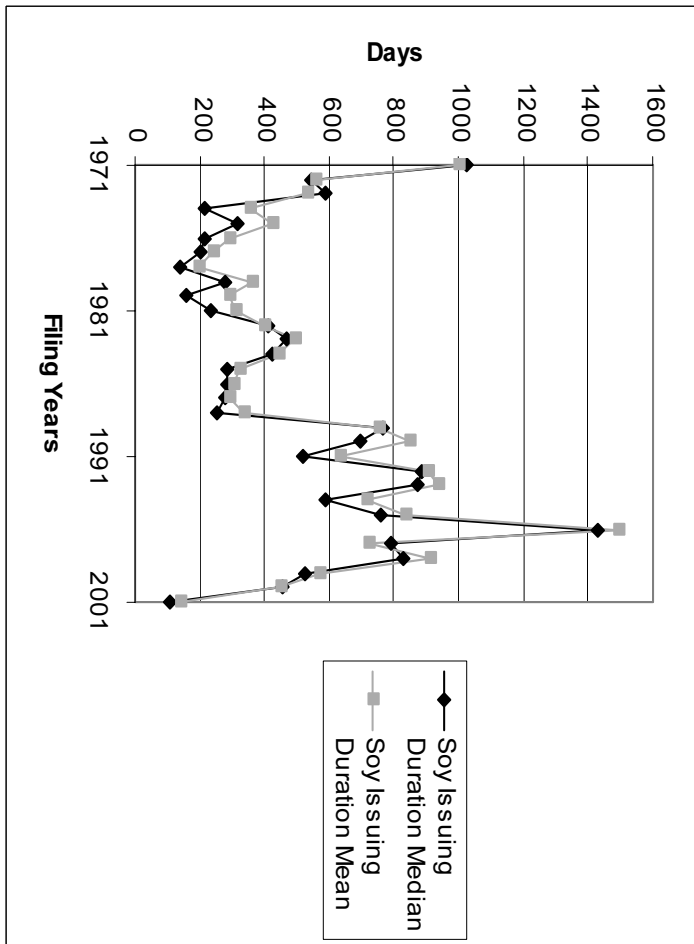


Figure 7: Trends in Median and Mean Issuing Durations for PVP Corn Certificates

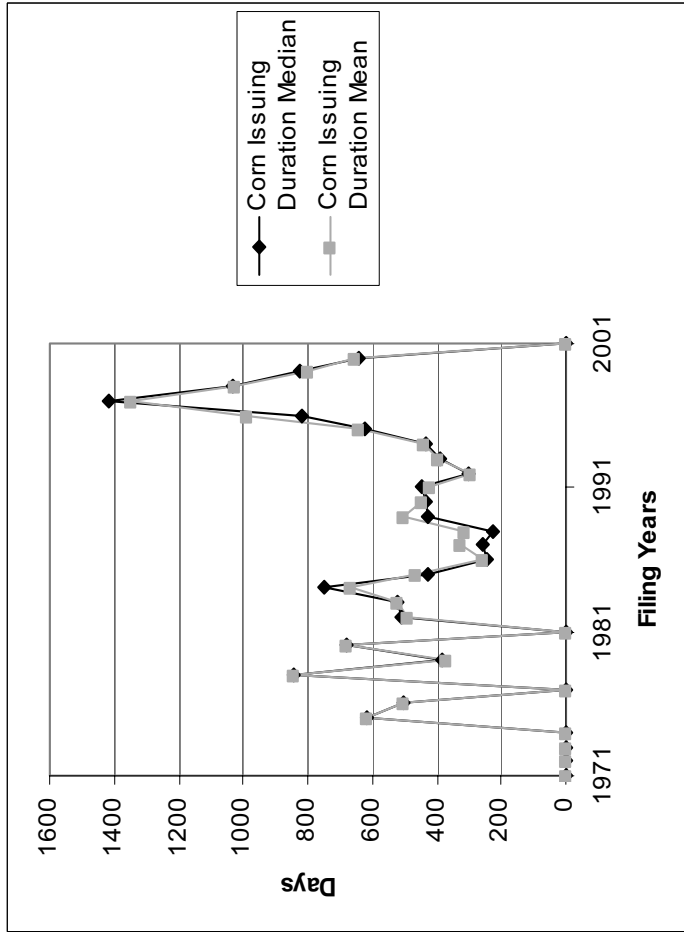
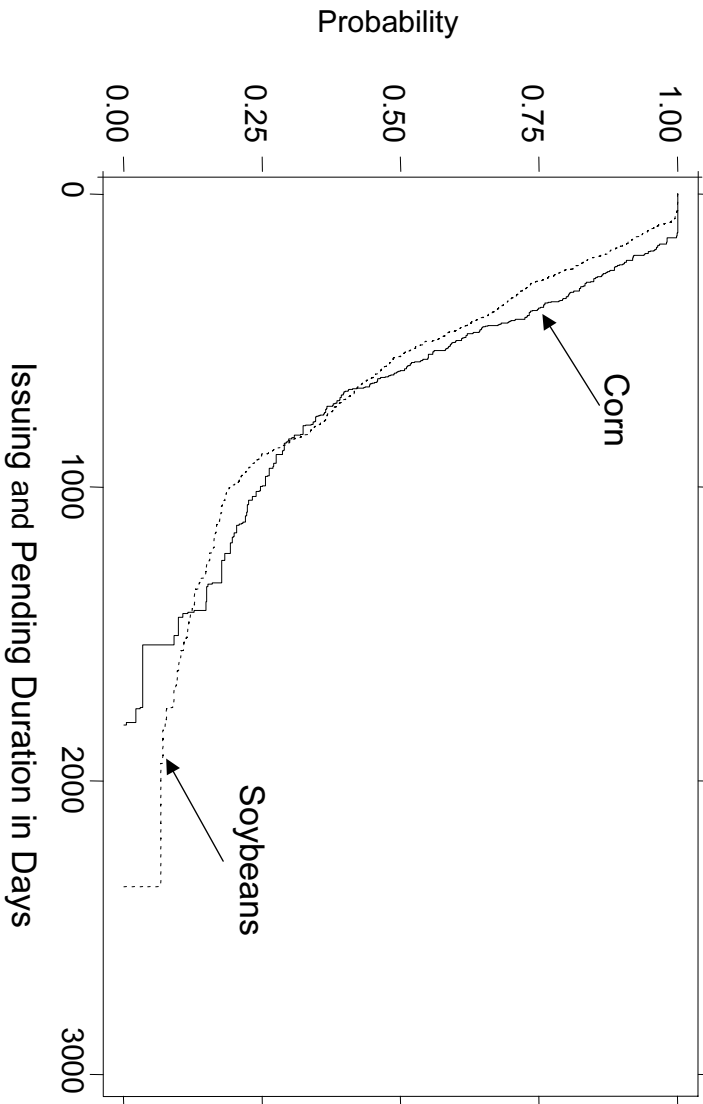


Figure 8: Kaplan-Meier Survival (Duration) Estimators for PVP Soybean and Corn Applications



of corn.¹⁵⁴ In sum, soybean PVP certificates tend to take longer to obtain compared to corn PVP certificates. The reasons for this difference need to be explored further.

B. *The Post-Issuance PVP Picture*

In the last section, we saw that although the PVP examination process is most likely to result in the applicant receiving a PVP certificate, it is nonetheless laborious, time-consuming, and not inexpensive. In this section, we study the post-issuance activities of licensing and enforcement of PVP certificates.

1. *PVP Licensing.* We have conducted extensive interviews with a number of practicing attorneys in private law firms representing agricultural biotechnology companies and with in-house intellectual property counsel at DuPont/Pioneer to determine the magnitude and extent of PVP licensing activities.¹⁵⁵ The unanimous consensus among our interviewees is that the only licensing of plant varieties that is protected solely by PVP certificates is standard “bag-tag” licensing that accompanies routine sales of seed to growers.¹⁵⁶ For example, DuPont/Pioneer has filed 410 PVP applications in the five-year period from 1997 to 2001, and in the same period, it has been granted 381 PVP certificates.¹⁵⁷ From the previous section, it is clear that Pioneer has a very large portfolio of PVP certificates, but it has neither licensed nor initiated infringement lawsuits based solely on PVP certificates.¹⁵⁸

This PVP picture is in sharp contrast to the utility patent picture for protecting plant innovation. In the same five-year period from 1997 to 2001, DuPont/Pioneer filed 1203 utility patent applications and obtained 540 patents.¹⁵⁹ It has also signed numerous licensing agreements with different entities, ranging from universities and small companies to other large

154. *See supra* Tables 3–4.

155. Telephone and In-Person Interviews with Peter Goss, Herb Jervis, Bob Giaquinta, Steve Callistein, Ed Sease, and Bruce Morrissey (Apr. & May 2002) (specific information on file with the Authors).

156. *Id.* The “bag-tag” licenses place a number of restrictions on the growers’ use of the seed. Thus, seeds are not the subject of any unconditional sale, allowing seed companies to assert that the patent law exhaustion doctrine should not be triggered.

157. Telephone Interviews with Herb Jervis, Chief Intellectual Property Counsel, DuPont/Pioneer (Apr. & May 2002).

158. *Id.*

159. *Id.*

peer organizations, based on its patented technologies.¹⁶⁰ In addition, DuPont/Pioneer has initiated fifteen patent lawsuits in the period from 1997 to 2001 and, in the same period, has also been sued for patent infringement eleven times.¹⁶¹

The so-called “bag-tag” or “seed-wrap” licenses constitute the only example of PVP licensing that we have found in this study typically restrict the grower in the use and reuse of the subject seeds. A representative example of the key licensing restrictions in a bag-tag license is shown below:

USE RESTRICTIONS AND LIMITED LICENSES FOR HYBRID SEED: One or more of the parental lines used in producing this product and this product are proprietary to ABC, Inc. (“ABC”). Parental lines and this product may be U.S. Protected Varieties (see tag for additional information), and may also be protected under the laws of other countries. Export or transfer of possession may be prohibited. Purchaser agrees that this purchase is directed to, and ABC intends to supply, only hybrid seed. Purchaser agrees that it is not acquiring any rights from ABC to use any parental line that may be unintentionally contained herein for purposes other than production of forage, or grain for feeding or processing. One or more of the parental lines used in producing this product may constitute a trade secret. Purchaser agrees that it is granted a limited license under ABC’s trade secret rights to use any parental seed that might be unintentionally contained herein only for purposes of producing forage, or grain for feeding or processing. Purchaser further agrees, that under these trade secret rights, any parental seed, and the genetic material contained herein, is confidential and must be maintained in confidence. If the tag indicates this product or the parental lines used in producing this product are protected under one or more U.S. patents, Purchaser agrees that it is granted a limited license thereunder only to produce forage, or grain for feeding or processing. Resale of this seed or supply of saved seed to anyone, including Purchaser, for planting is strictly prohibited under this license. Use of this product, or the parental lines used in producing this product, for use in development or breeding also is strictly prohibited. All uses outside of the United States are prohibited to the extent they result in

160. Interviews with Bob Giaquinta, Director Technology Transfer & Licensing/Intellectual Property Management, DuPont/Pioneer; Bruce Morrissey, Corporate Counsel, Dupont/Pioneer; and Herb Jervis, Chief Intellectual Property Counsel, DuPont/Pioneer (Apr. & May 2002).

161. Telephone Interviews with Herb Jervis, Chief Intellectual Property Counsel, DuPont/Pioneer (Apr. & May 2002).

infringement of U.S. patents. For availability of other licenses contact ABC.

Note that PVP protection is not necessary to enter into these bag-tag license agreements. It is possible to establish these license agreements based on trade secret or utility patent protection for the plant varieties being traded. Recent court decisions suggest that key provisions of these agreements will be upheld against a variety of federal law challenges.¹⁶²

2. *PVP Enforcement Actions.* On the enforcement front, there are few reported decisions involving infringement of PVP rights in the last thirty years.¹⁶³ Most of the successful enforcements of PVP rights have been against farmers who have been guilty of “brown-bagging” seeds of PVP-protected plant varieties, thereby going beyond the crop exemption in the PVPA.¹⁶⁴ It is evident that the PVPA does provide some limited leverage against farmers or grain elevators that deal in saved seed derived from a protected variety.

The PVPA may also provide some advantages over trade secret protection. Whereas trade secret protection can be circumvented through “reverse engineering” practices, the PVPA does appear to proscribe some forms of reverse engineering, such as the practice of “chasing the selfs” to identify inbred parents of a protected variety.¹⁶⁵

However, our interviews persuade us that the obstacles to PVP enforcement are far more significant. As we shall see in the next section, it is clear that the PVPA does not provide the scope of protection necessary to prevent appropriation of PVP-protected

162. *E.g.*, *Monsanto Co. v. McFarling*, 302 F.3d 1291 (Fed. Cir. 2002). Older decisions from outside the seed industry present similar scenarios. *See, e.g.*, *Tripoli Co. v. Wella Corp.*, 425 F.2d 932 (3d Cir. 1970) (suggesting that product instructions showing an intent to prevent a distributor from selling beauty products to non-licensed professionals was reasonable and not in violation of the Sherman Act given, inter alia, there was no showing of a significant anticompetitive consequence); *Chemagro Corp. v. Universal Chem. Co.*, 244 F. Supp. 486, 490 (E.D. Tex. 1965) (concluding that a limited patent license can take the form of a written label notice attached to a product, which can restrict usage of subsequent purchasers and yield infringement actions if violated).

163. Especially rare are any definitive appellate level pronouncements on PVP law. *See, e.g.*, *Asgrow Seed Co. v. Winterboer*, 513 U.S. 179 (1995); *Delta & Pine Land Co. v. Sinkers Corp.*, 177 F.3d 1343 (Fed. Cir. 1999); *Delta & Pine Land Co. v. Peoples Gin Co.*, 694 F.2d 1012 (5th Cir. 1983).

164. *See, e.g.*, *Asgrow*, 513 U.S. at 179; *N. Star Genetics, Ltd. v. Bata*, No. CIV. A3-00-57, 2001 WL 1820380 (D.N.D. Aug. 9, 2001).

165. For a brief account of the technique of “chasing the selfs” as a potential reverse engineering activity, see Mark D. Janis, *Intellectual Property Issues in Plant Breeding and Plant Biotechnology* (forthcoming 2002) (on file with the Authors).

varieties by competitors and others players in the value chain such as delinters or ginners.¹⁶⁶

There are three main reasons for the absence of significant post-issuance PVP rights-based licensing or enforcement activity against competitors in the agricultural value chain.¹⁶⁷ The PVPA is easy to circumvent because the scope of protection that is accorded is limited; even a minimal modification of a PVP-protected variety puts one outside the scope of protection as not being an “essentially derived variety” (EDV).¹⁶⁸ In other words, the PVPA does not permit replication of protected varieties (knock-offs), as even minor changes to a protected variety put one outside the sphere of infringement. Second, the research or “breeding” exception is broad and permits all breeding activities by commercial and non-commercial entities based on protected varieties to be exempted.¹⁶⁹ This exemption is related to the EDVs and protects use of a protected variety to create other varieties, even if the new variety is genetically predominantly related to the original protected variety.¹⁷⁰ Third, the crop or “saved-seed” exemption permits farmers to set aside seed for their own subsequent use, but it does not permit sale of seed for use as feed or food, or for third-party use as seed.¹⁷¹ This requires PVP plaintiffs to establish proof of purpose for specific activities that may be undertaken by potential infringers, a difficult evidentiary task.

3. *Conclusions About PVP Excludability and Incentives.*

We have asserted that our anecdotal studies reveal little or no evidence that the PVPA provides patent-like incentives and excludability when we consider indicia traditional legal scholars ordinarily consider—that is, licensing and enforcement activity.

166. *Sinkers Corp.*, 177 F.3d at 1351 (concluding that, to hold a delinter liable for the unauthorized transfer of possession of protected seed, the plaintiff must establish scienter).

167. We acknowledge that other factors may also explain the apparent absence of significant enforcement activity. It is possible that PVP owners have routinely threatened enforcement actions and settled them without litigation, or without any proceedings that resulted in reported decisions. Our anecdotal studies reveal no evidence to support this possibility. It is also possible that the provisions of the PVPA are so crystal clear that everyone in the industry knows exactly what behavior to avoid, so that no opportunity for dispute would ever present itself. We are willing to wager that this is not a viable explanation.

168. For an explanation of the concept of EDVs as understood at the international level, see, for example, ASSINSEL, *Essential Derivation and Dependence: Practical Information*, at <http://www.worldseed.org/derive.htm> (last visited Sept. 20, 2002).

169. See 7 U.S.C. § 2544 (2000).

170. *Id.*

171. *Id.* § 2543.

The agricultural economics literature contains some assessments of PVPA performance using other economic indicia—including direct evidence of research and development (R & D) spending in plant breeding before and after the passage of the PVPA, and evidence on improvements in crop quality across the same time frame. These studies tend to buttress our conclusion that the PVPA does not provide patent-like *ex ante* incentives.

In the mid-1980s, there were some cautious suggestions that the PVPA might increase R & D investments in breeding programs.¹⁷² Although the limited degree of exclusive rights permitted by the PVPA was a concern because it did not appear to provide optimal levels of incentives to engage in plant breeding, there was some hope that the PVPA might have parallel effects to the utility patent laws.¹⁷³

However, more recent studies now confirm misgivings about the PVPA's capacity to provide adequate *ex ante* incentives. For example, in the case of wheat breeding, a study by Alston and Venner shows that there is no evidence of an increase in private investment in breeding research activities based on the PVPA.¹⁷⁴ Another commentator, Professor Jack Kloppenburg, Jr., acknowledges that private R & D spending in plant breeding has increased substantially since 1970, but argues that the trend simply represents the extension of a pre-existing tendency, with no evidence that the passage of the PVPA has caused this trend, or even accelerated it meaningfully.¹⁷⁵ Alston, Venner, and Kloppenburg agree that economic and other evidence suggests the PVPA serves “primarily as a marketing tool with no impact on excludability or appropriability.”¹⁷⁶ While Kloppenburg lays the blame in large part on the PVPA's omission of any “superiority” prerequisite, we think that the problem inheres mainly in the PVPA's limited scope of protection. Accordingly, while we may disagree with Kloppenburg's rationale and with some of his broader conclusions about intellectual property rights for plant biotechnology, we agree with his assessment that the PVPA does not stimulate R & D spending.

172. See generally L.J. BUTLER & B.W. MARION, *THE IMPACTS OF PATENT PROTECTION ON THE U.S. SEED INDUSTRY AND PUBLIC PLANT BREEDING* (1985).

173. WILLIAM H. LESSER & ROBERT T. MASSON, *AN ECONOMIC ANALYSIS OF THE PLANT VARIETY PROTECTION ACT* 60, 127 (1983).

174. Julian M. Alston & Raymond J. Venner, *The Effects of the U.S. Plant Variety Protection Act on Wheat Genetic Improvement*, DISCUSSION PAPER NO. 62 (Int'l Food Policy Res. Inst., Washington, D.C.), May 2000, at <http://www.grain.org/docs/eptdp62.pdf> (last visited July 19, 2002).

175. See KLOPPENBURG, *supra* note 59, at 141–50.

176. Alston & Venner, *supra* note 174, at 31; see also KLOPPENBURG, *supra* note 59, at 140–41.

Recent studies also raise questions about whether the PVPA has enhanced crop quality or crop yields. The Alston and Venner wheat study shows that the PVPA does not appear to have contributed to an increase in the commercial or experimental yields of wheat.¹⁷⁷ Alston and Venner also find no evidence of an increase in the average price of wheat seed above competitive levels and, by extension, no evidence of the existence of an increase in inventor royalties to wheat breeders.¹⁷⁸

Professor Kloppenburg draws similar conclusions regarding the quality of the soybean crop, citing a soybean study showing “no statistically significant difference in the rate of yield improvement” for soybeans before and after the passage of the PVPA in 1970.¹⁷⁹ He argues that the increase in choice, measured in terms of sheer increased numbers of varieties, may be illusory if these varieties differ one from another in only a narrow range of qualities—that is, if they present minute refinements in genetics of specified elite lines—and the differences represent no agronomic improvement, but merely facilitate product differentiation.¹⁸⁰

V. CONCLUSION

We draw a number of conclusions from these studies. First, the history of plant variety protection regimes in the United States and abroad reveals that the role of plant variety protection in the overall intellectual property scheme has mutated greatly without any fundamental changes to the general statutory approach to plant variety protection. Whereas plant variety protection was initially designed as the primary (or even exclusive) form of intellectual property protection for seed-grown plants, the coming of plant biotechnology, and the dawning acceptance of utility patents for plants, has relegated plant variety protection to a secondary role. Modest statutory amendments to the PVPA have shown no real promise of lifting the PVPA up from this secondary status.

Second, our empirical assessment of licensing and enforcement activities concerning U.S. plant variety protection certificates confirms that the PVPA regime as presently constituted plays only a marginal role in stimulating plant breeding research in the United States. Our assessment strongly suggests that the PVPA

177. See Alston & Venner, *supra* note 174, at 31.

178. *Id.*

179. See KLOPPENBURG, *supra* note 59, at 141–50.

180. *Id.*

does not provide patent-like *ex ante* innovation and investment incentives and that the PVPA has not generated substantial *ex post* licensing and enforcement activity. Instead, its role in the United States appears to be very modest: it may serve as a marketing tool; it may provide some non-propagation licensing rights akin to contractual shrink-wrap rights, enforceable against those who deal in “saved” seeds; and it may provide a superior alternative to trade secret protection—for example, for seeds whose secret parent lines might otherwise be revealed through reverse engineering.

Third, the insights from this paper have implications beyond the area of plant intellectual property rights. For example, we intend to adapt our analysis to analyze the effectiveness of other *sui generis*, technology-specific, legislatively created intellectual property rights, such as the Semiconductor Chip Protection Act. We then intend to formulate broader conclusions about the effectiveness of “small” and porous, technology-specific intellectual property rights regimes.

PVPA proponents presented the PVPA as a regime that would meet the lofty objective of providing patent-like protection in a specific technological area—plant innovation—by seeking to capture the social benefits of patent protection, but nevertheless, accomplishing this by striking a different balance between protected and permitted activities. Our thirty-year PVP experience suggests that narrow, Swiss-cheese like, intellectual property protection does not promote excludability and, consequently, does not permit appropriability.

Taken together, these observations suggest to us that to encourage plant innovation, reformers should direct their energies not towards refining the PVPA, but rather towards better shaping the utility patent regime to accommodate plants and plant biotechnology innovation. Indeed, the very existence of the PVPA may pose future political and legal problems by exerting pressure on the more robust utility patent protection regime for plants by, for example, creating opportunities for seeking heightened standards for non-obviousness for plant utility patents.

There are very limited reasons that support retaining a PVP regime of protection. The PVP may be favored by small plant breeders who may wish to protect their varieties without seeking utility patents, as patents are relatively expensive to obtain and set a higher threshold requirement for protection. By contrast, the PVP is easier and cheaper to obtain and does provide some marketing

benefits. Our international obligations under UPOV mandate that we continue to retain PVP protection for new plant varieties.¹⁸¹

All the same, it remains to be seen whether large or small breeders will continue to pursue exclusive PVP protection in light of the *J.E.M. v. Pioneer*¹⁸² decision permitting dual PVP and utility patent protection for new plant varieties.

181. See *supra* note 83 and accompanying text (describing U.S. accession to the UPOV).

182. *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc.*, 534 U.S. 124 (2001).