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Patented Agriculture

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On December 10, 2001, the U.S. Supreme Court issued an opinion that may have important long-run implications for U.S. agriculture. Ruling in *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc.*, the Court held that plant seeds and plants themselves (both traditionally bred and produced by genetic engineering) are patentable under U.S. law. This opinion concerns a case that started when Pioneer Hi-Bred sued J.E.M. Agricultural Supply (doing business as Farm Advantage) for selling Pioneer hybrid corn seed without Pioneer’s authorization. Pioneer alleged that the seed in question was protected by a number of patents and that, as the patent holder, it had the right to decide how, and by whom, the seed was to be sold and/or used. J.E.M. Ag Supply’s defense, in a counter suit, argued that the patents claimed by Pioneer were invalid. Specifically, J.E.M. Ag Supply maintained that Congress had excluded plants from the subject matter of patents when it provided specialized protection for plants through the 1930 Plant Patent Act (for asexually reproduced plants) and the 1970 Plant Variety Protection Act for sexually reproduced plants. The Court disagreed with this line of defense and ruled in favor of Pioneer. Essentially, it held that the landmark 1980 U.S. Supreme Court decision in *Diamond v. Chakrabarty* (which established that biotechnology innovations could be patented) does in fact extend to plants. Whereas this interpretation has been standard at the U.S. Patent and Trademark Office since 1985, the explicit U.S. Supreme Court ruling removes any ambiguity and, as a result, the right to patent plants is now firmly entrenched in U.S. law. We can expect that patents increasingly will be used to assert intellectual property rights on plant varieties and cultivars, inbred lines and hybrids alike. To understand what difference that might make, some background is in order.

What Is a Patent?

A patent gives an inventor the sole right to exclude others from economically exploiting the innovation for a limited time (20 years from the date of filing). To be patentable, an innovation must be novel in the sense of not constituting part of the prior art or more generally of not being already in the public domain. A patentable innovation also must involve an inventive step, meaning that it must be non-obvious to a person with ordinary skills in the particular field of application. The innovation also must be useful; that is, it must permit the solution of a particular problem in at least one application. A major element of a patent application is disclosure: the invention must be described in sufficient detail to enable those skilled in the particular field to practice it. The patent application also lays out specific claims as to the scope of the patent itself. Traditionally, patents were used for new machines, industrial processes, chemical and pharmaceutical compounds, and various manufactured articles, but more recently patents also have been used to assert ownership of computer software, information technology, biotechnology innovations, and internet-based business methods.

Patents are special kinds of property rights secured over intangible assets associated with human inventiveness and creativity. Patents are perhaps the most important legal instruments for protecting intellectual property rights (trade secrets, copyrights, and trademarks are other common instruments). Patents are awarded by the U.S. Patent and Trademark Office upon successful review of an application (a process that can take years and entail considerable legal expenses).

Why Patents?
The rationale for the existence of patents stems from the presumption that, without patents, not enough resources would be devoted to research and development activities required to bring about new products and other innovations. This perspective can be appreciated by viewing the product of research as a public good. Absent patents, private producers of knowledge will not be able to acquire fully (or even measurably) the value of their work, and this failure to reap the benefits of their knowledge would lead to underproduction of new ideas and new technologies in the economy. A well-defined (and enforceable) allocation of property rights on new discoveries—such as that afforded by the patent system—can address this problem by restoring sufficient private incentive to invest in research and development.

Thus, patents can be considered a system of incentives: they stimulate and bring forth innovations that otherwise would not take place. In fact, this seems to be the motivation for patents envisioned in the U.S.
Constitution: “The Congress shall have power ... to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.” An additional benefit often attributed to patents is related to the disclosure requirement. By bringing knowledge of the innovation to the general public, patents contribute to a desirable dissemination of scientific and technical information, allowing other inventors to avoid duplicating existing discoveries and making it easier to develop further innovations that build on the known state of the art (possibly by “inventing around” a patent as well).

**Drawbacks of the Patent System**

The fact that patents affect the incentive to innovate, and are likely to increase the flow of innovations, clearly is desirable from an economic point of view. But by giving the patentee exclusive rights on the exploitation of a new product or process, patents can adversely affect the efficient use of new knowledge after it is generated. In effect, a patent creates a legalized monopoly, a market setting that is notoriously inefficient because it brings about lower quantities and higher prices than are socially optimal. Consider, for example, the case of Roundup Ready soybeans and YieldGuard Bt corn. Monsanto invested heavily in the development of these technologies. Without the prospect of obtaining patents on its discoveries, the development of these efficiency-enhancing technologies in all likelihood would not have taken place. But now that Monsanto owns crucial patents to these technologies, it has considerable market power, as reflected in the price premium of the seed of these improved crops. This extra seed cost limits the adoption of these new technologies below what is socially desirable. The fact that patents necessarily restrict use of innovations actually carries even more importance when the patented product is used primarily in research to develop further innovations. It is now commonplace to hear, especially among university researchers, that patents in biotechnology seriously affect researchers’ freedom to operate, which could reduce the future flow of innovations.

**More on Patents and Plants**

The strengthening of intellectual property rights for plants, which culminated with the U.S. Supreme Court opinion discussed earlier, can be expected to have important consequences for the U.S. seed industry and for U.S. farmers. Patents give stronger protection than do the patent-like “certificates” that breeders can obtain under the Plant Variety Protection Act (PVPA). Specifically, PVPA certificates and patents have somewhat different requirements. To obtain a PVPA certificate, a plant breeder need only have a variety exhibiting distinctiveness, uniformity, and stability (as compared to the standard of novelty and non-obviousness required to obtain a patent). But, more importantly, patents and PVPA certificates differ in the protection they provide for two important attributes. First, harvest from seed protected by PVPA certificates legally can be saved by farmers for use in replanting. Second, varieties protected by PVPA certificates legally can be used by others for research purposes to develop new crop varieties. Patents do not allow these “farmer” and “research” exemptions. The patent holder has exclusive control over the use of the patented innovation.

Whereas PVPA certificates may continue to be used by public and private breeders, seed companies likely will rely more heavily on patents for their crucial germplasm and biotechnology innovations, putting far less importance on the use of PVPA certificates. This trend is illustrated in the figure, which reports the number of new patents for maize and soybeans issued over the period 1991-2001. While an average of only eight such patents per year were issued in the period 1991-1993, an average of 281 patents per year were issued in the period 1999-2001. The increased importance of patents emphasizes a particular feature of the new environment that is characterizing American agriculture in the twenty-first century. Innovations, and the ability to keep up with innovations, matter more and more. But innovations are produced increasingly by a private sector that relies heavily on intellectual property rights protection. The possibility of “owning” the results of research and development activities undoubtedly fosters innovation, but the resulting ownership structure of knowledge also has important impacts on the size, and distribution, of the economic benefits that arise from agricultural innovations.

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