

PLANT PATENTS

& Public Research Priorities

by Judith I. Stallmann

Colleges of agriculture have been working with stagnant or declining applied research budgets for several years. In spite of the budget squeeze, new items must be added to the research agenda and traditional clientele groups continue to expect services. In an effort to supplement research funds, many universities have begun to patent varietal releases from their experiment stations.

Supporters of patenting plant varieties released by universities see this approach as a "fair way" to generate needed research funds because the users of the research output—producers—pay the royalty.

Those against patenting public sector releases fall into at least three groups, each with a very different basis for opposition. One group opposes patenting any and all life forms, whether by the public or private sector, on ethical grounds.

Judith I. Stallmann is Assistant Professor, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

> The potential negative impacts of public patenting are enormous. Although the current political climate favors private sector activity and "no new taxes," there is a strong case to be made for public sector breeding. These political slogans do not take into account the many cases where the market does not provide incentives for the private sector to invest in breeding. Cash-starved university research programs facing increased demand for their services find private contracts increasingly attractive. The better alternative is for state and federal executives and legislatures to appropriate sufficient funds.

A second group specifically opposes patents on public sector varietal releases. They disagree with the fairness argument suggested by supporters of public sector patenting. In contrast, members of this opposition group argue that competition in agricultural production and marketing makes it difficult for producers to pass on cost increases, such as royalty charges, to consumers. Yet consumers, not producers, are the main beneficiaries of agricultural research. In addition, consumers have already paid for the research through their tax dollars. As a result, the argument goes, it is "unfair" to charge royalties either to producers or consumers. In the same vein, restricted licensing of public varieties is also opposed; because the research was funded through taxes, all who want to use the variety should have access to it.

A third group of opponents moves beyond the question of patenting to argue that universities should concentrate on basic research—leaving breeding and other applied research to the private sector. The USDA is following this line of reasoning by switching funding to more basic research programs. Going one step further, Great Britain sold the Plant Breeding Institute at Cambridge to Shell Oil Company.

Even with increased private investment, there is still a role for the public sector in plant breeding.

Ruttan has given three reasons for publicly sponsored agricultural research: to invest when the market does not provide sufficient incentives for private research, to maintain competitive conditions in agriculture, and to provide training in research as one component of education.

The primary question is whether the public sector can perform its role if it patents plant varieties.

The applied/basic research dichotomy oversimplifies the issue. Some areas of basic research provide incentives for private research. Bell Laboratories is perhaps the best known example of private investment in basic research. On the other hand, not all applied research is attractive to the private sector. In addition, the university's education mission, particularly at the post-graduate level, is to provide research skills. To provide graduates with skills relevant to the private sector, universities need to engage in some applied research.

The focus on who benefits and who pays for the research is only part of the point. The primary question is whether the public sector can perform its role if it patents plant varieties. Depending on how this question is answered the issue of who pays for the research may or may not be relevant.

Some Other Things To Consider

As the main debate above illustrates, administrators of public research programs confront extremely difficult choices about their approach to patents.

Public patenting may in fact subvert the very reasons for the existence of public research. The patent system creates incentives for the private sector to invest in research and development. Given patent incentives, the public sector is likely to begin acting and reacting like the private sector, rather than fulfilling its unique role. In particular the public sector might invest only in the same crops, work to develop the same characteristics, and use the same breeding techniques as the private sector. In addition, public patenting and licensing may result in premature release of varieties, changes in seed and nursery industry structure, and a decrease in genetic diversity. Such a patent policy could also result in a net decrease in the flow of scientific information and damage farmers' perceptions of the Extension system's objectivity.

Concentration on Major Crops. Patenting of publicly bred varieties creates incentives for researchers to concentrate on crops which are likely to bring in the most money—the major cereal crops. The danger is that the public sector will withdraw from the breeding of minor crops, crops which the private sector does not breed despite the availability of patents to them. There is a danger that there will be no breeding programs, public or private, for some crops.

Adapting plant varieties to local conditions has been an objective of state breeding programs for many years. Yet in addition to withdrawing from minor crops, the public sector may also decrease breeding of regionally and locally adapted varieties because these markets tend to be small even though these varieties may be important to the state's economy. New York State, for example, is closing down its strawberry breeding program which developed varieties adapted to local conditions.

Ignoring Particular Plant Characteristics. Private firms may lack incentives to focus on characteristics important to society. The role of the public sector should be to identify and breed those characteristics which may have high social payoffs but provide little payoff for the private sector. To do this the public sector may have to maintain a breeding presence even in crops which have substantial private investment. For example, a seed company owned by a chemical firm does not have an incentive to breed a plant that would require fewer chemical inputs. Rather, it would work to adapt the plant to chemicals, as is the case with the development of varieties resistant to common herbicides.

Concentrating on Hybrids. Patenting has not made private investment in plant breeding as profitable as was expected when the laws were originally passed. This is because growers can avoid the royalty charges by saving their grain for seed. Hybridization is a breeding technique which forces farmers to buy seed every year so that they cannot avoid any royalty charges. Hybridization was the private sector's technique of choice before patents, and continues to be so. For example, Pioneer has closed down its wheat breeding program in the United States. Even though the varieties were protected, farmers avoided the royalties and an economical way to hybridize wheat has not yet been found. The private sector will continue to select breeding techniques which are the most profitable either in terms of lowering breeding costs or increasing sales and revenues. Biotechnology may provide new ways of preventing farmers from saving grain for seed.

In contrast, to date the role of the public sector is to explore promising techniques for creating genetic improvements even if they do not increase revenues to the breeding program. If the public sector finds out that patenting does not produce the revenues it envisioned, will breeders be pressured to develop and choose

breeding techniques which increase revenues? The incentives created by giving breeders a share of the royalties could also lead breeders to choose techniques based upon potential royalties.

Premature Release of New Varieties. Prices are highest when a variety is introduced because supply is limited. Once a variety is on the market, farmers and seed producers can multiply it, increasing supply and causing price to fall. Seed companies maintain a steady flow of new varieties. The varieties are enough of an

THE WORD "PATENT"

The word "patent" is used in this article to include all laws although Plant Variety Protection issues a certificate which appears to be a cross between a patent and a copyright.

Public research nurtures competitive conditions in agriculture by providing both products and information.

improvement over existing varieties that farmers switch and pay the higher price. Similarly, I found that fruit tree nurseries introduce sports of popular varieties when prices decline or patents expire on the first variety. Admittedly, there is a question of cause and effect. For example, seed firms argue that a variety only has an economic life of 6-8 years so they must introduce a new variety. However, the short life may be caused by the introduction of a new variety.

The time spacing of new introductions for variety marketing reasons may override sound agronomic practices. For example Sparrow concluded that between 1964 and 1968 the uncoordinated introduction of fifteen barley varieties in Northwestern Europe with only small improvements in barley mildew resistance allowed the pathogen to quickly overcome any new resistance by 1969.

For a characteristic such as disease resistance, a pathogen can rapidly overcome a small improvement in new varieties. To slow the pathogen, a large difference in resistance is needed between the new and older varieties. Better gene management would have provided longer-term resistance.

The public sector generally has not had incentives to release new varieties with only minor improvements. But with public sector patents, breeders may be pressured to release varieties more rapidly in order to increase royalty income for their universities.

In an effort to retain breeders, most universities have established royalty sharing agreements. The pressures for early release can be exacerbated by these contracts. Some contracts provide a high percentage of royalties in the first few years and a lower percentage in later years. High quality varieties increase their market share over time and remain on the market longer. To encourage high-quality varieties, breeders should receive a higher percentage of the later royalties and thereby discourage early introduction of varieties.

Industry Effects. Implications of patenting procedures obviously extend beyond the individual researcher. Extensive licensing by the university deans across the country could lead to decreased competition among firms, reduced genetic diversity of plants, limited flows of scientific information, bias in extension information and undue influence of private companies on public research agendas.

Decreased Competition. University policies for the release of patented varieties can impact the structure of the seed and nursery industry. The most common policies include:

- Licensing the variety to the state crop improvement association;
- Licensing the variety to any firm willing to pay the royalty;
- Licensing the variety exclusively to one firm.

Exclusive licenses tend to go to big firms with large advertising budgets. There are many regional seed companies which do not have their own breeding programs or significant advertising budgets. They tend to concentrate on multiplying and distributing publicly bred varieties and varieties uniquely adapted to the region. Today these firms are a major source of competition in the market. However, Wisconsin economists Butler and Marion conclude that without access to public varieties they probably would not survive.

Private firms will heavily promote and advertise only varieties for which they hold exclusive license. Currently, university interest in exclusive licensing may be motivated as much by the desire to see public varieties widely used as by the desire for funds. For example, public breeders argue that superior public varieties are losing sales to the heavily advertised private varieties. Alternative mechanisms for achieving wide use of publicly bred superior varieties include increased investment in both field trials and dissemination of the trial information.

Even if a university licenses its varieties to all firms willing to pay the royalties, the royalty structure or licensing fees may shut out smaller firms. In particular, a lump-sum license fee rather than (or in addition to) a per unit royalty may strain the cash flow of small firms. In the early 1980s, for example, several smaller nurseries did not obtain a license on an apple rootstock released by

A BRIEF HISTORY

For the last half century the United States has been steadily expanding the right to patent plants. In 1930, the United States became the first country to specifically allow the patenting of some plants. The 1930 Plant Patent Act allowed patents for asexually reproduced plants, except tubers and micro-organisms.

The 1970 Plant Variety Protection Act allows certificates of protection for sexually reproduced varieties. Hybrids do not meet the criteria for protection under this law.

A 1980 Supreme Court decision found that micro-organisms were patentable under the general patent statute. A 1985 decision by the Patent Office Board of Appeals clarified this decision by finding that any plant could be patentable under the general patent statute rather than being confined to the 1930 and 1970 Acts specifically for plants.

Michigan State University because of the lump-sum license fee.

Reduced Genetic Diversity. Several universities have responded to criticism of exclusive licenses by granting exclusive licenses to other firms on the sister seedlings (seedlings of similar quality resulting from the same parental cross). This practice can have major impacts on genetic diversity.

The importance of genetic diversity was demonstrated during the 1970s by the Southern Corn Leaf Blight. The majority of hybrid seed corn in the United States had a common ancestry which made it susceptible to the blight, causing severe crop losses in several states. Generally, farmers plant several varieties which mature at different times and which have a range of resistance so

that an entire crop will not be lost to a single disease. To insure genetic diversity, farmers often buy from more than one firm, but when sister seedlings are available from several companies, farmers may assume mistakenly that they are acquiring genetic diversity.

Chemically testing each variety to determine its genetic heritage—and disseminating that information to farmers—will be costly. The costs are likely to exceed any revenues the public sector receives from the release of sister seedlings.

Limited Flow of Scientific Information. The public sector must also consider the impact of its patent practices on dissemination of scientific knowledge. For a patent to be issued in the United States, the product or process must be “new,” that is, it cannot

Faculty evaluation on the basis of grants and contracts obtained has also become more common.

have been disclosed to the public more than a year before the patent application is filed. In Europe, the requirements are even more restrictive; there can be no disclosure whatsoever prior to the patent application. Traditionally, public breeders in the United States have discussed promising new varieties while still testing them and have exchanged germplasm at all stages of development. Both public and private sector breeders have noted that public sector interest in patenting has limited this flow of information and germplasm.

Extension Information Bias. The extension system provides a mechanism for distributing agricultural information to farmers and agribusiness. There is a conflict of interest when a breeder is in charge of field trials which include varieties on which the breeder receives a royalty. If public breeders and research programs stand to gain directly from the sales of patented varieties, extension service recommendations of public varieties would no longer, by definition, be objective.

A recent article in *Science* magazine discussed the conflict of interest problems faced by medical colleges when a scientist participates in clinical trials of a drug and holds shares in the drug company. Major medical colleges are instituting strict rules to govern such situations.

One alternative is to give the breeder salary increases or bonuses rather than direct royalties. A second alternative is to set up a crop testing association which is independent of the breeder.

Undue Influence By Private Companies. In addition to patents, the public sector has increased contracting with the private sector to obtain additional research funds. What is new in these relationships is that the public sector is the subordinate partner in the contract and the private firm has control over the research product. To get such research contracts, universities must orient their research program to the needs of the private firm rather than to broader societal needs. Faculty evaluation on the basis of grants and contracts obtained has also become more common. This increases the potential for undue influence by the private sector on the public research agenda.

As they gain control over the public research agenda, private firms and organizations may attempt to gain control over other aspects of the university. In 1987 the Rochester *Sunday Democrat and Chronicle* reported that the graduate business school of the State University of New York-Rochester (SUNY-Rochester) is heavily funded by the Kodak Corporation, and Kodak executives interact with students during their training. A Japanese employe of Fuji (a major Kodak competitor) was admitted to the MBA program. Under pressure from Kodak, the business school rescinded the admission. While SUNY-Rochester now has established a mechanism for avoiding future incidents, it seems likely that more incidents will occur as research contracts with the private sector become more important to universities.



Breeder inspecting new varieties.

Photo: Virginia Tech Media Center


Emphasize the Basics

As technology and institutions change, the public research agenda will be affected. In adjusting its agenda, the public sector must keep in mind its unique role in agricultural research. By responding to incentives created for and by the private sector, the public sector must not lose sight of its own unique responsibilities.

The role of the public sector in agricultural research is to do the research the market does not drive the private sector do, to maintain competitive conditions in agriculture, and to provide training in research.

Public research nurtures competitive conditions in agriculture by providing both products and information. Regional seed firms which multiply public varieties have been shown to be an important source of competition in the seed industry. But universities can thwart that competitive atmosphere by patenting and variety release policies coming into play. Also, release of sister-seedlings by the public sector to private seed firms makes it more difficult for farmers to get information on genetic diversity. Further, extension will lose its position as a source of unbiased information if field trials are supervised by a breeder who stands to benefit directly from the sales of a particular variety. The need to maintain secrecy about a product until a patent application is filed slows the flow of valuable information to the rest of the public sector and to the private sector.

Money is always tempting to administrators and scientists of cash-strapped breeding programs.

However, the private sector has been disappointed in the revenues from patents and public decision-makers should be careful not to overestimate royalty income. For many varieties, royalties will be low, perhaps less than the cost of patenting. If research administrators feel they must patent (or are required by university policy to do so), they should simultaneously consider ways to ameliorate some of the potentially negative impacts on their research agenda. 

FOR MORE INFORMATION

Butler, Leslie J. and Bruce W. Marion. 1985. *The Impacts of Patent Protection on the U.S. Seed Industry and Public Plant Breeding*. Madison, WI: North Central Project Monograph 16.

Hansen, Michael, Lawrence Busch, Jeffrey Burkhardt, William Lacy and Laura Lacy. 1986. "Plant Breeding and Biotechnology." *Bioscience* 36(1): 29-39.

Marshall, Eliot. 1990. "When Commerce and Academe Collide." *Science* 248 (April): 152-156.

Stallmann, Judith I. and A. Allan Schmid. 1987. "Property Rights in Plants: Implications for Biotechnology Research and Extension." *American Journal of Agricultural Economics* 69(2): 432-437.