Some Current Options in the Use of Plant Variety Protection in Horticulture

David W. Davis and James J. Luby
Department of Horticultural Science and Landscape Architecture, University of Minnesota. St. Paul, MN 55108

The large number of horticultural crops represents a great genetic diversity. This diversity is important in numerous ways such as in pollination control, product use, and environmental requirements for the production and handling of seeds, propagules, and the commercial product, to name only a few. The diversity is reflected further in the business structure of horticulture and, most relevant to our discussion, to relationships at the interface between the public and the private sectors in crop improvement.

Our objective is to describe the results of a survey on the use of various variety protection options by the public sector and to describe opportunities and concerns voiced by horticultural scientists, administrators, and others as they look ahead. Protection alternatives in use fall under the Plant Variety Protection Act, the Plant Patent Act of 1930, and the general (utility) patent and trademark law, as well as under certain less formal agreements. The option elected is influenced by many factors, but particularly by the corp species and how it is propagated, by the character of the commercial sector that has developed around the crop, and by plant breeders and their home institutions. Differences also will arise from one institution to another as to how a particular option is used, but certain basic generalities are seen. These are summarized in Table 1.

The reader is referred to Evenson (2) for discussion of general historical aspects of the use of intellectual property rights in the public sector, and to probable implications for the public agricultural research system. Williams (5) reviewed the range of formal options that might be used for protection of plant varieties and drew comparisons between living and inanimate matter. He did not include a variety of informal protective agreements that have evolved here and there in horticulture. Schmid (4) dicussed implications of biotechnology and plant variety protection on the status of intellectual property rights in agriculture, with particular reference to the future research agenda and the inexorable problem of product space, i.e., the minimum difference between the new product and the existing, protected products (e.g., cultivars). Lesser (3), writing after the general utility patent law was extended to plants in Sept. 1985, discussed the greater degree of protection possible via the utility patent law and the difficulties that it might bring. Lesser noted that the question of germplasm exchange eventually might become the major issue related to the protection of plants and plant parts. To this concern we should add the problem of information flow.

Williams (5) grouped formal plant protection options into two broad categories: registration and examination. Trademark and plant variety protection (PVP) schemes were cited as, essentially, *registration*, with trademark controlling use of a name and PVP controlling the right to propagate something stable, uniform, and distinctly (describably) different. Williams described protection via the utility patent law as protection by *examination* (i.e. different, useful, and nonobvious or requiring an inventive step) and as more difficult to obtain but as providing a broader range of protection.

Historically, the public research sector, comprised of the USDA and the land grant and 1890 institutions, has developed and released horticultural cultivars for a variety of reasons. Perhaps foremost among these has been a fulfillment of mission to make available to the public improved cultivars and to help assure that propagating material of high quality and purity is widely distributed. Improved cultivars and improved germplasm have been recognized as tangible and practical products of both basic and applied research programs, often meshed with a graduate education mission. There has always been a sense of credibility attached to programs from which improved cultivars or advanced germplasm emerge.

The evolution of the mission continues. While the reasons for cultivar development in the public sector continue, the growth of investment in private-sector plant breeding, particularly with certain field, vegetable, and ornamental crops, has produced excellent cultivars and gradually has tended to change the focus in the public sector regarding these crops. To our previously stated logic behind public development of cultivars may now be added the need for the public sector to develop cultivars that fill gaps in the private sector effort, i.e., cultivars of limited acreage crops and cultivars to fill special environmental niches. Further, with the seed-propagated crops, especially, there continues to be opportunity also for "Hallmark" cultivars, (i.e., those that represent significant advances to new levels), as well as "Proof-of-Concept" cultivars (J. Mitchelmore, personal communication.), such as 'Pennfresh ADX' sweet corn, which provide a demonstration of the application of basic research. The public sector also augments the cultivar development work in the private sector by release of improved parental material and germplasm. Hence, a sense of partnership between private and public continues to grow. Finally, we must remember that the public stations still have nearly complete responsibility for the breeding of tree and small fruit crops and woody landscape plants, and the responsibility for graduate education.

Interest in protecting plant cultivars and plant parts continues to increase both in the public and in the private sector, for the following major reasons: a) there has been an escalating attention to intellectual property rights in our information-based society; b) the Plant Variety Protection Act of 1970 (broadened, 1980), and, more recently, the extension of the general (utility) patent law to cover *all* plants (except hybrids) has increased the opportunity to protect; c) the growing internationalization of the seed industry has brought recognition that marketing cultivars overseas will, in many nations, be expedited if they are protected in their home country; d) there is increasing concern in the public sector not only to facilitate the acceptance and distribution of newly released public cultivars, but to provide a means for financial assistance for public breeding program survival; and e) there has been stimulation of interest through recognition that the plant or seed is the delivery mechanism to agriculture for advances in biotechnology. With regard to the latter two points, Brooks and Vest (1) document the occurring decline in public breeding programs in horticulture, while, concurrently, horticultural departments are moving rapidly into biotechnology research, which fairly soon will need a delivery system into agriculture.

PROTECTION ALTERNATIVES

Plant Patent Act of 1930

Designed for the protection of plants that were only propagated asexually, but excluding tuber-forming plants, the plant patent route has been the major option for tree fruits, small fruits, woody landscape plants, and asexually propagated herbaceous ornamental plants. Except for the last category, nearly all of the cultivar development work on these species is carried on in the public sector. Of 13 inquiries that we made of state stations having woody plant breeding programs, we found that eight had experience with plant patents on woody plants. A small but increasing number of stations currently assume that all

Received for publication 27 May 1987. Miscellaneous publication no. 15422 of the Minnesota Agricultural Experiment Station.

Table 1. Some generalized release and protection options currently in use by state agricultural experiment stations.[z]

Protection mode	Seed/propagule distribution mode	Degree of release restriction	Kind of payment	Funds distribution within university
		A) Vegetable crops		
None	Any bonafide seedsman	None	None	NA
None	Bonafide seedsmen invited to participate	Release only to participating seedsmen	Royalty	Formula; project shares
Within-state distribution	Foundation growers	Within state	None	NA
PVP	Release to one seedsman who PVPs	Exclusive to one seedsman	Varies: none to front-end fee	To project
PVP by university, which then licenses a state crop inprovement association	One or more selected seedsmen following negotiation are sublicensed	Exclusive one to several seedsmen	Front-end fee plus royalty	Formula; project might or might not receive share
Long-term memorandum of understanding	Cooperating U.S. and foreign seedsmen. Agree to provide seed to home state first.	Exclusive one to several seedsmen	Royalty and small grants	To project
		B) Herbaceous ornamental and florist crops		
None	Propagators invited to apply	None	None	NA
PVP by university	Invite several seedsmen, choose one	Exclusive	Royalty	General university fund; project does not share
PVP by university research corp.	Propagators invited to apply	None	Royalty	Formula; project shares
Occasionally use plant patent	As above	None	Royalty and nominal front end	To project
Trademark	Commercial tissue culture labs within state	None	Front end plus one-time royalty on initial buildup	To project
		C) Fruits, nuts and woody landscape plants		
None	Propagators invited to apply	None	None	NA
None	Via nonprofit state industry assoc.	None	Royalty	To project
Plant patent by university or a non-profit research corp. or a foundation set up by university	Propagators invited to apply	Optional	Royalty	General university fund
As above	Via nonprofit state industry assn.	Optional	Royalty	Formula; project share; project leader shares
As above	As above	Optional	Royalty	To project
As above	Negotiate with propagator(s)	Can be exclusive	Front-end plus royalty	Formula; project shares
As above	To the contract research grantor	Exclusive	Research grants plus royalty	Formula

[z]Based on survey of breeders and administrators at 22 state agricultural experiment stations.

cultivars of all asexually propagated crops (except potatoes) originating from their work will be protected. These stations do, however, consider each case on its merits. The decision to patent is made if the licensing of rights to one or more outlets will provide incentive for promotion and distribution of the new cultivar to the public, and if the proceeds from patenting will offset the costs involved. The most common practice is for the university, or state agricultural experiment station, or nonprofit university research corporation to hold the rights and to license a firm or firms, or an industry association that in turn provides sublicenses to firms who may propagate and sell the product (Table 1).

Plant Variety Protection (PVP)

Protection under PVP is now very common in the private sector for either open-pollinated cultivars or pure lines of seed-propagated crops. Use of this method in the public sector is significant but scattered, both with regard to the institution and the crop species. Of 13 state agricultural experiment stations queried, three had some experience with PVP in vegetable releases and one in the release of seed-propagated ornamental crops. Many of the stations queried regarding vegetable releases now concentrate principally on germplasm enhancement rather than on cultivar development.

The mechanism for holding and assigning rights parallels that described above for asexually propagated plants. In a few cases, a state seed association (crop improvement association), either already existing for agronomic crops or brought into being for a horticultural crop, provides the infrastructure for such functions as assigning sublicenses, monitoring the production of high-quality seed, and collecting and distributing royalties (Table 1).

Trademark

At least one public program has used the trademark route for protection of an asexually propagated crop (Table 1). Since trademarking protects the name rather than the right to propagate per se, stock material for tissue culture and printed labels are supplied to tissue culture laboratories. A front-end fee for the nuclear propagation stock is levied, and there is a one-time royalty on the major initial increase and sale of the new cultivar by the laboratories. All commercial tissue culture laboratories within state receive the nuclear stock; hence, the release is nonexclusive within state.

The trademark option is used also by some commercial firms, particularly as a way to protect a brand or generic name under which cultivars will be sold. Hence, one can protect either the brand name or the cultivar name or both, or one might elect to register a trademark on the brand name and use some other plant protection alternative on the cultivar. Protection under trademark can continue indefinitely through periodic reregistration. Although less costly at the outset than patenting or PVP, repeated reregistration would reverse the comparison. Longer duration protection of woody plant material than that afforded by patenting might be desirable in view of the long evaluation period often required to determine the value of a new cultivar or rootstock.

Utility patents

Although the utility patent law was extended by the Hibberd ruling in Sept., 1985 as a protection option to all plant material, we are not aware that this option has been used thus far in the public sector for cultivar protection. However, its future use may be substantial. In the private sector, *process* patents for plants have been used occasionally for some time. Examples are the patenting of the 'Sweet Gene' combination in sweet corn, and, several decades ago, the patenting of hybrid corn by D.F. Jones. The quite recent protection of high-oil sunflowers is an example in which both utility and process patents are used. The potential use of and interest in both process and utility patents with plant material via the general patent law now is enormous, recognizing that such manmade entities as cell lines, transformants, DNA constructs, plasmids and other vectors, and monoclonal antibodies, as well as cultivars and novel, useful, discovered or manmade processes (systems), can be patented.

Approval for use of utility patents on plants provides the first opportunity to patent new cultivars of plants that are asexually propagated by tubers, as they were neither included under the Plant Variety Protection Act nor the Plant Patent Act. There is gathering interest in patenting potato cultivars as the first step in the development of certain overseas markets, particularly those in Europe. We know of no patenting of potato cultivars as of this writing, but interest is increasing with the recognition that protection in the home country may help facilitate protection and market promotion in another country under that nation's laws.

Unique and informal agreements

A variety of more specialized agreements between public breeders/agricultural experiment stations and the propagators, nurseries, and seed firms also are in place in horticulture. Often these have been made on a test-case basis. Most important, they have begun to establish precedent and the evolution of process by which public cultivars can enter the marketplace by providing more incentive for the private sector to market the new cultivar and also ensure distribution at a high level of quality and in the amounts needed, and at the same time assist financially in the survival of the public program.

Limited distribution release with royalty. Some stations provide new public cultivars to one or a very few cooperating seed firms with royalty payment based on sales volume. For the release of improved germplasm, royalties may be collected based on the contribution of this germplasm in the parentage of the cultivars developed by the seed firm. Cultivars and breeding material are released by the public station without plant protection, but distribution is restricted to the cooperating firms. Inbreds for direct use in hybrids also are released in this manner with firm verbal or written agreement that they will be used in a certain manner. This use may be in a recommended hybrid combination, perhaps with hybrid indentity recognizable for credit at the public institution, and with the understanding that some specific target markets be met first, such as growers needs in the home state. The strength of such agreements, if verbal, rests with the reputation of both the firm and the breeder and with the understanding that transgression will obviate the potential for agreement on future releases. Verbal agreements of this nature have been very successful per se in horticulture, and serve as the principal underlying strength of written agreements and contracts as well.

Products from sponsored research. Various methods have emerged by which the private sector is gaining new germplasm and information by providing financial support directly to public research rather than via the royalty system described previously. First, this assistance may be in the form of small annual grants that often continue over many years from a single firm or association. Alternatively, funds may be received from a number of contributors or organizations on a check-off basis. Such benefactors commonly cooperate in germplasm evaluation, and, even with a nonrestrictive release policy and the wide dissemination of published information, their closeness to the research enables a more rapid adoption or use of the material. Second, with the growing recognition that universities possess considerable resources and a dynamic environment for innovation, more firms are forging long-term contractual agreements that can provide specific benefits, as, for example, licensed rights to use or market new cultivars, perhaps internationally as well as domestically, and advance scrutiny of publications from research.

CONCERNS RAISED BY PLANT BREEDERS

As professionals, plant breeders quite naturally have strong opinions as to the continued need and opportunity for their profession and research sector in horticulture and, in particular, in the land-grant universities. Their view of the ramifications of plant protection and/or restricted release understandably is conditioned by these opinions and by awareness of the role that public plant breeding has played in the development of agriculture. While adequate treatment of the ramifications of plant protection and restricted release cannot be provided in this short space, a few points may be summarized. There is, for example, genuine fear that germplasm and information flow may suffer, or at least will be channeled to selected users in advance of general release. There are several additional concerns: a) should tax-supported institutions and their employees receive funds for products from their work; b) would royalties result in substantial cost increases of seed or propagules to growers; c) would public institutions become too dependent on royalty funds to the extent that the research agenda would be influenced; and d) would the liberal use of patent law protection in biotechnology complicate the distribution and use of germplasm in breeding and/or substantially increase costs?

There are, however, potential positive effects of cultivar protection: 1) restricted release may provide an improved mechanism for the introduction of public cultivars into the marketplace; 2) protection and a more effective release process may motivate public researchers to identify and to fill gaps in the marketplace; and 3) protection offers the breeding program a means of survival in a period of declining resources from traditional sources and changing priorities in research. Desire for program survival is conditioned by recognition that a) generally there are few or no private breeding programs in fruits, nuts, and woody landscape plants; b) the private sector may have a long-term economic incentive to provide only a small number of (albeit excellent) cultivars for sale and to concentrate on major crops in major growing regions; c) new plant breeders for industry are a product of university breeding programs; d) in the long run, both the private sector and the public sector each may benefit by the complementarity and "competition" offered by the other; e) based on the past, a productive synergism is possible in the universities by cooperation among various disciplines, all with longer range goals than normally are seen in commercial plant breeding; and f) biotechnology in the universities will be further stimulated by the presence of an in-house delivery system to agriculture.

Still other questions have been raised by one or more researchers. First, what will be

the phenotypic or genetic distance required by the new invention (crop variety or genetic material) to enable patenting under the general utility law? This question will be decided in the courts. There will be a compelling need for greater uniformity in the qualitative and quantitative description of the key traits among cultivars in a crop. If one is going to base a new item for patenting on flower color, for example, how is one going to *measure* color? That is critical in the eyes of the general patent office. This may not be very important for PVP, which essentially is a *registration* system, but it is very important for utility patenting, an *examination* system.

Second, there is a need for each public station to keep opportunity open among seed firms and nurseries for sharing in exclusivity agreements. There is potential for animosity toward long-term agreements between Experiment Station 'X' and Firm 'Y'. Others will want to participate.

Third, there is a lack of infrastructure in some states for handling certain, or even all, species via plant protection. The development of infrastructure could help bring incentive back into some of the experiment stations for research on breeding of horticultural crops, not only for cultivar development but also to provide synergism in crop improvement research within these stations.

Fourth, while trust among individuals still will be the key by which solid agreements are made, even with plant protection and patenting, will the public sector really seek to enforce patents and other agreements after they have been signed? Enforcement will be viewed as essential by the licensed distributors of a cultivar.

Fifth, uniform policy across units should be developed within each institution. The question is, and to pose an example, is the university or experiment station going to treat scientists, such as engineers and plant breeders, differently with regard to the distribution of royalty funds? Is a department going to treat someone in molecular genetics differently from someone who develops a variety? They could be one and the same person.

In conclusion, as a response to need, there has been development of a considerable diversity of release and protection options in the horticultural sector. For the most part, these are evolving on a workable basis, although there is some confusion in the private sector over current lack of uniformity among state experiment stations in protection and release policies. Most of the options have come about as a result of considerable interaction between each plant breeder and the private sector structure that exists for a specific crop species on which that breeder works. These breeders have provided leadership at their home station in policy development. Among the state stations, various successful role models exist for the handling of the several horticultural crop groups. This should be stimulative to others in the development of policy at their station for these and other crops. This has truly been a "grass roots" development in the state agricultural experiment station system. It has provided great flexibility in getting new varieties to the public in the amounts needed and at the seed or propagule quality level needed.

Literature Cited

1. Brooks, H.J. and G. Vest. 1985. Public programs on genetics and breeding of horticultural crops in the United States. HortScience 20:826–830.
2. Evenson, R.E. 1983. Intellectual property rights and agribusiness research and development: implications for the public agricultural research system. Amer. J. Agr. Econ. 65(2):967–975.
3. Lesser, W. 1986. Patenting seeds: what to expect. N.Y. Agr. Expt. Sta. A.E. Res. 86-1.
4. Schmid, A.A. 1985. Biotechnology, plant variety protection, and changing property institutions in agriculture. North Central J. Agr. Econ. 7(2):129–138.
5. Williams, S.B. 1984. Protection of plant varieties and parts as intellectual property. Science 225(4657):18–23.