

Trade in Grapevine Plant Materials: Local, National, and Worldwide Perspectives

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The high value of grape plant materials, the competitive nature of the grape nursery business, and rapid globalization of the grape and wine community have resulted in some fundamental changes in the availability of grape selections, varieties, and clones. The last few years have seen an increase worldwide in patented grape varieties and rootstock selections, the introduction of trademarked clones of traditional varieties, and the development of proprietary programs in which valuable selections are marketed exclusively and cannot be obtained by all growers. Some sales contracts for grape nursery stock even limit the rights of growers to subsequently propagate selections. Few governments today are willing to fund public programs for importation, certification, and distribution of grape stock, making the few remaining programs increasingly international in influence. The technology involved in both grapevine identification and plant disease detection has changed radically in the last ten years, resulting in rapid changes in grapevine quarantine, clean stock, and certification programs. In addition to these technical developments, changes in international trade rules may have important long term implications for US grape growers.

KEY WORDS: grape varieties, clones, patents, trademarks, phytosanitary, certification, trade

In marking the 50th anniversary of the American Society for Enology and Viticulture, it is only fitting that a day should be dedicated to the topic of the grape plant materials which are the essential starting point for developing our vineyards and our wines. I am here as Director of Foundation Plant Materials Service (FPMS), a department in the College of Agricultural and Environmental Sciences at the University of California, Davis, (UC Davis) which has been instrumental in providing grape planting stock to the industry since the 1950s. It has been my privilege to serve as director during a period of tremendous change in the field of grape plant materials. Although the processes which put those changes into place have been at work for many years, we can now see certain patterns emerging which are likely to affect the availability of grapevine stock for years to come.

The history of viticulture and enology is inextricably tied to the grapevine plant material available to growers. From the very earliest days of the University's efforts, new and interesting selections of wine grapes, table grapes, and rootstocks were collected by founding faculty members Hilgard and Bioletti, in collections that were maintained on the UC Berkeley campus, the Davis farm (which later became UC Davis and home of FPMS), and in experimental demonstration vineyards around the state [1]. As grapegrowing grew more technical and sophisticated in California, reports began to surface that the productivity and quality of some vineyards was being reduced by the presence of virus diseases; furthermore, many grapevine selections in commerce were mislabeled or incorrectly identified. Dr. Harold Olmo, a UC Davis faculty member in the Viti-

culture and Enology Department (VEN), lead efforts to establish collections of grapevines on the Davis campus that were selected for longevity, vigor, and fruitfulness. By 1952, the California Grape Certification Association was formed to develop, maintain, and distribute virus-tested and correctly-identified grape stock [9]. The collection was initially managed by C. J. Alley, a student of Dr. Olmo's who went on to become part of the UCD Viticulture and Enology Department faculty. By 1958, this program was combined with the UC Davis disease-tested fruit and nut tree program to become Foundation Plant Materials Service.

Around the world, similar clean stock programs for grapevines developed, each customized to fit the varying needs of individual national industries. Today, scientists working in this field share techniques, expertise, and the grape plant materials themselves, resulting in dynamic programs which undergo frequent change. Increasingly, these programs serve an international clientele with diverse goals.

Patents, Trademarks, Trade Secrets, and Contracts

One of the most complex and interesting areas of negotiations in the global marketplace is the area known as intellectual property. New grapevine varieties or grapevine selections made unique by the application of molecular biology technologies can be viewed as intellectual property because new and improved plants are created by the focused attention of researchers applying both traditional and innovative scientific techniques. The improved grape selection or new variety is a product of this investment of intellectual effort. At this time, there are a number of ways to protect grapevine plant materials in the US, including various types of patents, trademarks, trade secret laws, and contracts [7]. More than one of these protections may

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be used for the same plant material under certain circumstances. We will discuss these different approaches to ownership of grape plant material, provide some examples of current practice, and consider some of the consequences of the increasing importance of proprietary plant materials in the grape and wine industry.

Three types of patents are used to protect plant materials: the Plant Patent Act (see <http://www.uspto.gov/web/offices/pac/doc/general/plant.htm>), the Plant Variety Protection Act (see <http://www.ams.usda.gov/science/pvp.htm>), and Utility Patents. The Plant Patent act was established in 1930 to protect plants which could be vegetatively propagated such as grapevine varieties and most other horticultural plants; this patent applies to traditionally bred scion and rootstock varieties as well as to new genetic sports which are sufficiently different in appearance to satisfy the legal requirement of the patent description process. This act did not apply to seeds, tubers, plant parts (like the fruit of a variety), nor the processes of genetic manipulation or biotechnology. The Plant Variety Protection Act was enacted much later by Congress in 1970 to protect crops which are sold and planted in each generation by seed, rather than by clonal propagation; unlike plant patents and utility patents, which are administered by the US Patent Office, plant variety protection is administrated through the United States Department of Agriculture (USDA). Although this act is not normally applied to grapevine plant materials, if a seed-propagated grape crop were to be developed, it could be used. Finally, utility patents can be used to protect a new variety which has been developed using novel or innovative technology. This type of patent has wide applicability; it could be applied to a gene used to transform a grapevine, to a grapevine with a new gene, or to the technical process which was used to create the new selection. Although utility patents have been in effect for many years, 1985 was the first year in which a utility patent was used to protect a plant cultivar or hybrid *per se*.

The owner of a patented plant might choose to license propagation of the plant and charge a royalty fee during the lifetime of the patent. Alternatively, the owner can also chose to exclusively sell either the patented plant or its product (a table grape variety or a new rootstock variety, for example), keeping control of a profitable product. The current term of a US plant patent is 20 years from the date of application. Plant patents are national or regional, not global, and separate applications must be made to provide protection in individual countries and/or regions. When the patent expires, the plant materials can be propagated by any rightful owner. However, if the plant material has never been sold by the owner, it is possible for that material to be exclusively owned indefinitely.

Historically, USDA plant breeding programs have been publicly funded, and the new varieties released from those programs have not been patented or made proprietary in any way. In fact, USDA has had a long-

standing tradition of making its improved selections available to all growers, both in the United States and internationally, in the hope of improving agricultural productivity around the world. However, in recent years, discussions have begun between the USDA and the California Table Grape Commission (CTGC) about the possibility of patenting new grape varieties. In the intensely competitive table grape industry, many growers feel that new varieties developed with both federal and CTGC funds should be patented to insure that industry investments in these new varieties are protected.

Trademarks are also being used at this time in viticulture, particularly to protect grapevine clonal selections. Grape clones cannot be patented. Patent law requires that a patented plant can be described as unique by objective criteria that goes beyond the ability of current technology to differentiate clones; the variation between clones of a given variety are extremely subtle, and there are no molecular probes that can reliably distinguish one clone from another of the same variety. In addition, many important grape clonal selections have been distributed extensively around the world; one requirement of patent law is that until a patent is complete, the owner maintain control of the plant material. Therefore, a number of public and private institutions which distribute grape clonal selections of classic varieties have chosen to trademark their grapevine selections. A high-profile example is the trademark established by *Establissement National Technique pour Amélioration de la Viticulture (ENTAV)*. ENTAV has coordinated the international marketing of French clonal selections under the trademark ENTAV-INRA® [2]; these clones are entering the US as proprietary selections to be exclusively distributed by ENTAV's US partners.

Plant material can be protected as a trade secret. Trade secret laws are governed at the state level rather than the federal level and, therefore, vary from state to state. If plant material is to be protected under these laws, distribution must be absolutely controlled by the owners. Any lapse in control may result in the loss of trade secret status.

Finally, when a contract is used in the sale of plant material, that contract may limit the propagation or distribution of the plant material. A number of nurseries routinely restrict propagation of the grapevines they sell by the grower who purchases the plants. This is a strategy which is intended to keep selections exclusive and maintain a niche market. Like trademarks, contracts are most often used to maintain ownership in those cases where patent protection is not applicable. FPMS user fees (\$.02 per unit propagated from FPMS stock) are also enforced through contracts. In this case, propagation is not restricted, but the contract ensures that funds will be returned to the program based on the utility of the grape selection to the buyer; the more vines propagated by the new owner, the proportionally higher the fees returned to the originating program.

Changes in Funding for Agriculture

In the United States and many other countries, agricultural research and agricultural programs have long held a special status in society as an essential part of a healthy national economy. This special status has weakened as agriculture increasingly is seen as an industrialized part of the economy and as less of the population lives in a rural environment [13].

In the specific case of grape plant materials, there have been consequences of this changing status of support funding for grapevine plant materials programs. In the case of FPMS, the University of California provides administrative guidance, a community of talented scientific cooperators, and infrastructural support. The federal government provided funding for the construction of current facilities. However, each of the FPMS crop programs is required to be self-supporting in terms of income; no California state funds nor federal funds are available for the FPMS crop programs. The grape program is supported entirely by industry (predominately Californian) through income from sale of plant material, from FPMS grape program user fees, and from grants made by industry groups benefitting from FPMS programs. Prices charged for propagating materials and custom services reflect the high cost of establishing, maintaining, and documenting an elite collection of vines. This is in contrast to years past in which both the University and USDA were able to provide significant support to these programs [4].

The situation is even more bleak in some other grapegrowing countries. Successful public quarantine, virus testing, and certification programs have been either eliminated or reduced in scope in some grapegrowing countries of the world, including Australia, Canada, Israel, New Zealand, and South Africa. Many of those countries are now looking for a means to provide these lost services through public/private joint ventures. However, in the interlude, they are often dependant upon the availability of grape nursery stock from other countries' programs. If they also have strict disease quarantines in place, this can greatly limit the grape nursery stock that is eligible for import.

One result of the loss of these grapevine clean stock programs has been a significant increase in requests from foreign countries to FPMS for California Foundation stock. Some countries are using FPMS as a primary source of new varieties and clones. In consultation with advisors, FPMS has instituted a \$2000 per selection surcharge for providing grape materials to foreign countries; a credit is that amount is then applied to any future user fees the buyer may owe. This provides overseas growers access to the public grape selections at FPMS for a fee which insures that California's nurseries and growers are not carrying the expense of the grape clean stock programs for other countries without a fair return to their program.

Techniques for Determining Grapevine Identity

Ampelography is the science of identifying grapevines: species, hybrids, and varieties. There is no other horticultural crop of sufficient significance and diversity for an analogous field to have developed. For *Vitis*, specialists throughout the world have been called upon to describe, catalog, and compare grape selections, ancient and new. This is a well-developed field with a fascinating history [10].

Until recently, ampelography has been based on the physical characteristics (or phenotype) of the variety under study. Characteristics like shape, color, size, texture, and growth patterns of leaves, shoot tips, flowers and fruit, the architecture of bunches and the vine, the taste and smell of fruit have been extensively documented. However, some of these characteristics vary significantly with site, especially as selections move far from their original home to find their way into new soils and climates. Diseases, especially grapevine viruses, can also affect appearances. Further, although excellent texts exist in the field [3], very few competent ampelographers are comfortable identifying varieties strictly on the basis of a written description. A working familiarity with a variety or species throughout the seasons, over a number of years, is the ideal training for this field. As a result, the grapes of each region of the world are best known by specialists working in that region. If we could hypothesize a "global grape repository", it would require the attention of numerous traditional ampelographers to assure the accuracy of the identification of accessions. And even with this expert attention, given the huge number of local names or synonyms given to a single variety, the cases where different varieties are known by the same name in different locations, and the similarities between many grape varieties, there would certainly be some cases of disagreement among the experts.

In years gone by, great efforts were made to certify selections in the program as "true-to-type". As the challenges of objective ampelography have become clearer, we now work to provide "professional identification" of our vines. This means that we provide customers with the results of inspections by consulting ampelographers and keep records of each professional's evaluation. Where there is disagreement about selections regarding naming or identity, we provide that information as well. The collection at FPMS has been examined by both local ampelographers and guest ampelographers from around the world. For the last decade, Dr. Andrew Walker, UC Davis VEN, has taken a special interest in coordinating the professional ampelographic identification of the selections in our collection.

This area is undergoing a revolution due to the development of new molecular techniques for objective determination of identity (Meredith, in press). By using DNA-based techniques, it is possible to identify grape varieties in an objective, unambiguous way, comparing vines in widespread locations to respected interna-

tional references. Since this idea was proposed [12], it has been enthusiastically supported by the grape genetics community, and DNA profile data has been shared by teams of scientists. Dr. Carole Meredith, UC Davis V&E, is a leader in this area; she is coordinating DNA profile documentation for the FPMS grapevine collection with the support of nursery industry funding.

This technology is now available in private and public laboratories throughout the world. It can be used by growers, nurseries, wineries, and researchers alike. For the first time, questions that arise regarding the correct identity of vines, rootstock and scion, can be answered quickly and effectively whether in collections, in vineyards, or even in the marketplace, since fruit can be tested as well. It is easy to predict that this powerful technology will have a profound effect upon the availability of accurately identified grape plant materials around the world. As the database of DNA profiles for grapevines grows, individuals will be able to obtain objective, reliable reports on the identity of virtually any grape selection.

Disease and Pathogen Detection

The last 20 years have also seen a revolution in the technology which can be used to detect the pathogens associated with grapevine diseases [8]. This technology has a direct impact on the ability of grape growers to move grape plant materials quickly around the world, while minimizing the risk of spreading disease. In addition to slow biological tests for disease or laborious culturing and identification of the disease organisms, it is now possible to use sensitive laboratory tests for detection of virus, fungi, and bacterial pathogens. For example, polymerase chain reaction (PCR) tests are now being used to detect many grapevine viruses diseases in new accessions and selected vines in the FPMS foundation vineyard [11]. The PCR test can be substituted for some biological tests which can require up to 3 years to complete [See Martelli, this proceedings, for a review].

The main focus of PCR testing in grapevine plant materials programs to date has been the viruses which are often the focus of clean stock programs and quarantine programs. However, PCR tests have been developed and used around the world which will detect the bacteria which causes crown gall disease, *Agrobacterium vitis*, and Pierce's disease, *Xylella fastidiosa*, as well as the phytoplasmas which cause flavescence doree and grapevine yellows. These tests should also be useful in facilitating the safe movement of grape plant materials around the world.

As in the case of molecular techniques for grapevine identification, this technology is now available to individuals, allowing them to insure that the grapevine nursery stock they purchase is at the expected phytosanitary level. Quality control testing for virus infection of nursery materials can now be done for vines anywhere in the world within a matter of days.

International Trade in Grape Nursery Stock

As a result of the international character of the grape and wine industry, news about desirable new varieties, rootstocks, or clones spreads very rapidly. Where a single producer might create a unique product from a new or neglected variety, very little time elapses before growers or winemakers in other countries are planning to try the same materials in their vineyards and are working to insure that they have access to the same planting stock.

The speed with which selections can move around the world depends upon a number of factors. Some grape plant material is proprietary, protected by patents, trademarks, contracts, etc. as discussed earlier. For this material to become available, a business relationship must develop between the owners of the plant material and the new grower. When plant material moves between regions and between countries, phytosanitary laws and quarantine laws may apply that slow down the release of a new selection. And, in some countries, new varieties must be extensively tested before they can be authorized for planting.

Phytosanitary and quarantine regulations restrict the movement of grape nursery stock into most countries. These regulations attempt to prevent the importation of exotic pests and pathogens into pest-free areas and to limit the distribution of economically important pests and pathogens that might be under domestic control programs. Quarantine regulations for *Vitis* are highly variable between countries. Some of the reasons are historical, but in general, new grape growing regions have fewer disease and insect problems than the older grape growing regions. These new regions are more likely to attempt to protect their industry from the inadvertent introductions of exotic pest problems from older grape growing regions. Some of the strictest regulations in the world for *Vitis* are found in Australia, Chile, New Zealand, South Africa, and the United States; in these countries, importation may take years. However, the relative health and freedom from pests that vineyards enjoy in these regions is reasonable compensation in the eyes of most viticulturists. Another factor faced by international traders in grape plant materials, beyond the variation in the regulations themselves, is the uneven enforcement of existing regulations. Two countries might, in theory, have identical regulations when, in fact, grape nursery stock would move freely into one country and the identical stock could not enter the second country.

International Trade Regulations

In this climate of globalization, recent changes in international trade rules may have long-term implications for the US grape industry [5,6]. In the wake of the North American Free Trade Agreement (NAFTA), and the development of the World Trade Organization (WTO), long-standing global trade practices are coming under new scrutiny. In the US, voluntary state certification programs, in combination with strict quarantine

regulations, have resulted in high quality grape nursery stock with a minimum of regulatory infrastructure. However, as regional organizations like NAPPO (North American Plant Protection Organization) and international agencies like the FAO (Food and Agriculture Organization) of the United Nations work to harmonize standards for the movement of plant materials internationally, a more formal, coordinated national and international system may need to be considered for the US to insure that growers and industry are protected from non-quarantine, damaging diseases which can be transmitted with nursery stock by measures that will survive international challenge.

A national program of regulation, either through mandatory certification programs or official control programs for target diseases for each commodity, could allow classification of these economically important diseases as regulated non-quarantine pests, according to international guidelines. State or domestic regional regulations might also serve this purpose. By establishing domestic regulations, only imported nursery stock meeting high standards of freedom from specific domestic diseases could enter the country. However, the idea of a national mandatory certification program has no existing model in the US. Many nurserymen and growers find the idea intrusive and contrary to American ideals of free choice, trade and competition. Further, any program would require funding to enforce; this could come from industry, state, or federal funds, but it is likely to be far more expensive than our current exclusionary system. Discussions are just beginning among grape growers, scientists, and regulators about similar possible actions.

Although it might be a number of years before a change in our current practices is forced by either a WTO challenge or changes in US regulations as a result of international agreements, it would be wise to discuss issues, solutions and implementation before that time comes.

The Future

The story of grapevine plant materials today is one of the ongoing change which is necessary to keep up with the fast-moving scientific community and global economy. A look at the types of new materials at Foundation Plant Materials Service gives a good perspective on the many considerations that are needed to plan for a strong, healthy grape and wine industry. Since the FPMS Grape Importation and Clean Stock Facility was completed in 1994, introduction of new selections has accelerated dramatically in recent years in order to keep pace with industry demands. From 1995 to the present, over 440 new selections have been acquired, and a large number of them have since been made available to industry, with the rest at various stages in the quarantine process. These new selections include proprietary selections protected through all of the legal avenues discussed in this article. But, in addition, many of these new selections are entering the FPMS public program and are available to the public at large.

FPMS is strongly committed to insuring that its public grape collection is at the highest possible level in terms of professional identification, phytosanitary status, and diversity. FPMS has been able to acquire new public grape materials was through the use of exchange agreements. Often this is a simple, practical way for two government programs in different countries to improve the collections of both countries. In the future, variations of this type of agreement will be used whenever possible to obtain important materials.

There is also valuable plant materials exploration to be done in California. FPMS has worked with researchers, viticulturists, and winemakers around the state over the last decade to improve the public collection by bringing California heritage selections to FPMS. These are field selections that have been made popular by winemakers over the years in California, but have never been checked for virus or sold as certified selections. Many of these heritage selections are virus infected, so therapy is underway to produce healthy selections for release to the public. To date, this heritage collection includes well-respected field selections of Cabernet Sauvignon, Chardonnay, Pinot Noir, and Merlot. Of special interest to industry, Dr. James Wolpert of the UC Davis VEN, working with Extension Specialists and Farm Advisors around California, has created a heritage Zinfandel collection. He is working with FPMS to insure that these selections will be available as certified stock as soon as possible.

The high value of grape plant materials, the competitive nature of the grape nursery business, and rapid globalization of the grape and wine community have resulted in some fundamental changes in the availability of grape selections, varieties, and clones. This process has been facilitated by important technological advances in the areas of grapevine identification and disease detection. New issues of plant ownership, international regulations, and biotechnology will have a powerful effect in the years to come. For all of us involved in grapevine plant materials, these are interesting and fast moving times.

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