An Overview of Licensing New Varieties

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Plant Patents

When new plant varieties are developed in the United States, the breeder or whomever the breeder works for or did the breeding on behalf of, will often apply for a plant patent. Plant patents are intellectual property rights that can be granted to anyone who invents or discovers and asexually reproduces a new, distinct variety of plant, such as hybrids, mutants, or cultivars — except for tuber propagated plants such as potatoes. Plant patents are good for 20 years and prohibit anyone from asexually reproducing, selling or using the plant without permission from the patent holder.

Plant patent rights are recognized internationally under World Trade Organization agreements whereby members agree to provide protection for plant varieties. Although plant patents are unique to the U.S., most other countries protect breeder's rights through plant variety protection laws, which are equivalent to plant patents internationally.

Importantly, plants must be able to be asexually propagated to be patentable. Asexual propagation creates genetic clones of a plant by methods such as cuttings, grafting or tissue culture. In contrast, sexual propagation through seeds, resulting from the pollination and fertilization of flowers, produces offspring with unique genetic characteristics, which are therefore not patentable since the traits that made the parent plant unique are not maintained in the next generation.

Plant Breeding and Patents

Plant breeding is conducted either privately or publicly. Private breeding programs are conducted by private individuals or, more commonly, by private companies. Driscoll's breeding program for various berry crops is a good example of a private breeding program run by a company. Rudolph Hass's namesake avocado variety is an example of a private individual holding a plant patent. Public breeding programs are usually run by public universities or sometimes other institutions such as botanical gardens.

Private breeding programs often (but not always) keep their patent protected germplasm for their own use or for use by their contracted growers. The patent is used to prevent anyone from outside the company from growing their unique varieties so they can have a market advantage. In contrast, public breeding programs often make their germplasm available to anyone ("public") who is willing to sign a license agreement to use the patented variety. In both cases, plant patents are being used to make money — for private programs by keeping close control of the patented plants and for public programs by charging licensing fees and royalties to whomever wants to grow their patent-protected varieties.

Often plant patents filed by public universities are owned by the university itself and the breeder or breeders who developed the specific variety are listed as inventors. In some cases, universities will create non-profit corporations to own and manage varieties developed by their plant breeders. For example, the University of Florida created Florida Foundation Seed Producers, Inc., which is a direct service organization of the university, and owns all the patents for germplasm developed by the university's numerous breeding programs.

Funding Support for Breeding Programs

Usually, those absent from ownership of plant patents are organizations who provide funding support to the university, such as the California Avocado Commission. This is often for two reasons. First, the funding agency usually only pays a small percentage of the actual costs of a breeding program. For example, greenhouses, electricity, tractors or other farm equipment, land, and the breeder's salary and benefits are

usually paid for by the university as part of operating expenses or overhead, i.e., the indirect costs of the research. In California specifically, agricultural commodity boards, like CAC, are exempted by the state from paying the University of California for overhead. Thus, when CAC was funding the avocado breeding program our costs were for direct expenses — potting soil to germinate seeds, irrigation costs, pruning and maintenance of breeding stock, travel to and from field locations, etc. Significant costs no doubt, but they are not anywhere near the full cost.

Second, funding agencies usually relinquish their rights to own intellectual property developed with their funding, including plant patents. This is often in recognition of the costs paid for by the university as well as the recognition that managing intellectual property is a specialized job that is often beyond the ability of a funding agency. In the case of CAC specifically, the research agreement that was renegotiated with the University of California in 2011 specifically states: "All rights and title to discoveries or inventions arising from the University's performance of the Project under this Agreement shall belong to the University." That said, funding agencies will often have understandings with universities that provide them with favorable terms to license any intellectual property developed with their funding.

Licensing and Royalties of Varieties

Again, the purpose of plant patents for a public breeding program is to generate money. Money is generated by issuing licenses that allow individuals or companies to propagate and grow the patented variety. Typically, a licensee will pay a fee for the right to the license and then pay a royalty for every plant propagated under that license. Depending on the plant, royalties can be a few cents per plant for something that will be propagated millions of times (e.g., poinsettia cuttings) to a couple of dollars per plant for a perennial tree crop that may only be propagated a couple of hundred thousand times during the life of the patent. Sometimes, an additional royalty fee may be imposed on production (volume or pounds) of specific crops (e.g., a royalty per harvested stem of cut roses).

Historically, in recognition of the various commodity boards' support for breeding programs, the University of California would not charge a licensing fee to nurseries in California to propagate their patented plant material. Instead, they would only collect the royalty, often at a reduced rate, for each propagation. They would look to make the bulk of their money from other states and international license agreements.

Licenses and royalties can be huge money makers for universities. And in the best examples, the breeding programs become self-sustaining from the royalty stream. The University of Florida blueberry and peach breeding programs are excellent examples of this. Both of those programs generate enough revenue from royalties to fully support their continued breeding efforts with no external funding.

University of California's Plant Breeding Model

Unfortunately, the University of California has not adopted a model that directly returns revenues to support continued breeding of the plant that generated the revenue. Their model allocates net income into a 35% share for the inventor(s), 15% for campus research, and 50% for the campus "general pool." Specifically, the 15% research share is designated for research-related purposes on the inventor's campus. Depending on the campus administration, some portion of this 15% may be returned directly to the breeding program. The remaining 50% general pool share is used to cover the costs of the technology transfer office, with the remainder used for discretionary research support at the chancellor's discretion.

Under their model, it is in the University of California's best interest to sell as many licenses as possible and/or encourage as many propagations of a plant as possible to generate the largest revenue stream. How they go about this varies depending on the crop, but they often partner with entities specifically set up to manage varieties. For example, citrus varieties like the 'Gold Nugget' and 'Tango' mandarin are licensed to the New Varieties Development and Management Corporation (NVDMC) for the U.S. and to Eurosemillas, S.A. for overseas management.

Historically, there wasn't much concern about who controlled the licenses for the avocado varieties since the program was not very productive. In fact, the University of California, Riverside's avocado breeding program website (https://avocado.ucr.edu/) lists 114 avocado varieties in their collection, only seven of which are credited to the University's breeding program: GEM, Gwen, Harvest, Holiday, Lamb Hass, Sir-Prize and Whitsell. And of those, only Lamb Hass and GEM have seen any level of commercial success, but not until their patents had nearly expired, which happened in 2015 and 2022, respectively.

The avocado rootstock breeding program has not performed much better. To the author's knowledge, the University of California has only released three avocado rootstocks, Steddom, Uzi and Zentmyer. Their patents expire in 2031 (Steddom) and 2032 (Uzi and Zentmyer) and to date they have only seen moderate adoption in California.

Evolution of Commission Funding Related to Avocado Breeding

In 2017, it was determined that CAC had spent $8.3 million since 1991 on the avocado breeding program for very little return (see "Avocado Breeding Program Continues to Evolve" in the Summer 2017 issue of *From the Grove*). Thus, the decision was made in 2018 to discontinue funding the va-

riety breeding program all together. This would allow funding to focus on rootstock breeding, which is arguably more critical to California avocado growers given Phytophthora root rot and salinity issues. Dr. Patricia Manosalva was hired in 2015 to take over the rootstock breeding program, and since that time CAC has provided Dr. Manosalva with more than $1.9 million in funding for the rootstock breeding program. Despite promises that several selections that have been lingering in the program for decades would be released, for the past five years no additional rootstock varieties have been released by the university. Thus, rootstock breeding funding was discontinued at the start of the 2025-26 CAC fiscal year.

When CAC decided to pull funding for the variety breeding program in 2018, the university developed a proposal looking for new outside funding, which was reviewed in the article "The University of California Avocado Breeding Program" in the Fall 2022 issue of *From the Grove*. Briefly, the university tried to put together a consortium of California avocado growers and handlers to provide $1 million of funding annually for 10 years. When this failed, they began searching outside of California and eventually put together a deal with Eurosemillas for $2.25 million total for five years — far less than their original ask — and developed Green Motion to license and release avocado varieties and rootstocks developed by the UC breeding programs around the world. What has been released commercially since that agreement was signed? One single variety, Luna.

The Case for Not Funding Avocado Licensing or Breeding in the Future

That original five-year agreement with Eurosemillas is nearing its end. Should CAC or the California avocado industry in some way try to step in and negotiate a master license with the university? To what end? To try to control the market for fruit from any new varieties? To try to recoup the investment that California growers have made in the breeding program?

Plant patent rights, the legal basis for licensing varieties and rootstocks, only control genetic material and prevent propagation without the patent owner's permission. Since avocados, and most other crops, cannot be clonally propagated from seed, the fruit is not controlled by plant patent rights. In fact, some years ago the University of California tried to claim that their international licensing agreements for GEM precluded California-grown GEM fruit from being exported, as this would violate their international licensing agreements. CAC pushed back on this assertion and demanded the University explain the legal reasoning for this claim. After much back and forth, the University finally acknowledged that their license agreements could not restrict the trade of GEM fruit.

There is one major exception to this generalization and that is citrus. Seeds of citrus fruit (and a very few other species) are polyembryonic, a process whereby seeds contain one sexual embryo and multiple clonal embryos that are genetically identical to the mother plant. Often in citrus, the sexual embryo is aborted, thus the seedlings that grow from a citrus seed are genetic clones of the mother tree. For this reason, it may be possible for plant patent rights to be used to control citrus fruit. Otherwise, the shipment and sale of fruit is largely regulated by national and international laws of commerce.

Additionally, if licensing agreements were used to try to restrict fruit sales, this would largely take away the incentive for anyone to pay to license a variety of avocado. The United States and Mexico are the world's two largest markets for avocados. If licensed fruit is restricted from either or both of those markets, there would be little incentive for anyone to pay the costs to grow a licensed variety.

What about keeping new varieties exclusively for California growers so they have a unique product to sell that Mexico, or other importing countries don't have? Crop estimates for 2026 indicate that 94% of the crop is estimated to be Hass, 3.3% of the crop is estimated to be GEM, 2.4% is estimated to be Lamb Hass, and less than 1% for all other varieties. Lamb Hass has been available for 30 years and GEM has been available for 23 years and they are still just a tiny portion of production. Bringing new varieties to market is a slow, arduous, and costly process. Not to mention, if varieties are kept out of the world market, all the licensing costs and royalties will need to be paid by California avocado growers because the university still wants to make money.

In an industry where growers normally keep trees for 30, 40 or more years, there is no model by which avocado licenses make money within the life of the patent. Avocado breeding, not just in California but worldwide, is an excruciatingly slow process with far more failures than successes. Since 1982, the University of California has patented and released eight avocado varieties including Luna - arguably one of the more successful breeding programs in the world, and only two have seen any level of commercial success (Lamb Hass and GEM). That's an average of one variety every 5.5 years. However, there was a 20-year gap between the last two varieties — Harvest in 2003 and Luna in 2023.

In my opinion, it would be foolish for CAC or the California avocado industry to consider being the master licensee for University of California avocado varieties. The industry has heavily invested in avocado breeding for essentially nothing. That's a hard pill to swallow, but it is reality. Do I think it's good for the world avocado industry to be dominated by a single cultivar? No, absolutely not. The risks are tremendous, just ask the banana industry which is currently going through its second varietal extinction event due to Panama disease in the past 100 years. But that is a topic for a future article.