

College of Tropical Agriculture and Human Resources University of Hawai'i at Mānoa

Plant Licensing: The Development of University of Hawai'i–Grower Collaborations

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How to license plants to large foreign markets? It is a frequently asked question when I talk to growers about my Extension program. This paper describes the creation of an ongoing strategic collaboration between three Hawai'i growers and the Flower Research Institute (FRI) of Yunnan Academy of Agricultural Sciences in Kunming, China. These growers/breeders have been able to license five varieties for production, marketing, and sale of six million plants.

Like any business venture across countries, licensing plants is complicated and requires lots of patience. As illustrated here, in addition to procedures to be followed there are more strategic decisions to be made at every step: What market to target? What plants can be commercially appealing in that market? For how many plants and what quantity should the license be obtained? Are the breeders' rights protected? What are the import/ export restrictions? Is there sufficient technical knowledge (e.g., plant tissue culture protocols available and proven to produce plants that are identical and without mutations) and financial infrastructure (e.g., availability of payment options)?

To support the floriculture and nursery (F&N) industry, two statewide programs were developed, the New Plant Distribution Center (NPDC) Extension program that started in 2009 to develop alternative income-generation strategies for Hawai'i growers and plant breeders, and its evolution into the International Tissue Culture Network (ITCN) by 2012. This paper summarizes these programs from 2009 to 2016 and demonstrates the potential for passive income from plant licensing.

The Original Dilemma -

The Floriculture and Nursery Industry in Hawai'i The F&N industry in Hawai'i has been losing its competitive advantage in global and national markets for almost a decade (Figure 1) (National Agricultural Statistics Service, various issues). The industry is highly dependent on consumers' disposable income and the overall health of the economy. Despite a sluggish economy, there have been signs that the sector may recover. A portfolio analysis of Hawai'i's agricultural sectors found F&N to have desirable characteristics and outstanding contributions to the stability and growth of the entire agricultural sector in Hawai'i (Cai & Leung 2006). According to Cai, Leung, and Loke (2007) Hawai'i also has an aboveaverage revealed competitive advantage in the production of anthurium and cut orchids.



Figure 1. Hawai'i's floriculture and nursery industry, wholesale value.

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Hawai'i is a rich source of new ornamental varieties that are collected, bred, or created by growers and College of Tropical Agriculture and Human Resources (CTAHR) researchers. Every new product has its life cycle, which includes market introduction, growth to maximum sales, facing competition, then plateauing and declining in the market. Thus early major producers are rewarded with the largest market shares and profits. Every year, commercial growers from around the world travel to Hawai'i to collect new plants for their businesses. There are valid debates about breeders' rights after plants are sold. When Hawai'i growers sell novel plants they may forgo the opportunity to capture global gains because out-of-state buyers can multiply these plants on a large scale, over three to five years, and then release them to world markets to realize economic gains and to capture market share at competitive prices.

Growers' Needs

UH-CTAHR

In-depth interviews, two to three hours each, were conducted in the summer of 2010 with 33 growers in O'ahu, Maui, Kaua'i, and the Big Island. The results indicated that novel plants, marketing and promotion skills, and business-management skills were among their top needs. Even more alarming were their self-reported low profitability levels, which ranged between struggling and barely surviving. Causes were attributed to limited markets, high labor costs, high costs of inputs from a few suppliers, and price competition from rivals. In addition, they are unable to compete in international markets due to comparatively high production costs, slow production rates, and increasing shipping costs.

New Plants

Ornamental plant producers need a frequent infusion of new and unique varieties of plants in order to remain competitive. A strategic solution lies in innovation – the creation of unique, one-of-a-kind, new ornamentals that will be sought after in the markets. In the F&N industry, innovation is the engine of growth and competitiveness in global markets. New plants that are attractive, or that have new attributes, draw higher prices and can produce economic profit if growers enter the product cycle early.

NPDC was started in 2009 to improve the state's F&N industry's competitive advantage by strategically expediting new plant introduction, reducing produc-

tion costs, and facilitating the supply chain in local and national markets. The core strategies of the program included the following:

- New plants Receiving and selecting new suitable varieties with appeal to large markets.
- New technologies Applying updated plant tissue culture (TC) techniques or new protocols to achieve cost-effective commercial production.
- New markets Opening new domestic and international markets.

Forty-five plants were submitted to NPDC by eight growers and three CTAHR faculty for consideration as potential introductions to commercial labs. The TC labs' final selection was based on plant uniqueness and preferences of the Chinese market. A number of plants generated interest, including Nepenthes, orchids, and protea (Figure 2).



Figure 2. Sample of plants submitted to the New Plant Distribution Center.

New Technologies

Tissue culture was used because it produces high-quality plant materials that are true to type (i.e., identical plants without mutations) with lower cost of production and because it provides the ability to scale production. However, commercial TC production requires qualified personnel, facilities, and knowledge of specific micropropagation protocols. To develop new TC protocols requires even more trained and qualified labor, and sometimes years to optimize each stage of development. Micropropagation protocols vary depending on the particular variety. While some protocols might be useful across several varieties of the same species, particular varieties can be recalcitrant. In practice, commercial TC labs develop specializations in particular types of plants that they have the knowledge to propagate and avoid lengthy (i.e., difficult to clone plants may take three to five years) and expensive research and development.

The ITCN. By 2011 the limited availability of commercial TC in Hawai'i was evident. The ITCN program was created to meet the need for large-scale commercial micropropagation services as well as to open opportunities to bring Hawai'i's plants to mass markets.

ITCN is an academic–industry organization that facilitates submission, market testing, and access to commercial TC facilities and plant licensing. It is an implementation of pull-through marketing, a business technique that leverages skills and resources not easily available to plant breeders and gives them access to commercial micropropagation, promotion, and marketing in large markets via business collaborations (e.g., Armitage 2002, Kintgen, Krishnan, and Hayward 2013).

Why not have the TC cloning done in Hawai'i? There are only two small-scale commercial TC labs in Hawai'i. Commercial plant TC facilities in mainland USA, Asia, and South America are profitable thanks to their economies of scale, technological know-how, and proximity and access to large markets. While reduced costs of labor (i.e., one tenth to one half of those in the USA) allow China, Malaysia, and South America to produce and sell plants at cents per plant, USA facilities compensate through mass-scale production (4 to 7 million plants/year), innovative technologies, and unique plant varieties to remain competitive.

By 2012 five visits were made to ten labs, and verbal agreements were established to provide micropropaga-

tion services to Hawai'i growers based on their specialized plant knowledge. These are the labs:

- USA Mainland: Mt. Shadow Nursery, WA; Rancho Tissue Technologies, CA; and Agri-Starts, FL.
- Hawai'i: Chitose Hawaii TC Lab and Hawaii Agriculture Research Center.
- China: Shenzhen Nongke, FRI, Flora International, Guangdong TC Lab.
- Malaysia: TopPlant.

Plant Licensing. Getting to market first and in large quantities is vital for breeders to capture economic profits from their creations. Hawai'i's ornamental and foliage growers are limited by shipping costs to mass markets, high labor and input costs, and lack of commercial large-scale TC lab services. The latter is partly due to the fact that local markets are relatively small for supporting them.

In 2012, a deputy director and six researchers from the FRI of Yunnan Academy of Agricultural Sciences in Kunming, China, visited Hawai'i and met with three growers they selected based on interest in their plants. Drawing on previous industry experience, the author helped to negotiate licensing agreement and terms, and mediated establishment of a procedure to connect growers and TC labs (Figure 3).



Figure 3. Flower Research Institute meets with Hawai'i growers.

Three state-certified nurseries participated in the first meeting:

- A breeder/grower with a remarkable inventory of over 300 novel crosses of Nepenthes.
- A wholesale and retail orchid operator and breeder.
- An orchid breeder with hundreds of hybrids, owned and acquired.

Twenty-four varieties were presented, and FRI selected five for licensing with a target production of 6 million plants (Figure 4, Table 1). One year was required to complete the negotiations, identify payment methods, and address translation issues before the final licensing agreements were signed. Agreements allow for revisions and re-negotiations after three years or upon production of one million TC plants.

Licensing with a royalty framework allows growers to receive a smaller share of the sale of millions of plants in China instead of a higher share of limited numbers from direct sales domestically. This reflects a basic difference between applying conventional propagation to meet limited local market demands and large-scale plant TC production to meet mass markets. These initial case studies were structured as three-way collaborations between CTAHR, Hawai'i growers, and TC production labs (Figure 5).

Current trends in global business focus on development of value connections that capitalize on the strengths of regional economies, and integrate geographic and market information to generate revenue (Bhalla 2011, Porter 2008, Spulber 2007). In practice, global strategic collaborations only materialize after building mutual trust and when both parties benefit. The author provided seminars and consultations in China on plant TC for years prior to initiating a business relationship on behalf of Hawai'i growers.

TC Protocol Development. Nepenthes plants were the first group shipped to FRI. Unfortunately, the lack of commercially feasible TC protocols was an impediment to their TC production. FRI has invested resources in research and development for this plant and is also looking at alternatives including subcontracting to other labs that are knowledgeable about Nepenthes TC. Since TC protocols for commercial production of orchids have been developed and are available, no problems are anticipated in the massive production of the two orchids licensed.

New Markets

Why China? From a business standpoint, China's labs and markets appeared to be the most promising option due to market potential. Potential labs were investigated early in the process of forming the ITCN. Labs from Thailand and Malaysia indicated that 1000 plants were the maximum number of clones they would license from one plant; three USA labs set their limits higher, at 10,000 clones; but three Chinese labs set a minimum of 1 to 3 million clones.



Figure 4. Nepenthes and orchids licensed by Flower Research Institute, Yunnan, China.

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Plants

3

1

1

Production

3 Million

2 Million

1 Million

Nepenthes

Howeara 'Lava Burst'

Vuylstekeara 'Home Spun Sprite'



Figure 5. Strategic business alliance structure.

Overall, China is attractive as a global market for agricultural products (de Ridder et al. 2014). In particular, the ornamental plant sector in China has received government support and infrastructure investment and has relatively favorable production factors (Kargo, Mao, and Wang 2015). The Kunming province produces over half of the potted plants and flowers sold in China. Their government selected Yunnan to be developed into the largest flower production and export base and market trading center in Asia, during their 11th five-year plan, for 2006–2010 (Netherlands Agribusiness Support Office 2011).

The author has visited over 20 growers and TC labs around Guangzhou, Fushan, Shenzhen, Haikou, and Kunming, from 2009 to 2016. One trip was part of a Hawaii Trade Mission, but the majority have been invitations by Chinese academic organizations for the author to deliver seminars and workshops on plant TC.

Located in Kunming, FRI is a large flower research organization recognized for ornamental horticulture engineering, flower breeding and technology, and plant TC research. It maintains strong international research and development connections, such as with the China-Netherlands Flower Practical Training Center, and three very important marketing channels: the Dounan wholesale market, Kunming International Flora Auction Trading Co. (KIFA), and Yunnan United Floral Transport & Marketing Co. (FLY) (Ministry of Foreign Affairs of the Netherlands 2011, Food and Agriculture Organization of the United Nations 2011). In 2010 FRI



Figure 6. Flower Research Institute plant tissue culture facilities in Kunming, Yunnan Province, China.

opened a 30 million plants/year state-of-the-art plant TC lab (Figure 6), and it has since continued to build a production portfolio.

Licensing Business Model - Challenges

The strategic business collaborations between Hawai'i and China evolved gradually, and since this project was meant to be a proof-of-concept for potential licensing activities, neither the University of Hawai'i nor the author received any fees for coordination, advocacy, and TC technical support. However, a plant-licensing TC business model employing global business strategies has emerged from this work (Figure 7). A plant-licensing business derives revenues from fees. It receives new plants submitted by breeders and markets them to prospective commercial TC labs. It also assists or takes charge in negotiating contract terms, arranges for shipping of initial plants, and manages payment procedures and the overall progress of production and sale of plants over the following years. Breeders get licensing income, and commercial TC labs get new plants and the revenues from them.

Last year, the Office of Technology Transfer and Economic Development (OTTED) of the University of Hawai'i (UH) became interested in the potential of this project, and after a number of presentations it formally started exploring the viability of various forms of a licensing entity for the benefit of UH, the growers, the state, and stakeholders.

Plant licensing programs at the University of Georgia

Key Partnerships	Key Activities	VALU PROPOSIT	E TIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
 BREEDERS COMMERCIAL TC LABS TC RESEARCHERS 	 Plant Screening Marketing Contracts Key Resources Marketing & Sales Skills Funding For Operations & 	 FOR PLANT BREEDERS: GENERATE PASSIVE INCOME & OPEN NEW INTERNATIONAL MARKETS FOR TC LABS: ACCESS TO NEW PLANTS, & REVENUES 		 BUILD TRUSTING RELATIONSHIPS WITH BREEDERS & TC LABS CHANNELS TC LABS TAKE CARE OF DISTRIBUTION 	 BREEDERS COMMERCIAL, INTERNATIONAL TC LABS
	TRAVEL				
Cost Fees Must Covi Licensing Mana Including Trav	STRUCTURE ER OFFICE OPERATION, AGER, & MARKETING B EL	BUDGET —	 Revenue Streams Fees From Licensing Given To Breeders Fees From TC Labs For New Plant Introduction 		

Figure 7. Business model canvas for plant licensing to international tissue culture labs.

and the University of Florida, among others, have been successfully implemented for years with an emphasis on licensing plants produced by their universities. In this case, the emphasis was on having the University, through the role of international Extension, coordinate and facilitate the licensing collaboration between private growers and international labs.

As this was a first attempt, all parties involved characterized the process as prolonged and, at times, stalled. Patience and persistence were needed to overcome obstacles in translation, convey concerns, and find solutions. For example, an import/export company had to be found to handle the reception of plants in China, and other various issues arose related to shipping, import/ export procedures, plant handling, and payment methods. Lack of familiarity with tropical plants has led to some loss of plants in the colder conditions of Yunnan, and the lack of a TC protocol for Nepenthes has delayed mass propagation.

Two to four years were required from the initial meeting to the first payment to Hawai'i growers. This compensation helped them pay for exporting permits and shipping costs of plant materials. The licensing process has been initiated for three growers, but only one has shipped plant cuttings thus far. This was done intentionally to learn and develop shipment procedures. The other two growers are now applying for import permits from China. Three to five years will be required to evaluate the revenues from sales of these plants in China.

International Extension

Facilitating agreements in the best interest of both parties requires skills beyond the traditional role of educator played by Extension faculty. Bridging cultural differences and entering into a business agreement that is risky and necessitates trust from both sides requires brokering, negotiation, diplomacy, trust building, advocacy, sensitivity, and marketing abilities.

International Extension relies on the same basic principles and priorities of Cooperative Extension which are rooted in empowerment and community improvement by working and sharing together (see Selby, Peters, Sammons, Branson, and Balschweid 2005, Bates 2006, West, Drake, and Londo 2009, Henning, Buchholz, Steele, and Ramaswamy 2014, and Bull, Cote, Warner and McKinnie 2004). These are some of the principles applied in this program:

- The programs were designed to address the stated needs of growers, industry, and state.
- The approach was based on economic theory and research about global strategic collaboration.

- Stakeholders learned by experiential, participatory, interactive tasks while developing international business experience and a global perspective.
- Practical information was disseminated and led to adoption of new technologies and practices.
- The programs are contributing to improve the profitability and quality of life of stakeholders.
- The Extension member who led the effort used her own expertise to advocate, coordinate, and promote the success of the project.
- The programs are contributing to positive change around the world.

Future Collaborations and Co-Creations

Collaboration and co-creation are emerging new platforms for marketing and innovation in business. Opening emerging Chinese markets to Hawai'i growers/breeders while introducing new plants to China under licensing agreements is a feasible option to generate revenue for both parties. High shipping costs, limited local markets, and high production costs are working against a thriving F&N industry in Hawai'i, which makes this innovation even more attractive to plant breeders. Clearly this program has a limited impact on the industry, since it can only benefit growers/breeders of novel plants, not producers in general. Even though international collaborations can produce net positive income for the state and specific growers/breeders, its benefits to the overall industry would only be indirect.

The setup process was arduous, requiring flexibility, patience, and years of building trust and working relationships. As can be expected, there are no absolute answers, as it involves complicated issues across countries, but this work shows the potential for passive income from plant licensing.

Travel was necessary to open doors, build trust and confidence, and to discover facts in the national and international marketplace that can benefit the flow of trade in all directions.

These are some positive outcomes of this program:

- Exploration and expansion of Hawai'i's nursery products into new markets.
- Cursory competitive assessments were made available to further guide Hawai'i's nursery growers.

- Trade enhancement and support benefited Hawai'i's nursery industry.
- Barriers to trade were reduced primarily by knowledge acquisition, creation of contacts, and exploring the benefits of trade.
- The understanding of international ornamental markets was increased.
- Future opportunities to generate royalty revenue for CTAHR were identified.
- Export market information was disseminated among Hawai'i's growers and shippers.

The process may become faster although it will always be dependent on the availability of commercial TC protocols for specific plants. A few more years will be required to draw more general conclusions about viability, benefits and costs of licensing novel plants to commercial Chinese TC labs as a strategic business option for Hawai'i growers. This proof-of-concept for a variation of the university-industry business model highlights the important role of international extension professionals in developing global collaborations.

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