

SPECIALITY CROP BLOCK GRANT PROGRAM - FARM BILL

GUAM DEPARTMENT OF AGRICULTURE

FINAL REPORT

AMS AGREEMENT 12-25-B-1665

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In Vitro Propagation of Dendrobium and Phalaenopsis for Guam's local production.

Project Summary

Orchids represent the most highly developed family among monocotyledons with 600-800 genera and close to 35,000 species and Guam has a perfect climate to grow them. Beautiful orchids are also highly desired by 1.3 million Asian tourists per year who visit Guam. During their tropical vacation, they expect to find lush island vegetation that includes colorful exotic flowers.

Over the duration of this project we have developed a considerable production of *Dendrobium* and *Phalaenopsis* orchids in tissue culture. Local nurseries and the general public are able to purchase inexpensive disease-free varieties with several thousand available per year. At the same time Asian imports have been reduced and partially replaced by local production. At least five Guam residents (employed by the project) have developed the skills of tissue culture propagation, which has made them competitive on the job market. One former employee found a well paid job that directly utilizes these acquired skills. One entrepreneur is getting ready to start his own tissue culture lab and will support Guam's floriculture businesses.

Project Purpose

The main purpose of this project was to increase competitiveness of local nurseries to foreign imports and to develop a sustainable production of orchids on the island of Guam. Among the reasons for limited production of orchids on Guam was their health. Over last two decades Guam's Customs and Quarantine detected an alarming amount of orchid diseases. Surveys conducted indicated that the majority of imported orchids, over 70%, tested positively for harmful viruses.

Since 2013, local production (conducted exclusively by DoA with SCBGP grant) was practically disease free, which then gradually and significantly reduced number of diseased orchids in Guam nurseries. Continuous production and progressively declining imports will likely improve these conditions even further in the coming years.

Launching this project was possible because of earlier projects supported by SCBGP. This project used facilities, tools and equipment purchased from previous grants and its availability allowed DoA to continue work initiated by SCBGP years ago.

Project Activities

We have concentrated our efforts on the production of several of the most common varieties of certified, disease-free *Dendrobium* and *Phalaenopsis* orchids and we made them available to local nurseries. We propagated them *in vitro* in our tissue culture lab then out-planted them to nurseries before providing them to end-users.

For this project we chose two genera of orchids: *Dendrobium* and *Phalaenopsis*. *Dendrobium* was chosen because of the popularity of this genus. Overall, *Dendrobium* is the easiest to grow and maintain and they produce many long lasting blooming stalks, which makes them perfect for decorations and cut flower bouquets. *Dendrobium* can be propagated both vegetatively and from seeds, therefore we used both methods. Seed propagation was by far the most effective and starting the second year we concentrated most of our efforts on this type of propagation.

The choice of *Phalaenopsis* was related to its popularity and unmatched elegance manifested by long, arching stems with an abundance of flowers. *Phalaenopsis* has been the most fashionable orchid choice in luxury hotels, restaurants and other luxury businesses around the world. There are about 60 species and thousands of hybrids, ranging from classic white to jewel-like miniatures that bloom for several months.

In our lab *Phalaenopsis* clones were mostly obtained through *in vitro* node culture. This method gave far less plants than seed propagation (used for *Dendrobium*) but growing *Phalaenopsis* from seeds is extremely difficult.

Initially, we acquired *Dendrobium* orchids from Hawaii, Thailand and Taiwan. Alicja Wiecko traveled to a reputable orchid distributor - Waianae Nursery in Honolulu, HI. She selected and purchased over 100 plants of many different varieties of *Dendrobium* to be used for propagation in tissue culture on Guam. The health of all purchased and transported orchids was checked in the DoA laboratory. Unfortunately, most of them

were infected by viruses and had to be destroyed. Only about 20% were virus free and suitable for further propagation. Tissue culture propagation of these orchids resulted in about 5,000 seedlings. Many of them reached maturity and were distributed to Guam growers and some are still in the DoA nursery.

Another genera, *Phalaenopsis* was purchased from Taida Company in Taiwan. All 200 imported plants were tested for viruses. About 30% of the plants were infected by CYMV and 15% were infected by both CYMV and ORSV viruses. Again, all infected plants were discarded and only healthy plants were propagated in tissue culture. At the end of the project over 1,000 plants were still in the DoA nursery. Several hundreds were distributed to local growers, which increased their ability to compete on the floral market.

In 2015, we tried an additional source of Asian orchids that could be suitable for Guam. In March we ordered 24 flasks of *Dendrobium*, from Kultana Nursery in Thailand as well as 100 blooming plants. We found about 20% of plants infected by viruses but overall the imported plant material was of excellent quality. They propagated well on Guam and resulted in the creation of several thousand seedlings.

In addition to achieving all the goals of this project, activities performed at the lab helped us to acquire skills and substantial knowledge related to the successful self-pollination of orchid flowers. Although not planned, the acquisition of these skills can be considered an additional goal of this project. Initially, we crossed and self-pollinated about 60 flowers but only some developed seedpods containing useful seeds. We continually strived to develop and improve our techniques and we managed to overcome many challenges initially considered beyond our control. With improved skills, at each new production cycle we were losing fewer seedpods, and overall had more mature plants with flowers and consequently, with many more seedlings propagated *in vitro*.

Goals and Outcomes Achieved:

Project activities assured successful achievement of all four goals set up in the project proposal.

Goal 1) to increase the availability of local orchid production on Guam was not only achieved but exceeded expectations by about 1000 plants. Production of 50% more plants than previously anticipated 2,000 not only supplied orchids to existing nurseries but also resulted in the unexpected creation of numerous “mini nurseries” that suddenly gained access to healthy planting material distributed by Guam Department of Agriculture. Mini nurseries (exclusively orchid nurseries) became competitive to larger nurseries that still retained lots of diseased plants from previous shipments and struggled with contaminations. At least half (5) of larger nurseries changed their production profile to landscape or other flowers and abandoned orchid production. Lost orchid production was fully compensated by at least 10 very efficient mini-nurseries.

Goal 2) to produce orchids locally in quantities that would result in the reduction of imports from Asian countries was also achieved. It is difficult to document the magnitude of Asian import reduction (no agency collects these data) but Guam Customs and Quarantine told us that imports dropped immensely, by more than half. In the past years large number of shipments from Asia have been systematically confiscated and destroyed by Office of Customs and Quarantine. Sellers made up confiscation losses by price increases. Now, the emergence of cheaper and practically disease free orchids from mini nurseries do not allow for price increases which drives unprofitable imports out from Guam. That unintended but remarkably positive outcome resulted in even faster and more plentiful reduction of imports than previously expected. Five orchid nurseries had to change production profile but with the emergence of new type of mini-nurseries overall outcome was positive.

Goal 3) to train employees so they develop the skills of tissue culture propagation, which would make them more competitive in job markets, was also achieved and perhaps exceeded. Four technicians and at least 4 part time students acquired tissue culture skills that are unique on this small island. A recent position outside SCBGP and DoA requiring tissue culture expertise was filled with candidate who gained experience in our lab. Four students working with us part time were accepted to School of Pharmacy as well as research graduate programs in Australia, Philippines and the United States. Laboratory skills acquired on Guam benefitted their future education.

Goal 4) to create an opportunity to start businesses supplying flowers to hotels and florists was achieved but not yet implemented. SCBGP beyond a doubt created opportunities for the establishment of commercial labs. Two nursery owners showed serious interest in employing skilled technicians as well as learning techniques to grow orchids in vitro by themselves. They have spent many hours working and discussing expert issues with Alicja Wiecko and they are willing to open their own tissue culture laboratories. However, they are still working on a business plan and researching other economical aspects of this complex endeavor.

Beneficiaries

Nurseries

About 1,000 of *Dendrobium* and *Phalaenopsis* plants in mature stage became available to five commercial nurseries. In addition another 2,000 plants in less matured stages were distributed to ten newly created “mini nurseries” where they have grown them for profit and sell mostly on Saturday Farmers Market.

General public

Several hundred matured plants were used to decorate the Department of Agriculture during the annual Guam Organic Festival. Afterwards, these plants were distributed to over 100 volunteers who were involved in organizing the Festival. Similarly during University of Guam Charter Day orchids were used to decorate SCBGP display at

Collage of Agriculture. Banners, posters and flower arrangements presented our achievements to university students, employees and island visitors. After Charter Day orchids were distributed to volunteers involved in organizing UOG Charter Day.

Over the last few years, First Lady of Guam solicited our orchids to decorate Governor's House at Christmas and Easter. Governor House is open to the public with lots of individual visitors, school tours, etc. coming to admire Holiday Season decorations. Guam Department of Agriculture and SCBGP have been acknowledged on the list of donors and supporters.

Senior Citizens Women Club

A group of elderly Women on Guam (in Chamorro language called "Manamko") approached Department of Agriculture to help them in activities associated with their Orchid Club. SCBGP donated many orchids in various stages of growth (from seedlings to matured plants) to the Manamko Orchid Club and instructed women how to grow, propagate and maintain the donated plants.

UOG Students

Each semester, about 50 University of Guam students visit tissue culture laboratory conducting Lab activities for the Introduction to Agriculture course and Plant Science course offered by the Collage of Natural and Applied Sciences. For most students, it is their first contact with tissue culture plant propagation method.

Workforce

Several citizens of Guam acquired unique knowledge that has already enabled them to get a good-paying job, or gave them potential to find a job, or gave them helpful knowledge in their educational process.

Potential businesses

SCBGP created an encouraging environment to form the first commercial tissue culture facility on Guam. Adequate know how and a local skilled workforce is in place.

Lessons learned

Initially we anticipated a substantial enhancement of *Phalaenopsis* production on Guam. However, in constantly warm tropical climate these orchids are not growing well compared to locations experiencing cooler temperatures at night. Since the usage of air-

conditioning inside a nursery is economically not practical, *Phelanopsis* would likely be less competitive than other genera.

As we anticipated an influx of healthy orchids to the nursery holding many contaminated orchids, disrupts routine operations. Fertilization programs, disease control as well as insect control programs become inadequate for either old or new plants sharing the same physical space. It is a goal of the subsequent and already awarded SCBGP grant to eliminate all contaminated orchids from Guam's nurseries and keep all production entirely virus-free.

Other information.

Government of Guam Agencies selected SCBGP Orchid Project for the Guam Gubernatorial award as one of three most successful GovGuam projects conducted in 2015.