

**SPECIALITY CROP BLOCK GRANT PROGRAM-  
FARM BILL**

**GUAM DEPARTMENT OF AGRICULTURE**

FINAL PERFORMANCE REPORT

AMS Agreement 12-25-B-1456

Project Coordinator

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In-Vitro Propagation of Pacific island Crops for Guam  
Agreement 12-25-B-1456  
Final Performance Report  
11/18/15

## Project Summary

Yams, taro and bananas have been important staple crops in the Pacific Islands since the first inhabitants from Southeast Asia settled them thousands of years ago.

Yams and taro are valued root crops because they can be cooked in many ways and can survive the destruction of storms that may wipe out other crops. Bananas are popular worldwide and Guam is no exception. Bananas, both dessert and cooking types are an important part of local diet on Guam.

In 2012 we imported 14 varieties of disease-free, short-trellised and anthracnose – resistant yams from the SPC laboratory in Fiji. None of these varieties were available on Guam, so our goal was to propagate them in vitro to have enough plant material for distribution among local farmers and residents.

At the same time, we established twenty-nine varieties of taro in tissue culture, which were introduced to local people during workshops and at the Organic Festivals in 2014 and 2015. The most popular varieties were kept in vitro for further propagation and subsequent distribution.

Bananas remain the most important local crop on Guam. Over the three years of this project we were able to propagate 24 different varieties of bananas, most resistant to nematodes, Moko disease, Black Leaf Steak, Panama Wilt and Fusarium. All of them are maintained in tissue culture and most are still available in the DoA nursery. All new varieties in DoA banana collection were presented at a workshop during the University Charter Day. Officially, this project started in 2012 and will end in 2015 but banana cultures will be maintained in the tissue culture lab, in the nursery and in the field for many more years benefiting local population.

Guam is a relatively small place with limited local resources. Three separate projects that addressed propagation of bananas, taro and yams were initiated in the past and funded by SCBGP. They were successful, however needed follow up, some adjustments and further enhancement. This project allowed valuable previous work to be completed and resulted in substantial impact, especially in propagation of bananas. In addition, this project was even more efficient because it used facilities, tools and equipment purchased with funds from previous projects. Existing facilities, tools and equipment will remain available to conduct further projects that increase competitiveness of local specialty crops. Thanks to SCBGP, services provided by severely underfunded Guam Department of Agriculture increased remarkably. This tissue culture program was nominated for a Gubernatorial Award for the most successful programs across the entire Government of Guam.

## Project Approach

In 2012 we received 14 varieties of yams from various national and international sources. Four of them failed with 10 established in tissue culture and then planted in the field. In the subsequent years, five additional varieties failed and were eliminated from collection. In 2014 Guam experienced unusually high precipitation that destroyed a big part of the yam collection at the nursery. We had to build a plastic roof to protect the plants. Additionally, we experienced massive damage caused by wild pigs, which necessitated spending unbudgeted funds for fencing taro and yam plantations in order to prevent damage by wildlife.

Over the duration of this project, 29 taro varieties were propagated in tissue culture and in the field. All of them (corms and taro leaves) were introduced to the local people at workshop and the Organic Festival.

Similarly, during this project twenty-four varieties of bananas were produced in the tissue culture lab in large quantities. Unfortunately, cooking varieties were not responding so well to traditional tissue culture techniques and propagation was less successful. To compensate for this deficiency, seven new banana varieties were added to this collection at the end of 2014 from the new import received from Puerto Rico. Two of the varieties FHIA 01 and Lacatan from Puerto Rico were produced in the thousands as a special order from the two largest farms on Guam.

Occasionally, we had to modify the approved budget because of unanticipated new needs or reduced needs for previously budgeted expenses. For example, in January 2014 we requested \$6,633.00 to be moved from personnel and fringe benefits to the equipment category. We needed to purchase a shaker with a platform and flasks in order to speed up the production. In 2014 we requested permission to allow Ricardo Lizama to travel to the International Banana Symposium in Davao City, Philippines, held from 19-22 November 2014. In May 2015 we requested a permission to create a new budget category Contractual Services. Over budgeted funds of \$4,000 in the category Salary and Fringe Benefits allocated for Alicja Wiecko were transferred to Contractual Services without any change in the dollar amount. In the same month we have requested to move \$8,000 from Fringe Benefits Category to Salary Category because fringe benefits were calculated excessively for an employee with full benefits including expensive Government of Guam Retirement rather than part time employees with little benefits. In August 2015 we have requested another change in the budget by moving \$16,821.00 from Fringe Benefits category to Supplies category to keep up with the demands of this project. We also needed two new Glass Bead Sterilizers (previously unbudgeted) to sterilize tools for propagation of bananas and taro plants in the tissue culture laboratory. Because of high demand in production of bananas and taro plants we needed a new screen cage, greenhouse benches, pots, labels and sunshine mix to keep our whole collection of bananas and taro.

## Goals and Outcomes Achieved

- Over the last 3 years we have imported 14 new varieties of yams from Africa, Papua New Guinea and Vanuatu.
- Only 5 varieties, one from Africa, one from Vanuatu and 3 from PNG survived in tissue culture as well in the field. Many of presumably rust resistant varieties appeared not to be rust resistant in our climate.
- All successful varieties were cooked and tested among DOA workers. The response to the new taste was positive and many employees took yams to plant them in their garden or farms.
- We have discovered frequent necessity of protecting yams in the field from wild chicken and pigs. Special cages above the yams and fences surrounding plantations need to be built.
- We have established 29 varieties of taro and kept all of them in the nursery for the customers. Many were planted in the field, harvested and presented at Guam's Organic Festival. All taro corms were cooked and taste-tested by around 80 participants of Organic Festival. A taste survey was also conducted by 15 DOA workers. Results were published in local newspaper (Pacific Daily News) and online.
- The book and posters describing 29 taro varieties that was published during previous Taro grant award was printed again and distributed among people who showed interest of taro guide: [Guam Taro Guide](#)
- We also made a big taro banner and posters used at the Organic Festival and UOG Charter Day as well as other agriculture events (see attached "Taro varieties on Guam", and "Taro collage flyer" and "Taro corm tasting flyer")
- 24 bananas varieties were established in tissue culture and the whole collection has been kept in the nursery for people interested in planting them in their gardens or fields (see attached "Banana Flyers" file).
- Each banana variety has a flyer available to customers presenting valuable information regarding planting, taste, yield etc.
- 24 bananas varieties were planted at the DOA field (along with the taro and yam collection). Banana varieties will be maintained and used in newly awarded (2014) SCBGP grant.

In November 2014 Ricardo Lizama attended International Banana Symposium in Davao, Philippines. He attended presentations addressing two major banana diseases: Fusarium and Black Sigatoka. He learned about the new trends, opportunities and challenges for intermediate and small banana growers. He also visited Banana Farm rated the highest yielding banana plantation in the world.

Request to travel to the conference to Davao, Philippines was submitted to SCBGP and approved.

In collaboration with Guam's Cooperative Extension Service as well as local newspaper and local TV we made several announcements related to new yams, taro and bananas varieties available to farmers. We emphasized mostly the varieties resistant to diseases

and all varieties with exceptional taste and yield. Responses from farmers were mixed. Farmers were especially skeptical regarding yams and taro, in particular when grown in a big field. Most of Guam's farmers cannot manage extensive harm done by the wildlife on their fields. The number of wild pigs on Guam is high and pigs go after yams early after planting. With respect to taro, pigs find taro easily just before it is ready to be harvest. Consequently, in most cases, wild pigs damage plantations before any considerable crop can be harvested. Some back-yard growers indicated difficulties related to soil. Many say that taro and especially yams are not growing well in their coral type of soil. Taro is somewhat easier to grow in the back yard because it grows in relatively small and shallow beds.

Banana propagation and distribution to the local farmers and homeowners was the most successful. Almost every day we had people coming to our nursery to ask for banana plants. One of our biggest banana growers planted thousands of plants of the new varieties we recently brought to Guam. Unfortunately, when plants were fruiting in March 2015 the Tropical storm Bavi passed very close to Guam and his entire plantation was devastated. The entire 2015 was extremely challenging with 7 typhoons impacting Guam. Lots of days were lost preparing nursery and fields for approaching typhoons and again reversing the same steps after typhoons passed. Despite all these challenges:

We have distributed thousands of bananas plants and several hundreds of yam and taro plants to the public.

Overall, we have exceeded our goal to supply 10% of planting material produced in tissue culture. However, the distribution of our accomplishment was not equally divided. We have experienced quite unexpected success with bananas. Over the last several years at least 50% of new bananas planted on Guam originated from DoA nursery. They all have been produced by tissue culture lab funded by SCBGP. The goal to produce clean planting stock of disease resistant yams and taro plants (available to local growers) was not adequately achieved. It was impossible to overcome challenges related to disease outbreaks influenced by weather patterns, wild life damage, detrimental soil conditions, etc. All these resulted in diminished desire to cultivate yams and taro on a big scale on Guam. However some farmers and local homeowners who appreciated the new varieties of yams and taro may still maintain them but on much smaller scale and probably without making a big profit.

As previously mentioned, the goal to make clean planting stock of disease resistant bananas was not only achieved but also substantially exceeded. Despite somewhat discouraging results with yams and taro production, the most important and economically profitable banana production was very successful. In this particular project, knowledge and experiences were gained and hopefully will result in future progress on yams, taro and banana production.

## **BENEFICIARIES**

### **Farmers.**

Four farmers took 5,000 plants of new varieties of bananas and planted them in their fields. Three farmers took 200 yam plants and planted them at their fields. Two farmers took 800 taro plants and planted them in their fields.

Unfortunately, Guam Department of Agriculture does not monitor what crops and in what quantities have been actually planted. However, if farmers experience typhoon losses DoA is informed and help farmers with natural disaster compensation [Farmers' compensation moves forward - Pacific...](#)

### **Homeowners.**

Over 50 people got the new varieties of yams. They liked that all of them are disease free, resistant to anthracnose, short-trellised, which are perfect for their small back yard gardens. In addition, all new yams had completely different taste than the local yams, which was highly appreciated.

Over 100 people bought small quantities of banana plants and taro plants for back-yard farming. Information about their value is being exchanged among neighbors and typically large extended families, which has resulted in continuing demand.

## **LESSONS LEARNED**

We learned that local residents, especially farmers, are interested in opportunities to obtain new varieties, resistant to devastating diseases on Guam.

We observed that most popular local yams, taro and banana varieties are still their most favorite and they grow them despite losses and difficulties.

The massive problem with wild pigs stopped farmers from growing yams and taro on a large scale. In addition to the wildlife challenge, weather on Guam is unpredictable and typhoons can be catastrophic.

We learned that farmers and homeowners from other island such as Saipan, Tinian and Rota were interested in yams, taro and banana tissue culture propagation. They invited Ricardo Lizama for their local Annual Agriculture Exhibitions in Tinian in 2014 to present results of SCBGP project. Similarly, in 2015 Alicja Wiecko was invited to the island of Rota to give a presentation about benefits of tissue culture propagation.

We learned that most farmers and local residents are interested in growing many banana varieties but most of them will be reluctant to invest in yams and taro because of the risky outcome.

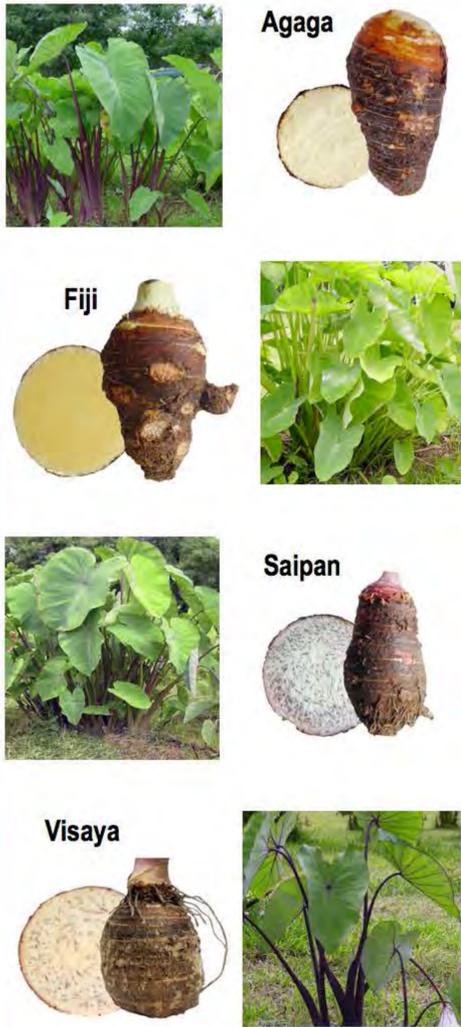
The goal of this project was not fully achieved with respect to yams and taro but with bananas was very successful.

In general, the lesson learned is that improvement is welcomed if gains are considerable. If gains are moderate or little, interest is limited.

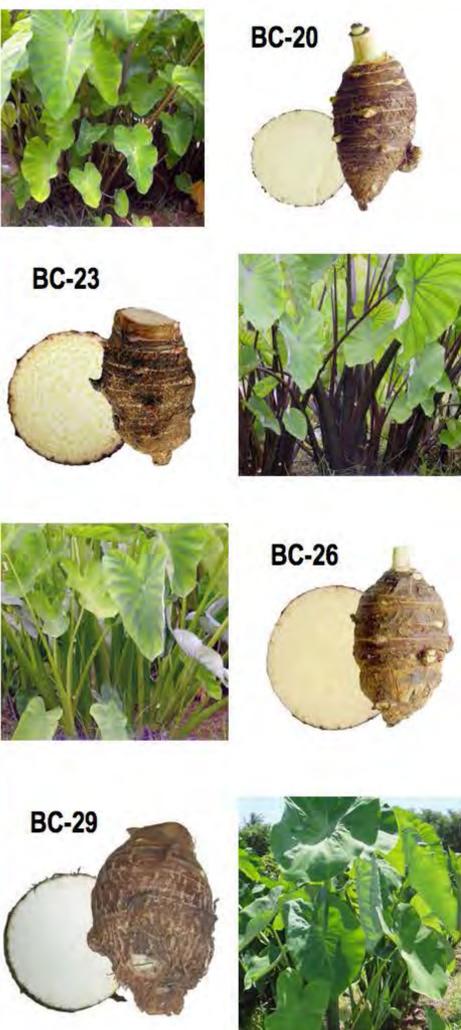


# Taro Varieties Available on Guam

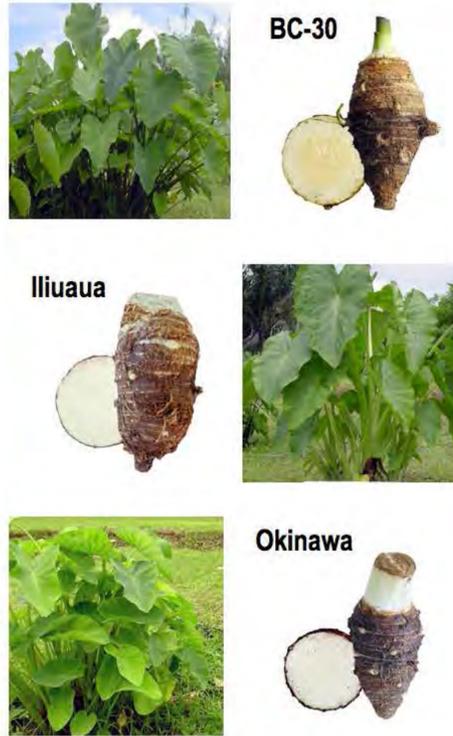
## Varieties from Guam



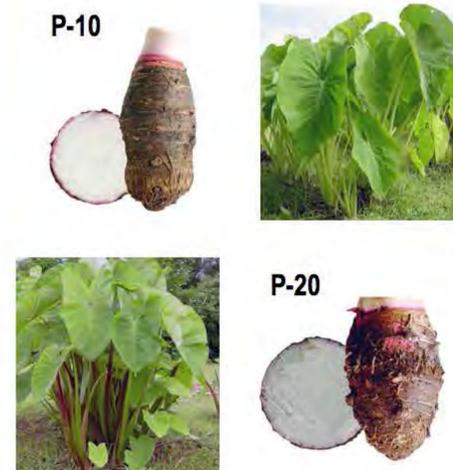
## Varieties from Hawaii



## Varieties from Hawaii



## Varieties from Palau



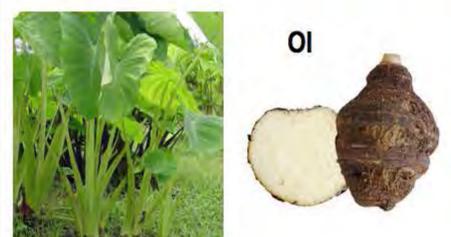
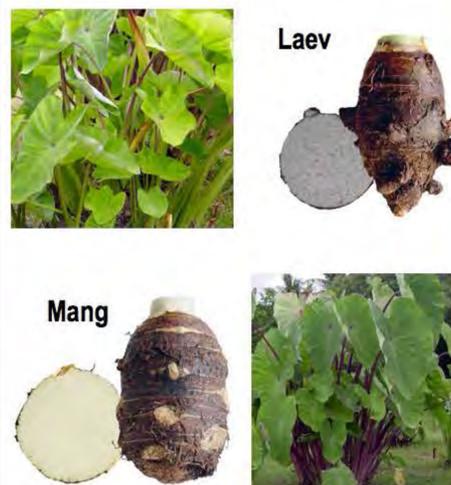
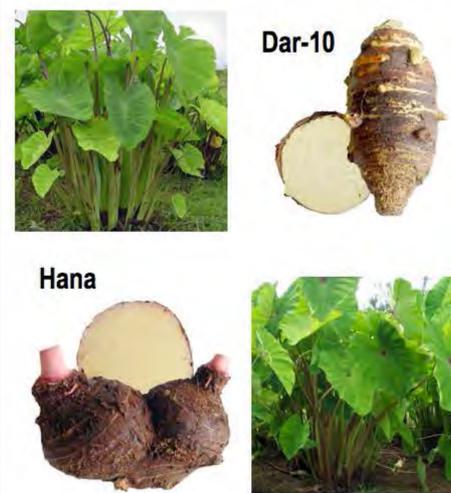
## Varieties from Pohnpei



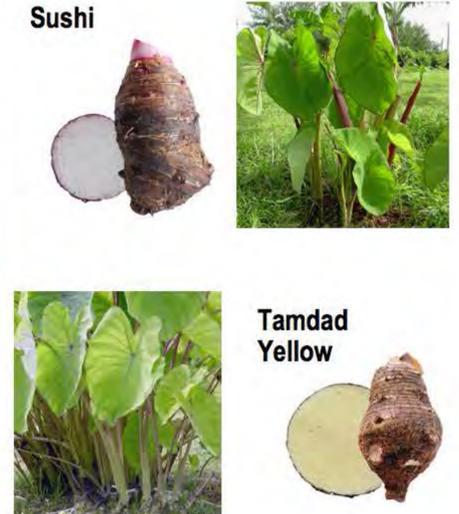
## Varieties from Samoa



## Varieties from Yap



## Varieties from Yap



## Taro

Taro, *Colocasia esculenta* (L.) Schott is also known as kalo, dalo, suni, sawan, malanga, dasheen, cocoyam, and many other names. It is a herbaceous plant with an underground corm producing several large leaves with long erect petioles.

Taro is mainly cultivated for its tubers that contain large quantities of starch and fiber. It is important to cook taro for the recommended time in order to reduce the amount of oxalates present in the tubers. Taro tubers are nutritious and contain considerable amounts of potassium, calcium, vitamins C and E, iron and are very low in fat.

Taro leaves may also be cooked and eaten as a vegetable. Leaves contain large amounts of vitamins A and C, fiber, beta-carotene, iron, folic acid and also proteins. There is ample evidence to classify taro as a HEALTH FOOD, especially beneficial when eaten on a regular basis.

Many varieties of taro from Micronesia and Hawaii are available at the Guam Department of Agriculture.

## Guam Taro Guide

Find the Guam Taro Guide on line at:

<http://www.wptrc.org/section.asp?secID=30>

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