



Open-pollinated Seed Production Training and Taro Breeding Training in Apia, Samoa

5 – 9 March, 2018 Millenia Conference Room, Sogi, Samoa

MONDAY 5 March, 2018

The Land Resources Division of the Pacific Community steps in to assist the Samoa Ministry of Agriculture and Fisheries once again in its efforts to effectively improve and sustain the open pollinated seed production for our local farmers.

The workshop was in response to a request from the government of the government of Samoa (Ministry of Agriculture and Fisheries – MAF) provide training on OP Seeds and also to support the ongoing efforts on the Taro Breeding Project in Samoa.

The Samoa Ministry of Agriculture in collaboration with the ACIAR Integrated Crop Management Team and the IntraAPP Pacific Agriculture Policy Programme are assisting Samoan farmers and extension officers to enhance their skills on Open Pollinated Seed Production, Pest & Disease Management, Soil Health, knowledge dissemination on Taro Leaf Blight (TLB) and Taro Breeding programme undertaken in Samoa.

The overall objective of the technical training was to strengthen the skills and knowledge of extension officers and lead farmers in order for them to provide training to their farmers on proper seed production, which will contribute to improving the quality of seed locally produce. This is a fundamental starting point for agricultural productivity, food security and post disaster recovery. The training assisted farmers to increase the production of their key target crops and better equipped to meet the quality expectations of vegetable and fruit market consumers.

The training commenced with a few encouraging remarks from the Chief Executive Officer Afioga Tilafono David Hunter and an opening prayer by Crops Division ACEO Afioga Moafanua Tolo Iosefa. As stated by MAF, CEO; “Locally produced seeds help farmers to decrease costs on imported seeds, enable fast and easy seed access, and increase capacity in seed production and save farmers from high costs.” In his speech, he also emphasized the upcoming South Pacific Games hosted by Samoa the coming year, to set as a goal for the local farmers’ harvestings and productions and to ensure that more money is spent on buying local produce than imports.

Before the conclusion of the speech by Tilafono, he voiced out a few requests for the Pacific Community staff for their consideration; harnessing this relationship, “Samoa needs support from SPC in terms of funding in order for the supply of more seeds and continue sharing resources amongst ourselves and also as we are now facing the critical weather conditions, new technologies such as tunnel houses and water irrigation are recommended and are encouraged for farmers’ qualitative production throughout the year.”

Forty participants attended the OP Seeds training and the Taro Breeding Training including some Farmers Organisations members from both Upolu and Savaii – Samoa Farmers Association, Samoa Farmers Incorporated (SFI), Savaii Farmers in Samoa (SFS) and staff members from MAF Crops Division, with the vision to build and enhance their capacity in producing Open pollinated seeds so that in return they can help train other farmers.

The first presentation was conducted by Tommy Tuuamalii, Principle Advisory Officer at Crops Division, Nu'u, focusing on the reality of the seed production in Samoa since 10 years ago highlighting some of the challenges that the Ministry of Agriculture and Fisheries (MAF) has been facing – for example, the limited availability of facilities for this purpose, lack of standard operation procedures in order to effectively produce good quality seeds, the seeds mainly used by farmers are hybrids (not true to type) and the limited availability of seeds after a cyclone or a natural disaster.

In this same session, the participants were divided into five groups to reflect on the different methods and ways that they are using for seeds production and what are some of the challenges and problems they are facing and some of the expectations that they are hoping to achieve, after being trained in this course. “We are lacking the support from the Ministry in terms of capacity building trainings to increase the knowledge of the farmers in certain agricultural methods.” shared Leaupepe Lasa, one of the farmers from Samoa Farmers Association.

The second presentation was facilitated by a member of the Pacific Community, Elenoa Tamani highlighting the standard guide and operation procedure in vegetables production enhancing the understanding of the farmers in this field. Ms Tamani said, the standard operation procedures should be part of the way forward or next steps by MAF'.

Field Visit to Nu'u Research Station

A field visit was part of the first day, where participants had the opportunity to visit the Chinese farm at Nu'u under the Chinese Samoa Agriculture Project. Participants learned about field selection, allocation, isolation for different open pollinated crops; specific crop characteristics that help determine the field site selection processes to maintain physical and genetic purity of the selected open varieties; roguing and pre-harvest selection for seed production. Later the participants visited the MAF Crops Division at Nu'u and had the chance to do on-hands activity on harvesting stages for fresh market and especially for seeds (physical and horticultural maturity); post-harvest selection of true to type characteristics (emphasized on the importance of knowing the characteristics); how to extract seeds from certain vegetables and fruits including tomato, capsicum, eggplant, pumpkin, pawpaw and cucumber – washing and drying of seeds before storage.

Method for extracting seeds, washing and drying

Tomato and Cucumber seeds were fermented for about 24 hours (to remove the gelatinous coat) before extraction and washing of seeds. Hydrochloric acid at 0.7% concentration can be used to remove seed coat quicker but not encouraged at the farmer level. Eggplant and Capsicum, which do not have a gel coat, were washed directly. Direct washing was also done for pumpkin and pawpaw seeds even with gel coats – different techniques, same principle.

Participants were advised on the different extracting methods for different levels/scales of production. The aim of the practical was to know the basics for seed extraction and then adapt as production scale expands in the future. Also to know which seeds need to be washed during extraction (of fleshy fruits) and those that go through direct drying (seeds of Brassica and pulpy crops normally do not need washing – go through direct drying).

The washing process was basically to ensure that any seed gel coat is removed and then rinsed repeatedly with water until all the flesh or seed coat is removed before drying seeds.

TUESDAY, 6 MARCH 2018

The second day of the training started off with a short reflection from the day before – based on the experiences of two farmers - Atinae Ata from Faleasiu and Line from Salelologa Savaii.

“Lettuce has a high demand in the Samoan markets and at the moment there is a limited supply of seeds and the high costs of seeds is not helping farmers at all,” Atinae shared. He also emphasized on his methods of extracting his seeds and that this training has enhanced his skills in effectively washing and drying and at the same time be mindful of the seeds viability.

“I produce my seeds by letting the fruit to rot, wash it once then dry it and plant later, but in this training I learnt that there’s more to the process to ensure quality seeds than just washing and drying once,” shared Line from Salelologa Savaii.

The first presentation of the day was facilitated by Samoa Farmers Association member, Leaupepe Lasa on the Pineapple farm in Samoa and her own experiences on the seed production as a seed supplier for certain local farmers. “SFA worked on Charlie Ah Liki’s pineapple and we prioritised our queen pineapple, the Fala Samoa experimenting and timing the growth hormone to ensure harvesting all year long,” Leaupepe stated. The consultation continued between the SFA member and staff of Crops Division capturing a lot of learning and some challenges that help improve the collaboration between the farmers and the Ministry along this continuum of agricultural growth.

Mani Mua of Pacific Community guided the participants through his presentation on the introduction to Rio Gold Seed Production program. Rio Gold is an open pollinated cherry tomato variety and was named by the Fiji Ministry of Agriculture (MoA) in honor of Fiji’s first ever-Gold Medal at the Olympic Games, in Rio 2016. It can be harvested at least 5-6 times and most interestingly, it is resistant to bacterial wilt and Fusarium wilt race 1. Rio Gold is also an indeterminate variety so farmers can continue to harvest for as long as they manage.

In his next presentation on Trade and Marketing, Mani highlighted the significance of farmers to know what is in demand and how it is very important for farmers to align themselves and their production plans to meet the demand in terms of quantity, quality and consistency of supply.

Advisory Facility Nu’u Research Station

The participants continued their lessons in extracting tomato seeds that were fermented the day before and left out to dry with other seeds. Participants took their seeds from the day before and applied further treatment for better quality. Seeds were spread out evenly to ensure they are uniformly dried before the treatment:-

- 1- Clorox Treatment (5% Clorox/ bleaching agent)
 - Ratio of Clorox to water is 1:4, that is one part Clorox to 4 parts water (1% Sodium hypochloride concentration).
 - Shake mixture with seeds to guarantee that all bubbles are removed so the solution thoroughly washes against the seeds for 2-4 minutes (it is advised to carry out this step at washing stage when seeds are still wet – just before drying).
 - Keep rinsing until the bleach smell is gone to ensure the chemical is removed
 - Bleach treatment is good but only takes care of any pathogens on the seed cover (disadvantage of this method is that some pathogens may have entered inside the seed and is not controlled with this method of seed disinfection.)

2- Hot Water Treatment (20 – 25 minutes)

- Keep water temperature at 50 degrees using a thermometer and the hand test.
- Use a small zip lock plastic bag to spread seeds evenly inside then roll the packet and submerge in heated water. Try to maintain temperature by adjusting heat.
- Leave seeds for 25 minutes at 50 degrees celcius or 20 minutes at 51 degrees celcius.
- Heat treatment is the best option hence as this method not only kills pathogens on the seed coat but within as well
- Most farmers do not have access to thermometer at home – the practical aimed at farmers memory by testing the heat of water at about 50 degrees to enable them to conduct seed disinfection without the need for high tech equipment. Every participant has a chance to dip their hand in the heated water and count until their pain threshold is reached at 50 degrees. Most participants vary in the count from 3-10.

Note: When drying, seeds should be stirred 2-3 times a day for uniform drying. Different seeds will dry at different rates. Tomato is normally sun dried 2-3 days at mid-morning and afternoons avoiding the extreme heat of the day at around 12-1pm. Participants were advised not to dry their seeds on metal or on high heat plates because it may fry the seeds and therefore lose the viability.

Rice can be added to the bottom of a container and then add seeds to remove any excess water from the seed to allow long-term viability of seeds.

A germination test was carried out after treating the seeds prior packing and storage.

For the germination test, a sample of seeds were selected at random were tested to represent the whole seed population. For each variety (e.g. bean), there were 4 samples selected and tested using different materials to help the participants understand the concept and the process.

Number of seeds germinated ÷ number of total seeds x 100% = Germination Percentage.

Germination test exercise: A chance was given to the participants to grasp their observations on the differences between the two treatments below:

1 – Seeds germinated in Petri-dishes, using Tissue paper and News paper

2 – A hydroponic like method using a used bottle and string and again testing out newspaper and Tissue paper as films for germination (Participants were encouraged to use the materials available to them for this purpose like, dish, empty container etc.)

Observations/feedback from participants:

Participants were given the chance to calculate the germination percentage of different varieties of different seed qualities in a group activity. Afterwards each group presented their results and recommendations for materials to be used for germination test. All groups agreed that tissue paper (better moist holding capacity) is a better medium than Newspaper (which dries out faster). Participants now understand how important the germination percentage is in seed saving. Also which materials they could use for germination tests.

Participants were advised not to save seed from Hybrid varieties because the next generations may not stay true to type, and therefore may lose the desired traits.

Participants were taught about treatment methods: - Dusting seeds with wood ash before packing. Or treat with pesticide or fungicide for extra protection during storage.

For packing, labelling and storage of seeds; there was no proper seed packing program at Nu'u Research Station in the meantime but will be in the near future. Nonetheless, examples of seed packing from MOA Fiji were shown to participants (of Rio Gold, Alafua Large, Melrose and Alton); apart from commercial seed packets from Yates and other seed companies.

Participants were advised to pack seeds in air tight containers, aluminium zip lock bags or even vacuum packs which is an advantage. Participants were advised to use the materials readily available and only purchase materials if the need arises, given the high cost of Agri input in Samoa.

- Store in Cooler (15-20 degrees Celsius) and long term storage at 10 – 13 degrees
- If not cooler then store in dark, dry, cool place away from rats and birds etc.
- Seeds should be labelled with examples:
 - Name of Variety
 - Date at beginning of storage
 - Germination percentage
 - Any treatments
 - Place of production
 - Name of Company etc
- The labelled should be clearly written on the packet

Having an information database (record book) for seeds is an advantage especially for management purposes (monitoring, evaluation etc).

The day concluded with a few comments from the Pacific Community members using Fiji, as a case study given it has been active and successful in producing and selling OP seeds. This was echoed by staff from MAF and their interest to follow suit in the interest of creating resilient communities, especially for their farmers.

WEDNESDAY, 7th March, 2018

The morning session started off with a recap of the previous day from some of the MAF Crops Research, Extension and Development staff alongside with some farmers who participated.

The first presentation of the day was guided by Mani Mua of the Pacific Community on the "Plant Health Clinics." Highlighting for the farmers the idea of PHCs and differences between pests and diseases, the importance of being able to identify the different changes in your gardens and farms and also developing the capacity of the farmers on how to recognize the symptoms and diagnose different problems that arise and most importantly; how they are going to solve them. The Pacific Pests and Pathogens App was once again encouraged to take on board and use it effectively – this app can be downloaded from Play Store or simply Bluetooth from someone that has one. The latest is in its version 6. Farmers were also given an opportunity to access the website on: www.pestnet.org.

MAF officers and Quarantine officers were encouraged to join PestNet to be updated on the problems around the globe and also address current pests and disease concerns in Samoa. There are moderators at PestNet so it is very much safe especially for sensitive issues.

Nu'u Advisory Facility

Farmers had the chance to collect some samples of diseased infected plants and some pests affected plants from the crops at the Nu'u Crops Division station. It is critical to understand the importance of differentiating between diseases and pests. Mani Mua shared, "It is very important for the farmer to monitor their crops and recognize changes in your plants because good knowledge and experience on the different pests and disease symptoms. This will enable you to give the best diagnosis and therefore the correct management strategy e.g. if it's an insect or bug; use insecticide but if it's a fungus use fungicides but please chemical control should always be the last resort."

The main problems discussed were of diseases, pests and nutrient deficiency – in the soil deficiency problem farmers can use Nitrogen Phosphorus and Potassium (NPK). But it's also important to encourage use of organic composting/ legume crops and trees/ fallowing/ crop rotation etc.

He reiterated to the farmers to always remember not to keep spraying the same chemical repeatedly because the pests will build up resistant to that chemical and farmers will not be able to get rid of the problem - this could become worse in the future.

Given there's very high costs of chemicals in Samoa, the participants shared that it is not helping them at all.

"We (farmers) are all facing this problem and it does not help us when all we do during trainings and workshops is talk about which chemical to use and all but when we come to the Agriculture store, the costs are too high for us farmers to buy and we cannot afford," one farmer shared.

There was emphasis on organic farming process on growing these plants or producing these seeds without using chemicals. The Pacific Organic (POETCom) team were acknowledged in the efforts of introducing organic agriculture methods and techniques to farmers.

Ms Lasa Leaupepe said 'she has been using marigold as a natural pest control and this has been beneficial to keep the insects and pests away'.

Ms Elenoa Fuli of the Pacific Community shared her experience from Fiji saying, "The Ministry of Agriculture in Fiji puts together their annual budgeting including, drawn from submission from national farmer organisations, the costs of resources and materials for the farmers. This is submitted to Ministry of Finance and this helps minimise the costs of materials by way of subsidies, maybe Samoa MAF can do the same depending on the needs of their farmers and submit it to MOF then to Agro Store(s) and this can really assist our farmers in terms of minimising costs".

At the moment, Samoa has two Agriculture stores – The Agriculture Store and Bluebird.

"The Samoa Farmers Association is fortunate to receive discounts on seeds at the Agriculture Store and we help farmers that are not part of our association', said Leaupepe Lasa.

In terms of chemicals there are two types of chemicals; Contact – becomes effective immediately when applied and Systemic – takes days until you see the change in the pest population if effective.

Top 20 plant pest and diseases of Samoa

<ol style="list-style-type: none">1. African Snails2. Birds/ <i>Vea Manuali</i> / Mouse3. Caterpillars on Cabbages4. Mealybugs on Coacoa Citrus fruits5. Mites on Capsicum/ Tomatoes6. Fruit moth7. Rhinoceros beetle8. Bunchy – top virus9. Nematodes on bananas – soil problem10. Fungus on tomatoes / blight	<ol style="list-style-type: none">11. Bacterial wilt on tomatoes12. Anthroses – fungus on pepper / chillie13. Cucumber mosaic virus14. Leaf minor- cabbage15. Damping off – seedlings / dieback16. Leaf mould on tomatoes / cucumbers17. Pythium on taro18. Black leaf streak on banana19. Canker on coacoa20. Banana weevil/ seeds moth
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Before the official closing of the Training, MAF and SPC organised a closing ceremony to acknowledge the efforts of the participants. Participants were awarded certificates and acknowledged for their continuous efforts and hard work in sharing their experiences throughout the three days. Participants shared experiences, shared learnings, socialised and networked. At the closing, it was important to mention that everyone has to work together to advance the open-pollinated seed production and sector in Samoa.

MAF CEO Afioga Tilafono David Hunter presented the certificates and a group photo of all the staff members and farmers from both Upolu and Savaii at the end of the programme.

TARO BREEDING TRAINING

THURSDAY, 8 March 2018

The Taro Breeding training was officiated by Moafanua Tolo Iosefa – welcoming the farmers and the staff members of MAF and the members from the Pacific Community. The Taro Breeding program is in collaboration between the SPC, USP, MAF and the farmers of Samoa and other Pacific islands including Fiji, Tonga, Federated States of Micronesia, Cook Islands and others.

The Taro Breeding Program has been established for almost twenty years now ever since the Taro Leaf Blight destroyed the taro farm and taro of Samoa in 1993.

The main aim of this program is to provide farmers with diverse taro cultivars and or improved lines from breeding cycles with high levels of resistance to TLB and excellent eating quality to assist the farmers. The training was to:

- To provide hands-on training in taro breeding and building skills in the process of breeding and the techniques of mass recurrent selection for agricultural researchers of the Ministry of Agriculture and Fisheries and interested farmers
- For researchers and farmers in Samoa to gain an understanding of the benefits of genetic diversity for climate change, disease management and yield qualities when utilized in a breeding program
- For Samoa to form and establish their own participatory breeding program, built on a strong foundation of Farmers, Researchers and Advisory officers working together to improve food crop production.
- To establish and strengthen national root crop breeding networking between the Ministry, Farmers Associations and regional institutes (SPC) in sharing and distribution of genetic materials for the benefits of farming communities.

There are more than nine taro breeding programs in the Pacific and over a hundred (100) taro varieties which have been bred and spread. “Networking is really important – the sharing of the information and resources is a fundamental aspect of this program” Moafanua emphasized.

The main reasons for taro breeding are:

- climate change
- to improve market yield quality and eating quality
- to ensure the richness of its nutritional value (producing coloured taro varieties which are rich in Vitamin A);
- and improve the value adding potential of taro.

At the moment the Scientific Research Organisation of Samoa (SROS) is producing an alcoholic drink using taro ‘Samoa Talo Whiskey’ – this was recently launched in Samoa

Peter Tulaga Eliesa, young farmer said, “People are confused of the taro varieties for export at the moment so why don't we just focus on a certain variety?”

Tolo shared that ‘everyone has different tastes and therefore having a few taro varieties would be an advantage to have in Samoa’.

There were three parts of Moafanua's presentation:-

1. Breeding Approaches, focusing on the importance of working together of breeders, researchers and farmers because the inputs from these three protagonists are all important
2. Breeding Method, the two common breeding methods used by farmers producing hundreds of taro varieties that are now scattered around the world, and
3. The Process of breeding, there are 14 steps in the process starting from the selection of the parental materials to producing true taro seeds until the final selection of superior genotypes.

Hand Pollination is one step of this process and it is one of the methods that caught the attention of the participants. Participants were keen to learn how to carry out this step in an effective manner and it will be practiced along the training on the field.

“Can this hand pollination affect the yield of the taro and its growth?” asked one of the MAF staff.

Moafanua responded saying, ‘Yes - once the flower of the taro pollinates then the taro will focus on feeding the berries and at the same time the yield is affected and will not be suitable for eating’.

He continued by saying, “Many people do not eat taro because they fear the itchiness from it, but I guess in the Pacific, there is no such thing and even if there is, it is not that bad.”

Now the Melanesian islands in the Pacific are the richest in the diversities of taro, including Fiji, Vanuatu and PNG.

FRIDAY 9 March 2018

Guided by Moafanua Tolo Iosefa, a short but fruitful demonstration on the hand pollination of taro flower was carried out in one of the taro plots at Nu’u Station. This practice is required to be done in the early hours of the mornings because the female part of the taro flower are more receptive at this time of the day and after hand pollinating the pollens will be merged with the female part within twenty four hours and it is then considered ready.

The female and male parts have to be from two different taro varieties or it can be from one. Berries from the pollination can be removed from the female part within 2 to 3 weeks when the berries look like they are about to pop.

Then plant these seeds and monitor properly to ensure that there is enough water for the seed until germination.

These breeding and pollination processes sound expensive and requires resources like green houses or tunnel houses and clean houses.

Peter Eliesa, a young Taro exporter asked ‘Are there any funding or any sort of assistance from the government of Samoa to assist farmers to effectively carry out these activities to continue and further advance their taro communities?’

Tolo responded saying ‘The Ministry has a joint project with Chinese Government to provide tunnel houses to farmers. All farmers are encouraged to apply however there is a criteria in place for farmers’.

Materials needed for the open pollination practice are as follows:

- small sharp knife for dissecting
- a pen for labelling and an A4 paper for enveloping the pollinated sample in an envelope form.

In groups of four to five members, the participants of the training were divided to carry out the hand pollinating activity using the taro plots in Nu'u. Some groups did more than two samples.

"The nature of taro breeding produces a wide variety of taro, both good and bad quality." Moafanua stated.

Practical training on OP-Pollinated Seeds and Taro Breeding Training ended on Day 5, with CEO Tilafono David Hunter, thanking the participants and resource person for the active participation and valuable training rendered to the Samoa. He looks forward to future collaboration with SPC in strengthening their seeds work.

SPC led a formal closed meeting with MAF staff (Tilafono David Hunter, ACEO Tolo, Tommy, Aleni, Mafataga) to discuss the way forward and next steps. The agreed outcomes included:

1. Samoa needs to work on a Seeds Standard Operating Procedure
2. Samoa, to set up an OP seeds demo plot on Nu'u Research Station, to be used as the national seed centre, including tissue culture work. The first financing option would be to utilise the PAPP funds under the SPC Samoa Financing Agreement.

A separate half-day meeting was also organised with the Ministry of Finance and MAF policy and planning team to discuss the SPC PAPP and Samoa MAF Financial Agreement (FA).

For more information and presentations on the Open Pollinated Seed Production Training and on the Taro Pollination and breeding, is available online:

<https://lrd.spc.int/our-work/information-communication-and-extension/publication-/taro-leaf-blight-manual>

[All documentation process has been posted on the PIRAS and PAFNet facebook page.](#)