PIFON

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Growers' Federation of Tonga Inc.

MORDI TONGA
Enable rural isolated communities to fight against poverty

NISHI FOUNDATION

PACIFIC BREADFRUIT ROUNDTABLE

PBSP

PBSP

IFAD
Investing in rural people

Pacific Community
COMMUNAUTÉ DU PACIFIQUE

PAPP
Pacific Agriculture Policy Program

EUROPEAN UNION

INTRA ACP
Agricultural Policy Programme

SEPTEMBER 15TH - 16TH, 2016. NUKU'ALOFA, TONGA

Contents

1 Summary

The Pacific Island Farmers Organisation Network in partnership with Nishi Foundation, GroFed (Growers Federation of Tonga) and MORDI (Mainstreaming of Rural Development Innovation Tonga Trust) co-organized a Pacific Breadfruit Roundtable.

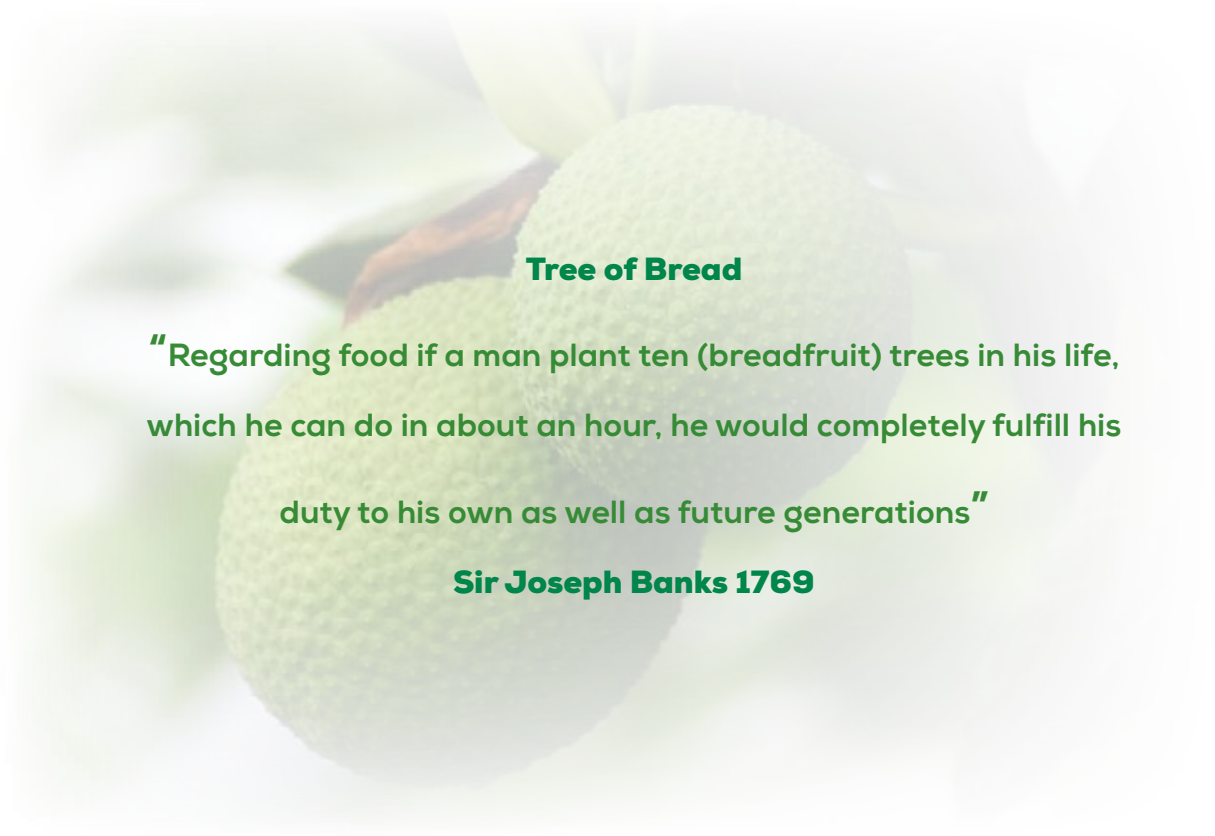
This two-day consultative roundtable was held in Nuku'alofa, on the friendly islands of Tonga from September 15th - 16th, 2016. The event was attended by 53 participants from seven Pacific Island countries including farmers, farmer organisation representatives, research organisations, government partners and aid agencies.

This event, a first of its kind for the region, was co-funded by the EU-supported SPC PAPP (Pacific Agriculture Policy Project) and IFAD/SDC funded MTCP II project.

The objective of this roundtable was to bring together PIFON members and other partners who are actively involved in breadfruit research and development in the Pacific to share experiences, get updated and work to synergize regional Breadfruit activities. Discussions on the context for breadfruit development in the region as well as PIFON's Pacific Breadfruit and Seed Program (PBSP) were the focus subjects. The roundtable also included four technical sessions including: Breadfruit Varieties and Propagation, Breadfruit Production Systems, Fresh Exports of Breadfruit and Breadfruit Processing.

A promise was made on the first day of the Roundtable that it would not be all talk and participants were assured they would only be sitting for only half a day each day, which provided an exciting twist in that field trips were organised for the afternoon sessions that allowed participants to view the practical farm work that had been discussed and presented in the morning technical sessions.

Deputy Prime Minister of Tonga, Honourable Siaosi Ofa ki Vahafolau Sovaleni with Dr Failautusi of University of Hawaii representing Global Heritage Breadfruit Council of Hawaii at the opening ceremonies for the Pacific Breadfruit Roundtable in Utulau, Tongatapu.



Tree of Bread

"Regarding food if a man plant ten (breadfruit) trees in his life, which he can do in about an hour, he would completely fulfill his duty to his own as well as future generations"

Sir Joseph Banks 1769

A key outcome from the roundtable meeting is the detailed national work plans for each of the seven countries represented along with a series of inter-regional technical partnerships being established (see Section 14.4).

PIFON is now seeking additional funding for the PBSP to help support the national activities identified by the country members that attended this Pacific Breadfruit Roundtable which is a firm reflection of what is needed on the ground to grow this initiative for each country represented. PIFON in this aspect is represented by the seven countries that participated and it is anticipated that more countries will join PIFON's Breadfruit and Seed Program as this program is only in its infancy (seventh month) of being operationalised.

The Country outcomes document paves the way for a regional effort in a combined farmers program that has been put together by farmers from representatives of Farmer Organisations under the PIFON banner from their own countries around the Pacific, knowing what best is needed to grow this breadfruit to becoming a fruit of the future, resilient to climate change and gluten free when processed.

The Pacific Breadfruit and Seed Program, first conceptualised and proposed in 2009 as a worthwhile project that could yield results for its farmer members by its Farmer Organisations under their farmer organisation PIFON, has now completed its first Roundtable successfully in Nuku'alofa Tonga and the proceedings of the outcomes, deliberations and what happened in Utulau, Tonga in the premises of Nishi Trading is recorded herein.

2 Opening Ceremony

The Pacific Breadfruit Roundtable (2016) was the first time for a PIFON regional event to be hosted in Tonga. As such, the opening ceremony was characterised by high energy and the special Tongan spirit.

During the Opening Ceremony, the Master of Ceremony, Mr Taniela Hoponoa, Program Officer for MORDI Tonga Trust officially welcomed all participants to the venue of the Pacific Roundtable which was at the Nishi Trading Packing Shed, in Utulau, Tongatapu and invited the Reverend Dr Alifareti Mone to open the event with a prayer.

Reverend Alifareti Mone, now retired and an active farmer himself called on the heavens to pour down blessings on the Pacific Breadfruit Roundtable and its participants to be blessed with an abundance of motivation and strength to allow deliberations and learning to be foremost for the two Roundtable days.

The Chairman of Growers Federation, Mr. To'imoana Takataka welcomed everyone on behalf of the teams of GroFED, Nishi Foundation and MORDI to Tonga as PIFON hosting members. This was the first time that a PIFON event was being hosted in Tonga thus the privilege to showcase their island was indeed their pleasure. They hoped that all the participants especially the international participants would enjoy the hospitality of the Tongans over the two days program.

PIFON's Chairman, Mr Afamasaga Toleafoa acknowledged and welcomed everyone to this first Roundtable event, giving the participants a brief background of PIFON and its history to what it was today, a network of Farmer Organisations that began in 2008 but was officially registered in 2013 at its Foundation Conference. PIFON was about its member farmer organisations working together and one such way was through this Roundtable concept that was being hosted in Tonga.

Participants of the Pacific Breadfruit Roundtable posing for their group picture inside the Nishi Trading Packhouse in Utulau, Tongatapu

"Excerpt from speech of Chief Guest
Deputy Prime Minister of Tonga,"
Honourable Siaosi Ofa ki Vahafolau Sovaleni

Pacific Breadfruit Roundtable participants were greeted and welcomed by the Honourable Siaosi Sovaleni to Tonga stating that he was very pleased to see the revival of breadfruit in the region.

According to history, Captain Cook's expedition to French Polynesia found that breadfruit was a cheap nutritious food and would be good for the slaves that worked the plantations in the West Indies. His ship laden with breadfruit crossed the waters in Tonga where the famous Bounty munity happened right outside the waters of Nuku'alofa.

Breadfruit is a staple food that grows on a tree that is very resilient to Climate Change and it is a Pacific crop that we all should be very proud off. Today, breadfruit is also an income generating activity that includes fresh exports to New Zealand. Breadfruit is a source of livelihood for our Pacific people and it is part of our culture, heritage and diet.

"In the Tonga 2015 Agriculture Census, breadfruit is the top tree crop grown in homes and mainly in town allotments for ease of harvesting. In recognition of the importance of breadfruit, MAFFF supports through one of its programs the planting of breadfruit and the distribution of planting materials from its nursery. This it does in partnership with Tongan farmer organisations. MAFFF has also undertaken this because of the value of the breadfruit to food security, its resilience to climate change and its source of income for Tongan's. The breadfruit is resilient due to its root system and although the tree is vulnerable to cyclones, it can be trimmed to minimise damage during bad weather. Breadfruit as a fruit is a means of food security for our people and the need to develop and nurture this crop is a priority."

He added by saying that he was very thankful to PIFON in partnership with GroFED, MORDI and Nishi for hosting this Roundtable, more importantly, choosing Tonga as the host country. He added his complements to the funding partners of IFAD through MTCP2 and the EU and SPC through PAPP that made the event possible. He concluded by stating that breadfruit is a source of food security for economic development and its resilience to climate change made it a crop for the future.

3 Context for breadfruit development in the region – the role of farmer organisations and PIFON

Keynote address – Kyle Stice, **Manager PIFON**

> This is the crop of the future, climate change is expected to have less of an impact on traditional Pacific Island food crops eg breadfruit.

Why Breadfruit?

This question was posed to the participants as they settled after the opening ceremonies and morning tea spread that was hosted by Nishi Trading at their facilities.

It was opportune that Reverend Alifareti had likened it to the bread of life during his opening prayer remarks. Kyle then connected it to 'Bread' from a tree for our Pacific food security. The breadfruit was a traditional crop with cultural significance for many of our countries and native to the islands. The tree is well adapted to the Pacific's Island agro-ecological conditions and the fact that its resilient features withstand climatic extremes was as Rev Alifareti had quoted, "a heavenly gift from the heavens to our Pacific peoples', where incidentally it presents also income opportunities which the Roundtable hopes to demonstrate to its participants.

In a recently published SPC book on "Climate Change and Agriculture", breadfruit is discussed in detail. In fact, this book represents the first comprehensive study on the impacts of climate change on agriculture in the Pacific which had 23 main authors and took over 2 years to write and compile. The book is an important reference guide for Pacific Island agriculturists and is very applicable to the Roundtable discussions.

The book is quoted in expressing each Pacific Countries Food Import Capability Indicator (FICI) (ratio of food imports to total exports; the measure of a country's aggregate food security) and lists the Pacific countries as:

Fiji – 0.7 (moderate vulnerability); PNG – 0.08 (extremely low); Solomon Islands – 0.2 (low); Vanuatu – 1.4 (high); Samoa – 3.0 (very high); Tonga – 2.0 (very high); Kiribati – 7.5 (extreme).

More importantly, the book illustrated that imported grains (particularly rice) comprise half of PIC food imports. Future indications are that Asian rice production is highly vulnerable to climate change and substantial increases will be felt in the price of global rice which posed serious food security implications for the Pacific Islands. But there was good news; climate change is expected to have less of an impact on traditional Pacific island food

crops. Pacific staples (e.g. sweet potato, taro, cassava, yams) are efficient converters of solar energy - broad leaves producing photosynthesis stored in underground organs. So, again why Breadfruit? This is the crop of the future: its ability to secure food energy from the atmosphere, thanks to large leaves and canopy, also relatively undemanding of soil, high tolerance to climate extremes, well suited to inter-cropping, high yielding in biomass that can be converted to high quality gluten free flour & paste products.

Hence the Roundtable and the opportunities that breadfruit presented to FOs and its members in potential research and development in the region. These included:

- Variety evaluations and propagation systems
- Development of breadfruit 'orchards' for fresh export and commercial processing
- Promotion of breadfruit in farming systems for food security and cottage processing
- Development of commercial processing

What do Farmer Organisations (FOs) have to do with Breadfruit development in the Pacific?

FO's are market drivers and facilitators; they influence policies and are a source for extension and research, so what are the comparative advantages of FO's in agricultural extension and research? PIFON early this year had recently published 2 pivotal Policy Briefs for its FO's on Agriculture Extension and FO's on Agriculture Research.

- Related to agricultural research, the policy brief concludes that "a partnership between agriculture ministries, relevant public sector organisations and farmer organisations will increase the depth and quality of agricultural research as well as see more comprehensive and widespread adoptions of the results".

- Related to agricultural extension, the policy brief stresses that "farmer organisations can effectively and efficiently complement the work of government and aid agencies by extending the outreach of support to farmers".

What is a Farmer Organisation?

The PIFON definition of a FO is a group of farmers; or a group working for the benefit of farmers. PIFON is a network of FOs spread across 9 countries in the Pacific with members in East Timor, PNG, Solomon Islands, Vanuatu, Tonga, Fiji, Samoa, Cook Islands and newest member country New Caledonia, with a membership of 25 national farmer organisations and linkages with approximately 350 local farmer organisations with a total membership of +25,000 farmers. PIFON's network works to support FOs in national activities, to link all the FOs to share information, to work to access outside resources and influence (technical and financial) to improve the capacity of its member FOs whilst facilitating farmer to farmer learning exchanges.

In 2009, PIFON identified enhancing domestic food production utilising FOs as a key policy response to addressing the dual challenges of climate change and Food Security. In 2013,

it formalised its very own program "A farmer led initiative to operationalise this policy response was launched focusing on Breadfruit & Seeds," Pacific farmers responding to climate change and food security.

The Pacific Breadfruit and Seeds Program (PBSP) is currently operationalised in four countries (Fiji, Tonga, Solomons & PNG) and works to support its national FO activities in these countries; additionally the program allows regional learning exchanges between its FOs with particular emphasis of 'Farmers teaching farmers'. A practical approach to farmers' problems and successes are exchanged as a result of such learning exchanges. PIFON is seeking resources to scale up the PBSP as a regional program with all of its FO members in each country.

Interestingly to note, breadfruit plays an important role in all of PIFON's Pacific Island countries but in different ways as economic and social factors determine the different tracks of breadfruit research and development in each country. Some examples from the countries that have operationalised their PBS programs are:

Fiji .....Focus on development of breadfruit as an orchard crop for fresh export and processing on its main island, whilst on its outer islands, development for food security and cottage industry processing.
Solomons, Vanuatu.....Focus on incorporating more breadfruit into food gardens for food security
Tonga.....Development of breadfruit as an orchard crop for fresh export and commercial processing
Samoa.....Focus on commercially processing a range of breadfruit products: chips, flour, beer etc.

The purpose of PIFON hosting an event such as the Pacific Breadfruit Roundtable is for PIFON's members and anyone working in Breadfruit to:

- Share and document breadfruit initiatives and priorities across region
- Transfer findings from breadfruit research and development activities
- Network for future collaboration
- Plan for PBSP activities – 2017 and beyond

To summarise, Kyle used the quote from John F Kennedy, who challenged America during his Presidency with his famous quote "If not us, who, if not now, when?", the challenge to all attending the Breadfruit Roundtable, is to do likewise, to experience within the next two days the benefits of this crop, and from here, to ask ourselves the same challenge the Americans were asked by their then President, "If not us, who, if not now, when?"

4 Roundtable country remarks – Vision for breadfruit development and plans to achieve this

Kaitu Erasito - **Nature's Way Cooperative (NWC)**

> .....the recent Tropical Cyclone Winston which devastated large areas of Fiji. The only remaining crop left standing was 'breadfruit',...breadfruit was the lone survivor.

4.1 Fiji

Kaitu Erasito is an Extension and Research officer with NWC quietly known as Doctor Breadfruit, a nickname he has unknowingly earned whilst working on research activities for the Pacific Breadfruit Project with NWC and Koko Siga Pacific. Kaitu has travelled extensively around the Pacific and the Caribbean working on breadfruit in both research and extension.

In presenting the first of the country reports for Fiji, Kaitu told those in attendance that there are three reasons for developing breadfruit in Fiji, one is for food security, the second is cash income and the third is that breadfruit is resilient to climate change. He spoke passionately about the effects of cyclones in Fiji, especially the recent Tropical Cyclone Winston which devastated large areas of Fiji.

"The only remaining crop left standing in some areas was 'breadfruit', all other crops had been destroyed, breadfruit was the lone survivor."

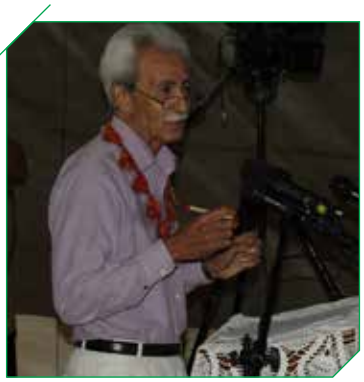
"As people, if we wish to remain healthy for our children, and children's children, then it comes down to the food that we consume or eat. Breadfruit is about food nutrition, it is about being food secure, knowing where your next meal will come from."

"In Fiji, we are starting to plant orchards so that we can produce for market targets. There is a large market that even collectively in the Pacific, we will not be able to cater for, but to produce and provide consistently to this market, we must start somewhere and growing the plant is a very good start."

Kaitu stated that working with breadfruit had been exciting. The first time he was asked to do breadfruit work, he was given a clean sheet of paper and pen and told to characterize breadfruit, he didn't know what that meant, but he was determined to find out what it meant and so he set about to do it. Today, he says he is still doing it, but his sheet of paper is now filled with figures, data and information worth sharing to those attending the Roundtable.

He ended by confirming that for Fiji, the emphasis is the planting of breadfruit; encouraging the planting of breadfruit on peripherals of land and encouraging the planting of breadfruit into orchards.

4.2 Samoa



Afamasaga Toleafoa –
Samoa Farmers Association SFA(Chairman of PIFON)

> Breadfruit has always been part of our country because of its 'elephant in the room' status.

Samoa's country report was presented by the President of the Samoa Farmers Association, Afamasaga Faamatalaupu, a retiree but now an active contact in the networking of Farmer Organisations in the Pacific through his role as Chairman of PIFON.

He introduced Samoa's report by confirming that breadfruit has always been there for Samoans from as far as three hundred years ago, if he were able to count out their years. He said, "breadfruit has always been part of our country or development program because of its 'elephant in the room' status." He simplified his statement by saying that that was what breadfruit was, an elephant in the Pacific room, big and there for everyone to see. It was in our face that it could not be ignored, but also big in its ratings on nutrition, big in the face of climate change and big in its resilience of surviving when things around were falling and, or dying, this 'elephant in the room' still stood tall and so it should. He added that as Pacific Islanders, "we ought to be proud of the breadfruit as our Pacific crop that is now in the Caribbean, Asia and other parts of the world, it is ours in the Pacific to claim."

He respected Samoan's who had left Samoa, many of whom migrated to New Zealand which created a market demand for fresh breadfruit exports to New Zealand. He further stated that, when people travelled they took with them their food, their traditions and it was this that created a market for those still in Samoa. This migrating trend was encouraging for Samoan's as it became a driver in economic development as there were several aid funds made available to make breadfruit an export commodity and the export of fresh breadfruit possible so much that it gained momentum with many Samoans becoming prosperous from this export business. However like all things Pacific, when the aid funds dried up, the enthusiasm and efforts dried up too.

SROS's research work to complement processing of breadfruit and working with the private sector to continue the processing research results into commercial markets. An Australian aided project called PHAMA, then assisted to help create market access of breadfruit into Australia by Samoans. At country level, the research and development continued on breadfruit for both cooked and fresh breadfruit.

Afamasaga stated that recently there have been changes in the Samoan Government that is driving breadfruit initiatives in Samoa. Samoa recently participated as a country delegation at the Global Breadfruit Summit in Hawaii led by Samoa's Minister of Agriculture, where Samoa bided to host the next Annual Global Breadfruit Summit in 2017. He was excited stating that for Samoa, there are some interesting paths ahead for them and their romance with the breadfruit tree crop.

"Breadfruit's adaptability makes it a perfect 'elephant in the room' choice for climate change, and where climate change is concerned; it attracts donor funds and programs."

4.3 PNG

Peter Gendua -
National Agriculture Research Institute (NARI)

> Recently when climate change become a topic and we found out the resilience in this one crop.

In his country's presentation, Peter Gendua, a Research Scientist with PNG's NARI said that breadfruit in PNG is not common like other Pacific countries. PNG is a very diverse country with many different micro climates with forests covering much of the land. Sixty percent do not have access to breadfruit therefore the growing status of this crop is different at the different levels from seaside up to the highlands. NARI has not done much work in breadfruit because it is in our forests and there has been no emphasis on this crop.

There are two types of Breadfruit in PNG; (i) seedless and (ii) seed growing wild in the countryside of PNG. Breadfruit has a low priority in PNG and its national work only until recently when climate change become a topic and they found out the resilience in this one crop, and through the work of PIFON promoting Breadfruit. PNG is attending this Roundtable to learn from those in the room that have done work on breadfruit already.

He said, "For us, the important project in PNG is to increase production and awareness of growing this crop. We have problems with propagation in PNG because of the seedless variety. This Roundtable is an opportunity to learn more about propagation methods. We are here to learn how to propagate so that we may assist farmers to increase local production. We can see that it is a very good crop as it grows at seaside level and withstands salinity, and it grows in the mountain range and takes in the high moisture levels present in the mountains. The other opportunity in PNG is cash income for those who farm it."

In PNG, depending on regions, some regions are potato based, others are taro based, some are banana based. In the last couple of years breadfruit has become visually seen in markets being sold by women. Because of interchange, travel and expatriates in PNG, market opportunities are expanding for breadfruit, so the opportunity for cash income is possible at the local level.

PNG's immediate aim is to increase local production and awareness. Another aim is to promote breadfruit, not just for production but also to put it on the table for food security for the PNG people.

"To summarize, our main priority and challenge for PNG is propagation, distribution and teaching farmers"

4.4 Cook Islands

Daniel Mataroa - **Te Tango Enua O Tupapa**

> We have breadfruit right on our doorstep and do not know the potential that it has.

"Breadfruit is everywhere in the Cooks but we eat imported food. If the ships stopped coming to the Cooks, we would be the first in the world to all die. We spend upwards of $30Million a year on imported food yet we have breadfruit right on our doorstep and do not know the potential that it has, that's why I have come here. "

Daniel Mataroa, the President of Te Tango Enua O Tupapa presented his country's report saying that when he received his invite, he found the Roundtable very inviting and wondered why breadfruit, as breadfruit was a crop that he never saw any value in. His first encounter with the breadfruit was to pick its dead leaves as a young boy every morning which, he remembers well and did not like.

"When I got the invite I thought, this is very interesting, who would think I would travel all the way to Tonga to find out what just grows outside here in the Cooks. But this is the strength of PIFON, it connects and brings us together and before we realize it we have the solution for our own food security right here, we just didn't know about it."

The Cook Islands need to build up our food security. $30M a year of imported food is an opportunity for our people to replace but it needs a lot of work and effort.

In the Cook Islands, they have two varieties of breadfruit, Kuru (breadfruit) Maori (seedless), Kuru Tahiti (seed).

Their challenge is to re-educate the people about Kuru. Cook Islands is small, after Daniel got the invitation for this Roundtable, he went around and counted approximately about fifty (50) breadfruit tree. They have a total people population of 18,000 and many Cook Islanders migrate to New Zealand.

His closing comments were simple, "If we have plenty Kuru, we can send our Kuru with our people to New Zealand too and make money as well, so there is opportunity to be learnt, opportunity to be harvested and that's why the Cook Islands is here at the Roundtable to find out about our opportunities. "

4.5 Tonga

Minoru Nishi - **Nishi Trading and Nishi Foundation**

> The nutritional value of breadfruit is undisputed and its economic development is still yet to be realized.

The Managing Director for Nishi Trading, Minoru Nishi delivered the host country's report, Tonga. He started by stating that Tonga is highly reliant on imports. "Tonga is not food secure and so programs are being aimed at import substitution."

"Breadfruit is everywhere in Tonga as you will see during your stay with us in our friendly islands of Tonga, the nutritional value of breadfruit is undisputed and its economic development is still yet to be realized. Our challenge in Tonga is for us to find the market opportunity that this crop offers so that it may assist the livelihood of Tongans. We are hopeful that this Roundtable will be about knowledge, lots of it and sharing of this knowledge in the true Pacific spirit."

Tonga's country aim is to build up breadfruit production here in Tonga for food security and income generation. In order to do this we need strong partnerships between researchers, farmers, farmer organisations and marketers. We have seen some great results working with our partners at the University of Tokyo on breadfruit processing and we would like to see more of this..

"We are here to learn and we hope that you are also here to learn from us and together, we will take breadfruit onto the world stage"

4.6 Solomon Islands

Moses Pelomo - **Kastom Gaden Association (KGA)**

> "Given the evidence that we are faced with breadfruit is becoming very important."

Moses is a retiree now active as a consultant and still works around the Solomons consulting and working with farmers. He presented Solomon Islands country report as President of KGA.

Breadfruit in Solomon Islands grows wildly in the bush and jungles. When its breadfruit season, we harvest and pick the fruits when ripe and that's breadfruit in the Solomon Islands. It is an afterthought crop that is there, we don't need to replant it, it grows itself, and we don't need to water or look after it because it just grows, so there isn't much more to it than that.

However, there is one Province in the Solomons who specializes in tree crops and they have taken breadfruit to a different level. They harvest the fruit, process it at the village level and have been able to package and market it to make money from this crop. My presentation tomorrow will touch on the product that they are doing

Longer term, Solomons is starting to realize the benefits of breadfruit, it's about climate change, it's about food security, and given the evidence that we are faced with breadfruit is becoming very important.

"In the Solomon's breadfruit is just a crop sitting there waiting to be used, so we are looking forward to finding ways in this Roundtable." Currently Nut Growers Association and Kastom Gaden Association are promoting tree crops. Breadfruit is a tree crop so it fits in with their vision and focus.

4.7 Hawaii

Failautusi Avegalio –
Global Breadfruit Heritage Council (GBHC)

> Market is not interested in breadfruit but is interested in what is IN the breadfruit.

Dr Tusi as he is commonly known was the lone representative from Hawaii representing Global Breadfruit Heritage Council (GBHC), a group of breadfruit enthusiasts from around Hawaii who have worked quietly for some years conducting research and keeping those working in breadfruit connected.

Dr Tusi shared that the role of the GBHC was about bringing people together and this Roundtable was a perfect opportunity to strengthen the bridge between the North and South Pacific in terms of breadfruit research and development.

"At the recent Breadfruit Summit in Hawaii we did just this, bring together everyone doing breadfruit work to share, to speak to each other, to network and harvest the spirit and energy of everyone's powerful combined research and development."

For Hawaii, they are the gateway to the US market, he said, "the US mainland market is not interested in breadfruit but is interested in what is IN the breadfruit."

The global demand for gluten free products was projected to be $5 Billion by 2013. In 2013 the projections for 2016 was $13 Billion, today 2016 the market is worth $15 Billion. It is the fastest growing market in the US. So as a region, the Pacific needs to develop a strategy about gluten free products and tap into this market, imagine the livelihood of the Pacific people if they were even going to achieve 1 – 10% of this market, he emotionally echoed, "the riches that our forbearers foretold will rain down on each of us." However, there is the problem with stove pipping and working in cellos, not knowing what the other has done, and possibly duplicating what someone has already done, or is doing and results are not communicated to or with each other. He stressed that this was very important, "there is so much work done in little bits around the world, here in the Pacific, out in the Caribbean, in Hawaii, therefore we must and need to share all this research and development that is happening and then we need to get together to meet the USDA standards so that what is IN the breadfruit can get into the market to get into the US and into that billion dollar market – that should all be our target. "

He concluded by stating, ***"The future is 'IN' breadfruit. Breadfruit if dried, has a shelf life of two years, we can harness the power that we have in this Roundtable, in this room to get there in two years or less if we all work together just like the ulu – the tree of life."***

Pacific Breadfruit Roundtable participants at the opening session of Day 1

5 Technical Session #1 – Breadfruit varieties and propagation

Tongan farmer and farmer organisations visit the CePaCT Regional Breadfruit collection in Narere, SPC as part of the PIFON Pacific Breadfruit and Seeds Program (PBSP)

Alipate Lovolevu -
Pacific Community (SPC)

5.1 Overview of breadfruit diversity in the region

Alipate from the SPC Centre for Pacific Crops and Trees (CePacT) shared their overall goal 'To support Pacific countries in their agricultural development by conserving important genetic resources, and to provide access to the diversity they need, when they need it.'

Alipate further shared about the core activities of CePacT which include: conservation, molecular work, crop diversity, training, research and distribution. Related to distribution it was shared that since 2005, CePaCT has supplied over 60,000 plantlets to 45 countries including Europe, Africa, Caribbean and Asia (under SPC EU International Network for Edible Aroids (INEA) project). The major crops distributed include: bananas, breadfruit, cassava, sweet potatoes, taro and yams. All distribution are accompanied by FAO Standard Material Transfer Agreements after June 2009 (Annex 1 material on the FAO Treaty multilateral system genepool).

Related specifically to breadfruit, Alipate shared that the 1st International Breadfruit Variety Collection was established by the Pacific community (SPC) in Samoa at Vailima. This included 166 recorded varieties from Tonga, Niue, Western and American Samoa, Papua New Guinea, New Hebrides and Rotuma. The 2nd International Breadfruit Collection was established by the National Tropical Botanical Garden, Maui Hawaii, with over 200 cultivars established including those acquired from the SPC Samoa collection. A 3rd International Breadfruit Collection was established by the Pacific Community (SPC) at Narere, Fiji with 37 varieties – in tissue culture & field accessions. These varieties were collected from Fiji, Kiribati, Marshall Islands, Samoa and Vanuatu. This collection is still continuing, supported as part of the Global Crop Diversity Trust, FAO International Treaty on Plant Genetic Resources for Food and Agriculture projects, ACIAR Pacific Breadfruit project and EU Pacific Agricultural Policy Project.

There are a number of reports on breadfruit diversity including one unpublished report from the Marquesas which indicates the presence of 200 cultivars. In Fiji, there are 70 known breadfruit varieties.

5.2 Experience in breadfruit characterisation in Fiji

Kaitu Erasito - **Nature's Way Cooperative (NWC)**

The history of Breadfruit Characterisation in Fiji dates back to work done in 1966, by Dominiko Koroiveibau which was funded by the South Pacific Commission.

Dominiko's characterisation work included documenting breadfruit's morphological characteristics of the fruit, leaves, length of the male flowers, fruiting time and the food value of each variety. His work concluded that there were seventy different varieties of breadfruit in Fiji.

NWC in partnership with Koko Siga Pacific began a Pacific Breadfruit Project (PBP) in 2011. Kaitu's task was to carry out characterisation work on present-day breadfruit in Fiji. His work's goal was to develop a practical understanding of the varieties done by Mr Koroiveibau to assist resource owners, nursery operators and farmers to maximise the diversity that existed in Fiji. His work resulted in a series of variety characterisation sheets that enabled users to be able to picture the variety and match it to the names that the fruits were so often called. The process was helpful as it clearly defined and provided a practical educational tool for breadfruit varieties in Fiji.

The PBP characterisation study included delving into traditional knowledge of breadfruit, sourcing the methods that farmers and nursery operators were using (if any) and documenting these as well. In studying breadfruit exclusively, the PBP found that in Vanua Levu, the second largest island in Fiji was a particular region where breadfruit was abundant. In this area, resource owners were food secure, they did not need to plant their food as they relied wholly on year round fruiting from their breadfruit trees. This area known demographically as the Natewa Basin consisted of several villages along the Natewa Bay, Vuasasivo, Nagaravatu, Muava, Wailevu, Navetau, Salia, Nailou, other villages on Vanua Levu further identified were Vakativa, Yaroi and Nawi villages.

Kaitu's research also documented the fruiting patterns of the various varieties and this information was able to be documented and illustrated into a very practical user-friendly table and guide able to be read by its audience of users, ie farmers, researchers and extension workers, others doing work also in breadfruit.

The research work that was carried out under the PBP is part of the results that the PBSP is using as base information to continue the work started under the 2011 Pacific Breadfruit Project.

5.3 Methods of breadfruit propagation – root suckers, root cuttings, marcotting, stem cuttings and tissue culture – results from Marcotting trials and update on propagation field trials

Kaitu Erasito - **Nature's Way Cooperative (NWC)**

Quoting from previous research undertaken by MacCaughey 1917; Pope 1926; Otanes and Ruiz 1956; Chandler 1958; Purseglove 1968; Handy et al. 1972; Rowe-Dutton 1976; Ragone 1991. The PBP reviewed the various propagation methods and planting materials of breadfruit trees knowing that breadfruit trees are generally propagated vegetatively from root shoots or root cuttings, by air-layering of its branches (Marcottage) or from its seeds.

Trials carried out by the NWC Research and Extension program in collaboration with the Fiji Ministry of Agriculture have identified a series of best practices for breadfruit propagation. These include:

Seeds: ***These are extracted preferably from soft ripe fruits and must be planted immediately as seeds lose viability within a few weeks. It is planted in loose, well-drained soil and kept moist. When planted, seeds germinate within 10-14 days and it grows very quickly to the point where it is ready to be planted into the field after a year of potting.***

Root cuttings: ***For mass seedling propagation, this method may be used where root sections of between 10-24cm are readily available. It requires suitable potting mix and is appropriate in rescue varieties. Growth from root cuttings takes up to 9 to 12 months before it is ready for field planting.***

Root suckers: ***Dependent on the number of suckers available, this method can be very effective for mass propagation. This method proved to be the fastest method with time taken to raise seedlings between 4 – 6 months.***

Root sucker potting to transfer:

1. **Select healthy, juvenile root sucker;**

2. **Sow in rick potting mix**

3. **Re-growth of shoots;**

4. **Root sucker planted in the field;**

When selecting juvenile root suckers, 75% of leaves are to be removed. Ensure to keep the root sucker moist to prevent drying (drying decreases viability) and nursery condition must have 70% intense shading with additional coconut leaves to keep the root sucker cool during this seedling phase.

Marcotting (Air-Layering)

For limited and quick seedling production, this method is appropriate. It requires a large plant population where re-growth is common (upright shoots give better results than laterals). This method is labour intensive to all the other propagation methods and requires an additional further nurturing of two months.

1. Marcotting

2. At 1.5 months

3. At 3 months

A step by step photo picture of how marcotting is carried out:

Steps to Marcotting:

Step 1 : Pick a branch that has just fruited, one that is upright

Step 2 : Cut out the skin of the branch as pictured to the core of the branch

Step 3 : Apply potting mix and affix firmly with tying string

Step 4: The completed marcot steps, leave the branch to allow root growth

Step 5 : Continually monitor and watch for root growth

Step 6 : At the appropriate time, open up plastic to view roots, saw/cut off branch from tree

Step 7 : Plant straight into ready potting mix. Keep in cool shade and ensure adequate watering applied

Step 8 : Transfer of marcotted pot plant into prepared field

Kaitu also presented findings from a series of formal trials to determine the best package of practices for marcotting breadfruit. These experiments were laid out in a split block design. A breadfruit tree is treated as a block and receives the various treatments for each trial.

- Trial 1 – Evaluation of various marcotting media
- Trial 2 – Evaluation of branch size and location
- Trial 3 – Evaluation of shade and leaf removal on success rate of removed marcotts.

Data collected included: root development, physiology of marcotted branches and mortality rate.

The Results of the above trials were:

The recommended best package of practice of marcotting breadfruit (Balekana ni Samoa variety) under Fiji conditions were as follows:

- The results from Trial 1, indicated that the use of plain sphagnum peat moss had the best success in terms of first sign of root development, percent root ball and overall success rate.
- Trial 2 indicated that the highest success rate can be achieved from larger branch sizes located on the higher part of the tree.
- Trial 3 indicated that the best way to treat after care of marcotts is 75% leaf removal under 50% shade conditions.

Field evaluation of various propagation types

During the above research, further comparison was made between the three methods of propagation types for Root Suckers, Marcots and Tissue Cultured breadfruit. Comparison on how each performed (Vigour, Yield, and Susceptibility to cyclones) on the breadfruit trees that were planted in actual farmer field trails under normal farming conditions in the field. This was achievable because Nature's Way Co-Operative used its farmer members to conduct these trails and research which allowed the NWC Extension and Research team to have easy access to the farmers' fields to conduct their research whilst taking into considering normal farming days and complexities of a farmer.

5.4 Mass propagation/collection of breadfruit germplasm - Experience from Fiji

A commercial breadfruit nursery in Fiji with potted root suckers sourced from resource owners on another island.

Kaitu Erasito -
Nature's Way Cooperative (NWC)

In order to facilitate orchard establishment farmers needs to have access to large volumes of high quality planting material of the preferred varieties. In the Fiji context this proved to be a major challenge. The search for the right variety was done, remembering that during the characterization research period, the team had travelled around and had found the Natewa area as the breadfruit hotspot for Fiji. The PBP team managed to obtain this location through its arrangement with another farmer organization and member of PIFON, Tutu Rural Training Centre (TRTC) whose members were in the villages that were nestled around the Natewa Bay but the distance proved a hindrance.

The initial strategy was to source root suckers and marcotts from wild trees around Viti Levu and to source tissue cultured breadfruit from CePACT laboratory, however these were met with difficulties as there was only one variety (Uto Dina) which had a low percentage growth for root suckers and marcots and difficulty to access trees because of land issues with various resource owners. From the laboratory, there was a limited number only with no commercial tissue culture laboratory in Fiji to cater for commercial volumes.

The second strategy was to return to the breadfruit hotspot of Vanua Levu (Natewa Bay) which required the establishment of relationships and networks with resource owners through the courtesy and connecting assistance of TRTC to NWC and the PBP.

The PBP also got Nursery operators involved and together with the Natewa Bay resource owners obtained root suckers by the truckload down to Viti Levu where the suckers were distributed around to nursery operators to plant and maintain over a period till the suckers were ready for field planting. Resource owners benefitted from the sale of the root suckers and the training that was provided in breadfruit propagation.

From the above exercise, the PBP recorded several key lessons, including:

- Relationships need to be established with resource owners based upon sound business principles
- Link with private nurseries is critical.
- To initiate the development of commercial breadfruit orchards it was essential to source a large volume of planting material from the outer islands.
- In the future it is expected that planting material will be sourced from the established breadfruit orchards and commercial tissue culture enterprises.

5.5 Discussion on Technical Session #1

A robust discussion took place after the presentations with Kaitu answering various questions from the participants on technical specifications related to variety and real farmer issues that were anticipated.

For a few participants, the introduction of air-layering or marcotting was a very new concept and many questions on this procedure kept the audience informed of how such a process was done, what potting material was best to be used and which variety was best.

It became apparent during the previous country presentations and again in Kaitu's presentation that the varieties were known by different names in the different countries. Until participants could relate the particular breadfruit variety to their country, then they were able to understand the complexity of the breadfruit technicalities that were being presented and appreciated more in-depth what was needed to be done and the work involved in such research, the results of which were being shared for their benefit.

Two Tongan participants who had recently participated in a Breadfruit Learning Exchange to Fiji in April spoke up about their experience with the training of marcotting they received whilst in Fiji and their reactions to being introduced to such a procedure, but how once they had been taught were able to return to Tonga and put it into practise in their own farmer fields. They acknowledged the lessons and the presentation that Kaitu presented stating that it was really great that it was farmers who were presenting to farmers in this Roundtable that made it very practical and easy, likewise the language used were very farmer friendly for them to absorb and understand.

6 Technical Session #2 – Breadfruit production systems

Dr. Richard Pauku -
Nut Growers Association of the Solomon Islands

6.1 Breadfruit in the agroforestry system (SI experience)

NGASI is the Nut Growers Association of the Solomon Islands with a vision that Solomon Islanders sustainably use their indigenous fruits and nuts resources resulting in an enhanced resilience of people, the economy and the environment leading to sustainable development. They do this by working to promote and support sustainable use of indigenous fruits and nuts resources in Solomon Islands to sustain livelihoods, protect their environment, and to preserve their traditions.

Dr Richard Pauku explained that breadfruit's work is classified with traditional nut work where it is encouraged to be a part of the islands agroforestry system. More than 80% of Solomon Islands population live in rural areas, and are dependent upon traditional farming system (= traditional agroforestry system). Traditional agroforestry system involves:-

- ***Enrichment planting of groves***
- ***Nurturing of wild siblings / seedlings***
- ***Planting in fallows***
- ***Planting within and along land boundaries***
- ***Planting in boundaries of food gardens***

Continued increase in population puts additional pressure on land, thus the need to improve traditional agroforestry system. Improved traditional agroforestry system involves:-

- ***Training of farmers***
- ***Establishment and Management of nursery***
- ***Field planting of selected IFN (Indigenous fruits & nuts)***
- ***Integrated Plantations***
- ***Planting in boundaries of existing cocoa / coconut plantations***

Where do they find these indigenous plants including breadfruit, they are found in their natural habitats in the montane, hill, lowland, freshwater, riverine, saline swaps, grassland, surroundings and peripherals of their forests.

NGASI works with its members to integrate planting into their plantations and forestry. Breadfruit work is treated similarly as other tree crops however from this workshop and knowing the benefits of this crop, there will be a greater emphasis on planting this crop into their agroforestry.

6.2 Breadfruit production in Samoa (Experience of the Pacific's first breadfruit 'orchard')


The Pacific's first breadfruit orchard at Atele, Samoa.

Philip John Tuivavalagi -
Samoa Farmers Association (SFA)

Samoa was the first Pacific country to plant breadfruit in orchards. As they demonstrated this, the participants viewed how each plot was documented with the variety type of breadfruit planted, date planted and other details. Participants were also shown how the land was further divided into smaller portions and each portion labelled according to the crop that was planted in that field, the land size, the block size, the spacing between plants, blocks, and land, distances from peripheral of land and distance from other varieties if they were planted in the same block or along the same lines. The various varieties that were planted were Ulu Uea; Ulu Hawaii, Ulu Puou, Ulu Maafala, Ulu Manu'a, Ulu Fagufagu, Ulu Sina, Ulu Aveloloa, Ulu Kala, Maopo, Ulu Maa; Ulu Momolega.

The purpose of the development of their orchard farm in Atele was to export fresh breadfruit to New Zealand because of the large Samoan population residing there. Fresh exports from Samoa began in 2004 with two consignments of a total of 213 fruits weighing 192.35kgs. Their best year was in 2006 with 77 consignments of 38, 789 fruits weighing at 43,607kgs but issues with the Quarantine pathway and bait spraying became cumbersome for Samoan farmers that proved destructive to continue fresh exports of breadfruit to New Zealand. Efforts and meetings have continued with New Zealand but the momentum of exporting is now lost on farmers who have moved on to other crops for their livelihood.

Samoa hopes that through the PIFON program and the recent participation of Samoa at the recent Global Breadfruit Hawaii Summit that breadfruit will again take centre stage and the emergence of this crop in Samoa's Agriculture workplan.

6.3 Developing commercial breadfruit orchards in Fiji (role of intercropping)

A commercial breadfruit orchard in Fiji, intercropped with pineapple.

Kaitu Erasito -
Nature's Way Cooperative (NWC)

Breadfruit needs to be planted in orchards to have a major impact as a crop as it currently grows "wild" in Fiji's forest systems, household backyard gardens and around villages. When grown in such cropping systems, it is not seen as a viable crop and it cannot make a major contribution to national food security, as it does not offer sufficient supply of consistent quality. As a standalone crop growing in these systems, it is very often ignored and left on its own to grow indiscriminately in height and breadth that is a challenge during harvest periods for commercial export purposes. Therefore orchards are an essential requirement to support fresh exports and commercial processing to have that consistent supply and grade applicable that is needed to go through this value chain process to get the breadfruit to market.

Fiji embarked on breadfruit orchard development citing several models. The first was planting using the conventional 'square' model with a spacing of 9m x 9m, mono crop styled with approximately 50 trees per acre. A second model was the farm perimeter model, which meant planting was done along the farm edges or roads to the farms, with spacing of 9m x 9m and planting up to 50 trees to equal an acre of planting. A third model was the conventional 'square' model with intercropping, spacing of 9m x 9m, intercropped with a range of crops – kumala, eggplant, cassava, pineapple. The current status of Fiji's breadfruit orchard development is a total of 1464 trees in the field, 32 participating farmers involved with a total of 30 acres (12 Ha) under commercial orchard system. NWC's approach to Commercial Orchard development was to work with interested export farmer members, present the expected returns and actively engage with the exporter. In this initiative, NWC provided the trees with farmers contributing land, labour and agro-inputs starting small with 50 trees (equivalent of an acre) and then expanding with the good farmers.

Key lessons learnt from the NWC Orchard development model was:

- Many farmers show interest when there are free trees but few spend the time looking after the young trees (water, weeding)
- The need to be selective with participating farmers
- Farmers should allocate good land
- Importance of intercropping
- Evaluation of breadfruit orchards on different agro-ecological conditions Comparison of a sloping degraded site (Sabeto hill site) compared to a flatter, more fertile site (Tui's farm @ Legalega) proved that flatter land allowed higher rate of growth compared to sloping degraded site.

Returns to a farmer:

- The breadfruit orchard planting uptake by farmers has been high and based on the relatively high expected returns to labour compared with the main alternative of planting sugar cane.
- Gross margin analysis has been conducted utilizing currently available data generated by the PBP. The standard model used is for a farm household in western Viti Levu, planting 50 breadfruit trees on 0.4 hectare of land
- Based on conservative marketable yield and price assumptions it is estimated that the small orchard will earn an average annual income of FJD 2,700 (USD 1,490) over a 16-year period. More importantly the resulting average annual return per day of household labour is estimated at approximately FJD70 (USD 39).
- Returns from intercropping with pineapple - By incorporating pineapples as an intercrop, for example, it is estimated that a farm household can earn an average of FJD 1,450 per annum in the first 5-years when there is no breadfruit income. This translates to some FJD90 per day of household labour.

Planting breadfruit orchards is a financially viable enterprise for Fijian small-holders. Intercropping is critical to establish initial cash flow income for the farmer. Breadfruit orchard development must emphasize the need for substantial regular supply of breadfruit of breadfruit planting material. In Fiji this will initially be based on Vanua Levu village suppliers.

Next steps in NWC's orchard development in Fiji are (i) Pruning and training research (ii) Nutrition trial work (rates and timing) with funding just received from ACIAR to carry out next stages.

6.4 Discussion on Technical Session #2

The discussions were focused on orchard development, the differences with the various varieties, its fruiting time, which were good for processing or for fresh exports.

Discussions also centred on how to prune the breadfruit tree, which branch and when to prune. The various varieties of breadfruit were also discussed with each country figuring to work out what were the particular breadfruit variety that was being discussed and showcased in the technical sessions which they could then relate too. Once the participants were able to know the name of their local variety to what was being presented, the participants were able to actively participate because of the local knowledge exchange that occurred due to the same varieties being discussed.

Intercropping and growing breadfruit within the current traditional systems was brought up and practical experiences discussed from the Solomon Islands, Papua New Guinea with the Tongan farmers contributing to provide a healthy discussion on where and which plants to plant with the breadfruit which allowed the natural environment and ecosystem around the breadfruit and other plants to thrive as a collective group. Fiji and Samoa contributed to the discussion on crops that were used to intercrop and its possible yields that made for interesting talk with the regional farmer participants.

7.1 Nishi Farms

The first field visit was a tour of Nishi Trading Pack house facility facilitated by Nishi Tradings Managing Director, Minoru Nishi.

Container loading and area at **Nishi Trading** that is certified for sea freight loading to **New Zealand, Japan, Korea** and soon **China.**

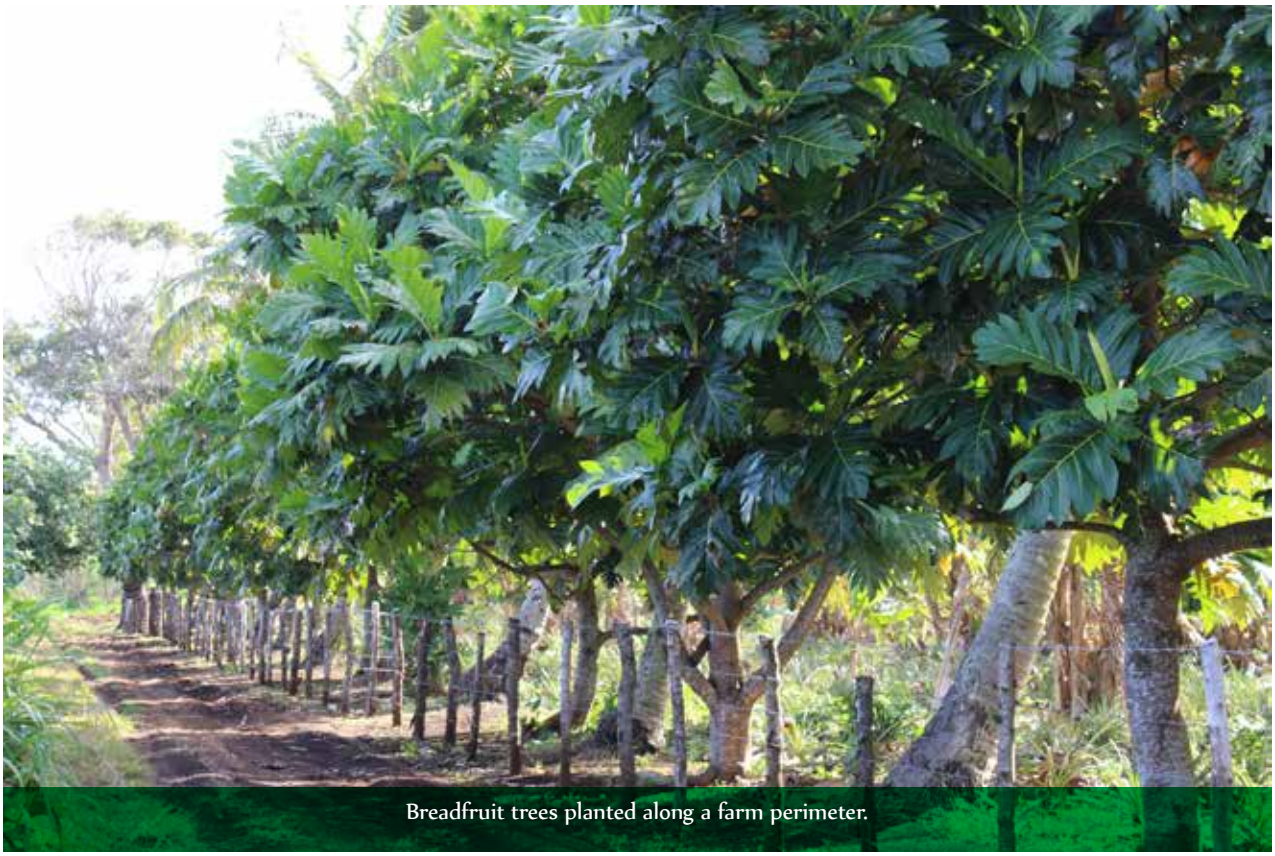
Grading and packing area at **Nishi Trading. Nishi** is a **grower** and **exporter** of a range of **fresh products** including **squash** and **watermelon.**

Minoru Nishi explaining his bar coding system to ensure traceability and quality feedback to **farmers.**

Participants learning about **applied research trials** taking place at **Nishi Trading** which include **variety evaluations** and **crop nutrition.**

7.2 MAFFF Nursery at Tokomolol

Participants were than taken to visit the forestry nursery for MAFF at Tokomololo to see the various potted breadfruit root suckers planted in bags in preparation for distribution to farmers.



Breadfruit trees planted along a farm perimeter.

MAFF nurseryman explaining about breadfruit propagation.

7.3 Filipe's Breadfruit Orchard at Puk

The final stop for day one field trip was to Filipe's Farm. Filipe had participated in a recent Breadfruit Learning Exchange to Fiji in April, so had recently returned with acquired knowledge of Breadfruit Orchards to implement at his farm. The participants thereafter were treated by Filipe to a dinner feast prepared by him and his family at their humble home in Puke, Tonga.

"Participants during visit to **Filipe's farm** at Puke. **Farmer to farmer** discussion around **breadfruit** propagation and planting proved very fruitful for all involved"

8 Update from 2016 Hawaii Pacific & Global Breadfruit Summit

Dr Tusi representing the Global Breadfruit Heritage Council and one of its founding members and main organiser of the recent Hawaii Global Breadfruit Summit shared how a discussion from a few years ago has led to the hosting of such an event that took place at the Imax Theatre of the Polynesian Culture Centre in Laie, Hawaii from the 27th to 31st of August 2016.

The participants watched a short video of the keynote address by Kalani Souza -, Kumu and cultural elder of the Pacific Regional Breadfruit Initiative with Craig Elevitch - Agroforestry scientist and internationally renowned author and specialist in Pacific Breadfruit flora. The two speakers spoke passionately about breadfruit, its origins and it's aloha spirit, however more importantly, their message of no mono-cropping of breadfruit rang out loud and clear to the participants as the video showed evidence of what mono-cropping had done to the landscape of Hawaii. They also pointed out that the breadfruit was a local tree crop from the Pacific that was now renowned globally, the Pacific needed to own its heritage to protect the crop. Their presentation came through rivetingly with their message that work needed to be done now to protect the breadfruit as the future was IN breadfruit.

Dr Tusi then summarised that the three objectives of the Hawaii Global Breadfruit Summit was to (i) weave traditional methods into modern agriculture; (ii) sustain the values of the crop and the culture that surrounded the breadfruit and (iii) provide the balance for the tree into today's world. He further shared that the breadfruit tree was all about sharing hence, the Hawaii Summit brought together everyone and anyone who was working in breadfruit to share what they were doing and the results so that everyone knew what was happening on the global scale for breadfruit whether it was in production, research, extension or processing.

He concluded by explaining the three core values of the Hawaii Summit were (a) wisdom of humility, the breadfruit was a crop that was passed down by our Pacific ancestors to avert famine, the culture that is wrapped around the ulu (breadfruit) is one of genuine love and compassion, therefore as Pacific people we were encouraged to (b) respect all humans. Lastly, the breadfruit (c) represented for the majority of the Pacific people, the true aloha spirit of embracing all with love. He paid testament to the Tongan hosts who ensured that their hosting duties included their culture which was unique and special to those that were attending the Breadfruit Roundtable and he thanked everyone including PIFON for inviting him to attend this Tonga meeting.

9 Technical session #3: Fresh exports of breadfruit

9.1 Tonga experience with fresh breadfruit exports

Emeline Ahoafi - **Tonga MAFFF**

In Tonga, there are various breadfruit varieties, the most common is Puo'u and it can be found growing around villages and in backyards. Tonga exports fresh breadfruit to New Zealand under a Bilateral Quarantine Agreement (BQA). The breadfruit export pathway for Tonga has different components and we work with the farmers and exporters to make sure there is compliance. Farmers and exporters all have to work together fulfilling their own requirements in order to make the BQA successful. In February 2015, a consignment of breadfruit was intercepted and found a fly in a consignment, so all the breadfruit exports stopped. New Zealand introduced a one-on-one certification process and we worked together with them to review each point on the pathway. When reviewing the pathway, each party was made to be complaint, farmers and exporters had to be registered and each went through thorough training. For on farm, there was a need to have sanitation, signage and each farmer or exporter was taken to task to sign an undertaking that they will work to be complaint and remain complaint. Farms had to be mapped with GPS systems, each farmer needed to ensure that they carried out bait spraying, and crop hygiene was to be practised. Documentation for all this work had to be kept and filed for inspection at any time, pest management practise, bait spraying dates, crop hygiene systems were introduced. For exporters – their pack houses needed to be certified and quarantine measures implemented, documented. Auditors from New Zealand searched and worked to trace back the fruit fly element incident and arrived at a conclusion that someone probably placed an untreated fruit into the consignment.

The Tonga experience needed all the parties to work together in relationship building, trust and work the value chain process for the fresh breadfruit export from the farmer to the exporter to the treatment at Tonga's HTFA to be able to reopen the pathway for Tonga exports into New Zealand again, today the pathway is now open. There is regular monitoring, reviews, audits and meetings to keep everyone on their toes and to ensure all parties are working together for the export of fresh breadfruit.

Participants during Technical Session # 3 being presented on the Context of Fresh Exports for Tonga by Emeline Ahoafi of MAFFF.

9.2 Fiji experience with fresh breadfruit exports

Kyle Stice - **Nature`s Way Cooperative**

Fiji has had market access for fresh breadfruit into New Zealand since 2000. Several market surveys have identified that there is demand for around 200-300 tonnes of breadfruit annually. Over this sixteen year period there has been considerable work done to strengthen the export supply chain however highest throughput was only 13 tonnes.

Continuity of supply has been the major constraint to commercial breadfruit industry development. In response to this major constraint the industry has moved towards the establishment of breadfruit orchards.

Other constraints facing the fresh breadfruit exports in Fiji include:

- Seasonality of breadfruit
- The stringent quarantine requirements to carry out numerous sprays for fruit flies (compliance and quality issues)
- High cost and capacity constraints of airfreight (sea freight will be required)

Nature's Way Cooperative in partnership with the Ministry of Agriculture and other stakeholders are steadily working to address these various constraints through its research and extension program. It is clear that this type of export development takes time and there must be a main driver, in the case of breadfruit in Fiji, NWC is ideally placed to be this driver.

The following conclusions were made related to the fresh export of breadfruit from Fiji:

- There is a large market for fresh breadfruit in New Zealand other accessible markets (Australia & US)
- Supply must come from commercial orchard production
- Quarantine issues such as bait spraying must be addressed
- Research on breadfruit varieties and extending season for the production and supply
- Obtaining market access for Australia and US

Fresh breadfruit exports from Fiji are constrained by a continuity of supply. The establishment of commercial orchards and other supply chain improvements will hopefully help overcome this constraint.

9.3 Breadfruit postharvest research in Samoa

Kuinimeri Finau - **Scientific Research Organisation of Samoa (SROS)**

Postharvest research in Samoa is undertaken primarily by the Scientific Research Organisation of Samoa (SROS). SROS was established by an Act of Parliament in July 2006, SROS's core funding is by the Samoan Government but it also relies on external funding for its technical and research projects, it is listed as a Public Beneficiary body in Samoa. SROS representative, Kuinimeri Finau, a native Samoan stated that SROS contributes to Samoa's national economy and community livelihoods through its research, product development and value adding of local produce.

A number of breadfruit variables were shared by Kuinimeri including that it is:

- Seasonal, perishable fresh produce
- Climacteric- high respiration rates upon ripening
- Inverse relationship between respiration & postharvest-life
- Fruits abundant and under utilised
- Export by air not economical – low volumes & costly

What is needed in postharvest is to extend the shelf life of the breadfruit to allow it be exported, preservation methods without affecting quality to allow exportation by sea.
The following Postharvest Research was conducted:

- Manipulation & Controlling of atmosphere in direct contact with food -Concentrations of gases -O2- lower levels slow respiration -CO2, - higher levels slow respiration & prevents growth spoilage micro-oganisms N- slow ripening –Temperature –controls respiration & other metabolic reactions -Humidity- controls transpiration -physical and chemical treatments (adjunct technology)

The method involved manipulation of only one or combination of two or all three factors. The experiments focused on:

- The effect of temperature (25°C & 14°C) on the post-harvest quality of Breadfruit
- To study the climacteric pattern of respiration
- The effect of precooling conditions – using water, ice and air
- The effect of shrink wrapping
- The effect of leaving or removing stem when harvested
- Varietal differences – Maafala and Puou.

An ACIAR Fruit Tree Project is providing funding to continue and complete the initial postharvest studies for breadfruit. Under this project, SROS will undertake more replicate studies, multi-locational collection and cover both islands and additional study; (i) systematic studies on the effect on rot development at low temperatures in conjunction with fungicides that are currently acceptable in New Zealand and Australia; (ii) determine the extent of sugar accumulation during low temperature storage and reduction. Conduct consumer testing with non-Polynesians to determine whether there is a different taste acceptability pattern and (iii) assess whether fruit are comparatively more prone to rotting when harvested during the wet season compared to the dry.

SROS is targeting postharvest shelf life a minimum life of -28 days needed, based on shipping schedule, from harvest to packing -, a maximum seven days for holding time at wharf to be only a max 3 days, clearance is 3 days whilst marketing is 5 days, however to note that if the breadfruit is not sold or cleared on time, it will all go to waste.

Cooked Breadfruit pouches developed by **SROS**

Breadfruit Fries developed by **SROS**

Breadfruit Flour developed by **SROS**

10 Technical session #4: Breadfruit Processing

Dr Richard Beyer - **Food Technologist**

10.1 Overview of breadfruit processing options/ opportunities

Breadfruit has a very short shelf life and the best way to extend any products shelf life is to delve into processing products that can be made out of it. To do this, one needs to understand what is in the product first before you 'tinker' with nature to create your own miracles. Breadfruit is similar, what is in the breadfruit that can be manipulated to create something that will sell in the market.

Therefore in taking a look at what is IN the breadfruit, we can summarise that there is vitamins (per 100g), pantothenic acid 0.5 mg; vitamin B1 (thiamine) 0.2 mg, niacin 0.9 mg, vitamin B6 0.1 mg, choline 9.81 mg, vitamin C 29.1 mg, vitamin E 0.1 mg.

This is very scientific – Mineral content of breadfruit (per 100 g) contains: phosphorus 30 mg, calcium 17.1 mg, sodium 2.0 mg, potassium 490.3 mg, iron 0.5 mg, magnesium 25 mg, zinc 0.1 mg, copper 0.13 mg, manganese 0.11 mg.

Its proximate analysis: Carbohydrate 53% to 76%; (–a 1,4 glucose Amylose, –a 1,4: a1,4,6 Amylopectin, –a 1,2); Fibre 4.9%; Protein 1.05% to 1.3%

Traditional processing techniques involve

- Lactic fermentation :
  - Sea soaked (salt);
  - Wrapped in leaves
  - Fermented
- Dried
- Baked and dried

Scientists cannot improve on nature, in all things, there is the life and death processes, natural maturation, cold storage (every 10oc drop in temperature slows down processes by 50%) and the life processes that produce CO2.

For breadfruit there is the option to carry out preservation freezing, where freezing is now institutionalised. The process to carry this out starts with the receipt of fruit, inspection process, peeling, deseeding and manual cutting, blast freezing and frozen storage < - 18oC

Other market opportunities for breadfruit include:

- Fresh : Fresh in a controlled and modified atmosphere (28 days at 8°C)
- Frozen free-flow
- Extrusion
- Latex
- Starch / Flour

Let's take a look at breadfruit flour. The process is expensive (Air has to have a relative humidity of less than 40%). When it is flour, what are you going to do with the flour? The obvious advantage is its 'gluten free' status.

For breadfruit sustainable food processing, the chain from raw material supply (farmers), Technology equipment to effect the changes and the Market must be thoroughly reviewed to get into.

There is opportunity now at this Roundtable, that's my message to talk to each other. There will always be demand for breadfruit in one form or another. It's about partnership and relationship building to getting to the next steps.

10.2 Breadfruit product development in Tonga – Nishi Trading and Tokyo University

Minoru Nishi - **Nishi Trading**

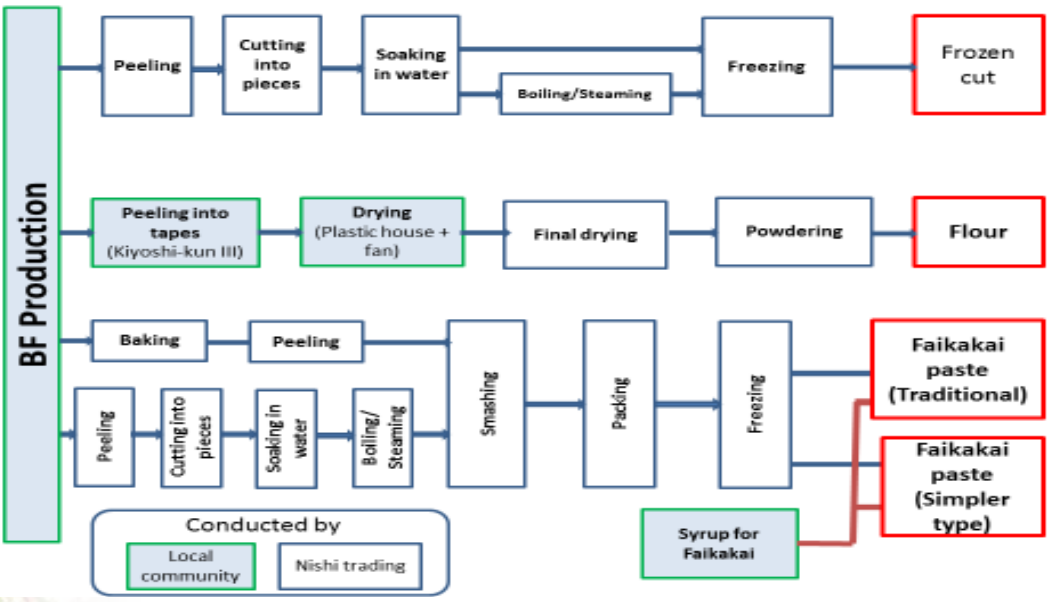
A partnership between Tonga and Japan has seen Tokyo University providing technical support from 2013-2016 to Nishi Trading, MORDI and MAFF around breadfruit development. To solve the challenges of import substitution and food security in Tonga, the research topics included:

1 Traditional use of native plant resources (BF) and its changing process
2 Farming systems and livelihood structure of local people
3 Nutritive usefulness of BF
4 New processing technology for drying & powdering of BF

With the expected results to be:

1 Increase of self-sufficiency rate of foods by substituting imported wheat flour
2 New exportable products other than squash
3 Recovery of identity as native pacific islanders by consuming traditional foods

A survey was undertaken of the five group of islands on breadfruit. Mapping of breadfruit in the islands and the varieties growing in home gardens and bush allotments and sales of breadfruit in the markets found that 80% of households sell breadfruit whilst in the outer islands, 100% is used for self-consumption and where 70% of fruits is wasted during fruiting season. The survey summarised that there were no big difference between varieties, the nutritious content of the breadfruit was mainly carbohydrate, rich in minerals and protein, surprisingly the core portion contains over 10 times then the edible portion of the breadfruit. It also summarised that the peeling of skin and core removal should be constant in order to get constant quality when turned into breadfruit flour. From the survey, the team were able to produce a map indicating a range of possible product streams.



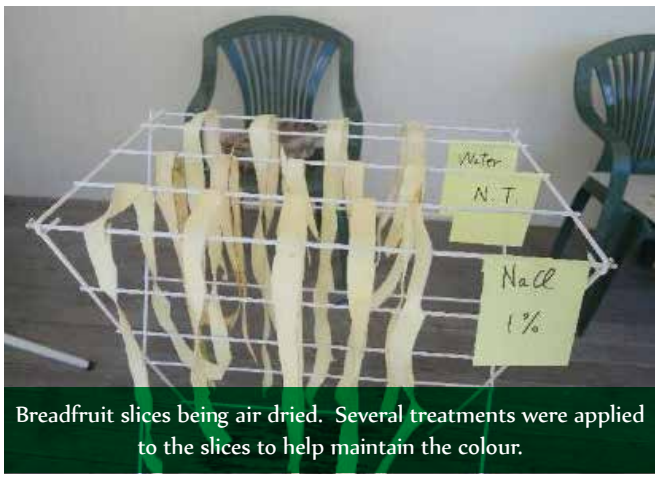
The team worked through the process of processing breadfruit flour by a step process of:

1. Peeling and slicing by Kiyoshi-kun;
2. Soaking in water;
3. Drying by sunshine and fan (solar energy) then
4. Milling.

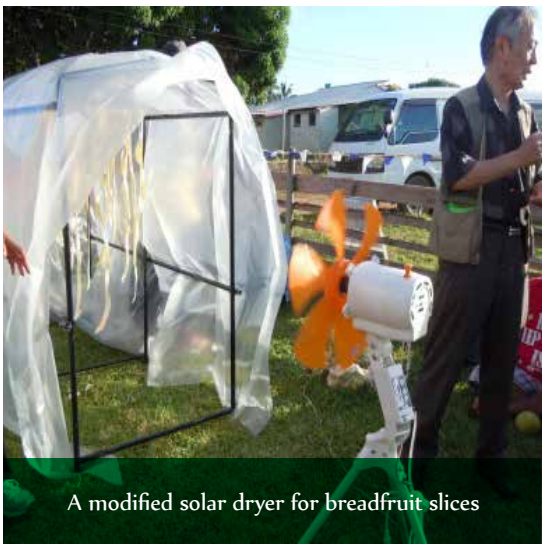
Training and awareness was done at the community level to determine interest and possible issues around these processes.

Sample flour was milled and various tests were done to bake bread documenting, recording and photographing the process each step of the way. Sensory taste tests were also undertaken with different percentage of water soakage done resulting in different colour flour variations that were all baked into bread for tasting tests. Further tests were conducted to mix other local ingredients of breadfruit flour with root crops like yam, rice powder, coconut and vanilla, mango/coconut and vanilla to get a best possible option result. Further tests need to be carried out on other possible products. The team collaborated and worked with the local community to map the process of making the local delicacy of Faikaikai, and tested this using samples of other ingredients mixed into it. They also collaborated with local communities to demonstrate the new products that can be made with breadfruit including a Japanese dish called Karukan, a traditional cake.

Peeling and slicing of breadfruit with a custom designed tool from the University ot Tokyo.



Breadfruit slices being air dried. Several treatments were applied to the slices to help maintain the colour.



A modified solar dryer for breadfruit slices

Milling of breadfruit flour samples

10.3 Traditional breadfruit processing and cottage industry development – Solomon Island

Moses Pelomo - **Kastom Gaden Association**

Temotu Province peoples inhabiting the most Eastern-most part of the Solomon Islands of Santa Cruz, Reef Islands,Utupua, Vanikoro, Duff Islands (Tuamotu), Tikopia and Anuta are great tree crops cultivators in Solomon Islands.

The province is peopled mainly by Melanesians especially on the main islands of Santa Cruz and Reef Islands but also Polynesian peoples on Anuta, Taumoko, Utupua, Vanikoro and other small outliers such as Tikopia and Anuta islands further to the East.

What is very notable about the people of Santa Cruz and Reef Islands compared to the rest of the Solomon Islands is that they are specialists in "farming" indigenous fruit and nuts and nuts including Breadfruit, Ngalinuts (Canarium spp), Alite (Terminalia spp), Tahitian Chestnut, Pacific Lycee (Pomitia spp) and other nuts and fruits through selection for various attributes over thousands of years that they end up with the best varieties in the Solomon Islands and may be in the region.

One of the indigenous fruit trees that they have developed to great advance is the Breadfruit. Their selection and husbandry efforts over many generations has resulted in many breadfruit varieties and cultivars with desirable characteristics such as good taste, early fruiting, high yield, all year round fruiting as well as adaptability to coralline soils of the mainland (Santa Cruz) as well as the low lying atolls that make-up most of the islands of this province.

Apart from the specialised husbandry practised, Temotu people had long recognised that Breadfruit as their main stable food for the islands especially in time of disasters as well as food for long sea travels between the widely scattered islands.

Thus they have developed a unique traditional way of drying the fruit so that it can store well even up to 6- 12 months. This serves them well as good source of energy as well as supports them between the seasons and in times of natural disasters. They called this traditionally dried breadfruit "NAMBO". Traditionally, Temotu people also exchange Nambo with their relatives and neighbours in the province as well as Honiara and other provinces.

Now-a-days, Nambo is gaining increasing popularity with most Solomon Islanders that it is becoming commercialised as a tastier alternative to "navy or cabin" and there is always ship-loads of Nambo baskets from Temotu to Honiara during the breadfruit season. Increasingly, Nambo is sold at the Central Market in Honiara, road-stalls and at homes. They are shipped on ships in 20 Kg flour buckets, specially woven round coconut baskets or even in 40 Kg hessian bags. In Honiara, they are packaged and in heat-sealed plastic pouches or zip-bags of different sizes of 200g, 500g, 1Kg and sold at $20/Kg or even $300-$400 per 20 Kg buckets. Indeed, Nambo is becoming a growing cottage industry forming an important source of income for many Temotu breadfruit owners. As demand increases, Nambo processors and retailers are becoming more innovative by including dried nuts such as Ngalinut and Alite (Beach almond or Terminalia spp) in the package. This makes eating more enjoyable as the oil from the nuts lubricates the much-drier Nambo to make it more palatable.

Nambo is processed traditionally using the following basic steps.

1. Fully mature or ripe breadfruits are harvested from the trees during the harvesting season, starting September to December
2. A fire is lit with stones just like when stone ovens or umu/ motu are done for other family food cooking
3. Once the flames have reduced, the full breadfruit fruit are placed above the heated stones and charcoal and continuously turned so that they are not charred.
4. After the fruits are cooked (30-40 minutes), the roasted fruits are removed from the hot stones and outer skin (crust) is scraped clean of dirt.
5. The cleaned roasted fruits are then stored in a secure place over-night to cool.
6. Next day, roasted crust (skin) are "peeled from the flesh carefully and then cut lengthwise into seven quarters or eight pieces. These pieces are further cut into "chips" or "cubes" ready for drying.
7. Traditionally, drying involved placing the "chips" on top of weaved bamboo low platform above a pre-heated motu stone oven and turning them periodically until the chips are dry. Now-a-days, drying is done more efficiently on mini hot-air driers using firewood for fuel, netting and drums
8. Once the "chips" are dry, they are left to cool and then stored in buckets, leaf-covered woven baskets or hessian bags ready to be eaten or sent to relatives or retailers in Honiara.

(Pictures below are sourced from AgrikalsaNius issue April 2013)

Temotu Pur[le-fleshed breadfruit (above, right) being readied for drying as NAMBO

Nambo- Traditionally dried breadfruit from Temotu Province, Solomon Islands.

NAMBO on sale ($20/Kg)

Dried Ngalinut often packaged with NAMBO

WAY FORWARD FOR NAMBO

While Nambo is currently thriving as a cottage industry there are aspects of it that need to be assessed or studied to increase efficiency and profitability. These include;

1. Value-chain and profitability
2. Drying technology –using solar drying
3. Storage, Packaging and shelf life
4. Grinding of Nambo into breadfruit flour and recipes for use as flour
5. Investigate export market
6. Identifying good varieties, collection, bulking and farming systems
7. Promote planting improved varieties
8. Getting other breadfruit owners in other provinces involved in processing Nambo and breadfruit flour

10.4 Sourcing breadfruit processing equipment – Global Mana

Josh Sybrowsky - **Global Mana**

Josh Sybrowsky presented on engineering solutions for standardized production of breadfruit fruit into flour. He had recently attended the Hawaii Global Breadfruit Summit where he met with PIFON who invited him to attend and present his solutions to the Roundtable. The feedback from the Summit had assisted him and Global Mana to arrive at the conclusion with Dr Tusi and his team from Global Breadfruit Heritage Council that equipment for making breadfruit flour needed to be robust and mobile because of the Pacific context. In this regard they set out to design a breadfruit processing unit built into a modified 20 and 40 feet shipping containers. Josh then shared their initial concept drawings to the participants at the Roundtable.

As an Engineer himself he told the Roundtable participants that in order to obtain Quality Check Engineering Certification, there was a need to:

1. Eliminate Variation in Picking
2. Eliminate Variation in Cutting
3. Eliminate Variation in Drying
4. Eliminate Variation in Milling
5. QC Checks and Guidelines

He also added that it was very important for group compliance and introduced Global Mana Equipment for breadfruit flour making which were:

1. Pickers
2. Ripening sensors (upcoming)
3. Peelers
4. Slicers
5. Small electrical dryer
6. Small solar heat dryer
7. Container Dryer system

The Technical Considerations on Heat and Humidity Sources for the equipment were:

a. Solar Electrical Power,
b. Solar Heat Power,
c. Clean Burn Oven,
d. Emergency Electrical Power,
e. Equalizer – outside air pump.

They looked at these options because of the relativity of the islands to electricity power.

Global Mana also looked at the Technical Considerations on Heat and Humidity Constants,

(i) Relationship between heat and humidity;

(ii) Benefit of Island Production – almost constant heat and almost constant humidity;

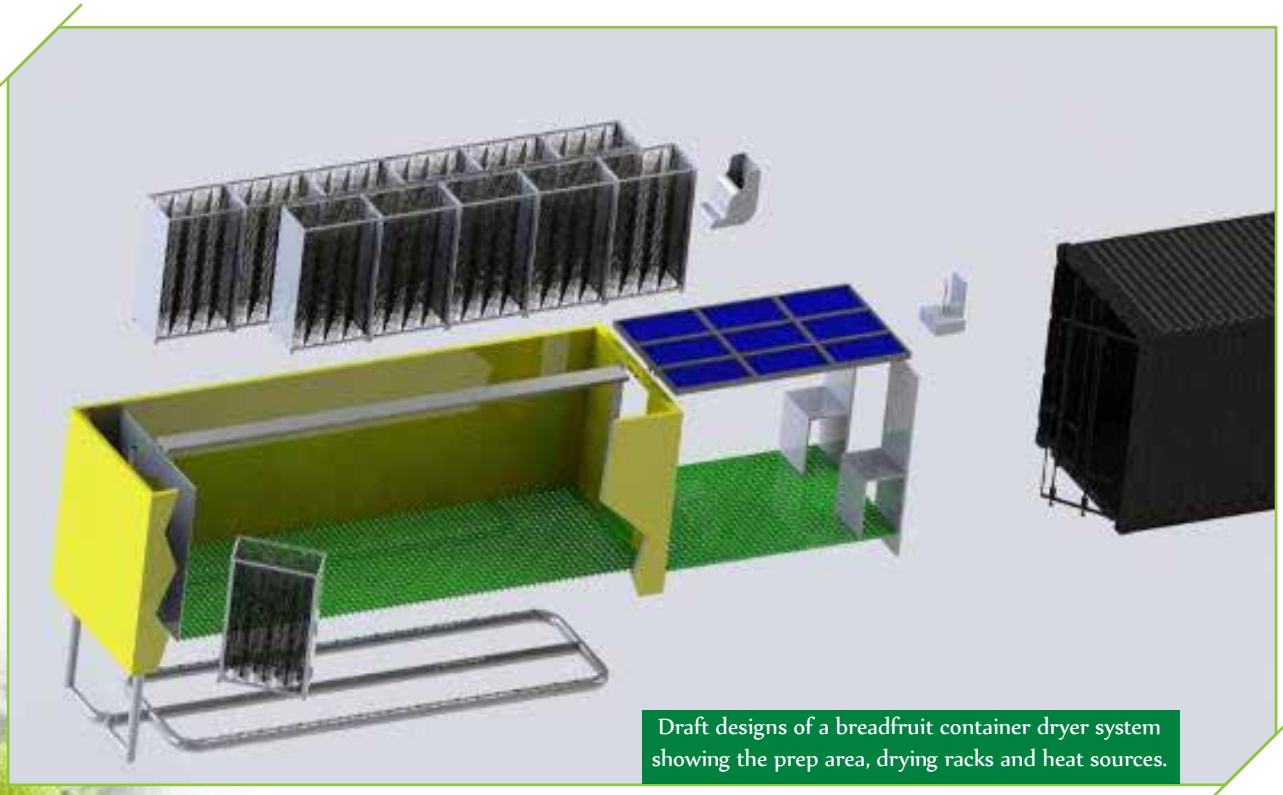
(iii) Computerized heating systems can equalize the drying temperatures and humidity making it constant each time; and

(iv) Heat curve computer managed

Attention on technical considerations on heat and humidity variables are:

- Variability in the system occurs based on the amount of breadfruit added into the dryer each time – more breadfruit means more heat absorbing mass and more liquid to extract.
- System could be calibrated by weight.
- Best method is calibration by determining how much heat is absorbed and adjusting the system based on heat absorption measured size.
- In a repeatable closed system the technology will be designed to obtain the same results each and every time without human intervention standardizing quality by standardizing the output.

Josh then unveiled to the participants of the Breadfruit Roundtable the first layout plans of Global Mana's 40 foot container concept drawings that he just received stating that costs for the research has been funded by Global Mana, and the components will be built at low costs. At this initial stage, the cost for purchase of a container were still to be determined, however Global Mana's profitability model is 0%. As a committed organisation he mentioned that building costs will be at a cost to Global Mana, their focus being volume, so the cost formachinery is theirs for all participating with them.



Draft designs of a breadfruit container dryer system showing the prep area, drying racks and heat sources.

10.5 Discussion and summary on Technical Session #4

The participants were presented with a range of options for processing of breadfruit and the discussion focused around which options were the most viable.

The experience of Tonga and their partnership with Tokyo University was a topic of interest in terms of how this research and development could continue.

The participants discussed the processing options that were best suited to the village level. Samoa's presentation provided a glimpse of what the market can be with their chips and flour products however production levels needed to be revamped to scale up manufacturing of the breadfruit products.

Global Mana's unveiling of their 20/40 foot container answer to the islands request for equipment was eagerly received and generated interest amongst the country participants. Dr Tusi adding that they were mindful that out in the islands once machines and equipment were shipped out, the expertise for maintenance and fixing the mechanical solutions had to be sustained in the islands, therefore the option to purchase a container would need to go with maintenance training for someone in the US for at least 8-12 weeks dependent on the training requirements to be trained to be able to assemble, take apart and fix everything that is in the container.

11 Roundtable country action plans – Outcomes of Breadfruit Roundtable Planning Session

Participants were invited to form their country groups and as a country work on "priority" next steps needed after being exposed to the Technical Sessions and field trips of the Breadfruit Roundtable. They were advised that their Next Steps will be written up as Country Work Plans that is a Key Outcome Document and Purpose of this Roundtable.

Fiji participants during their Country Work plan deliberations.

The Samoan delegates, from left to right, Philip John (SFA), Afamasaga (SFA) and Kuinmere Finau (SROS).

11.1 Fiji

No	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
			F I J I			
1.1	Kaitu to carry out Characteristic study	2017 Characteristic study of breadfruit for Fiji	2017	High	NIA	PBSP
1.2	Invite University of Tokyo to visit Fiji including Taveuni	Scoping study report by University of Tokyo	2017	Medium	PIFON	PBSP
1.3	Work with Global Mana for order of containers for Fiji (x 3 – TTT, TRTC & 1 x private sector)	Receipt of containers	2017+	Medium	NIA, PIFON	PBSP
1.4	TRTC to increase current BF Orchard	Additional x acres planted	2017	Medium	TRTC	PBSP
1.5	TTT to pilot 10 orchards with its members	- 10 farmers to sign LOA - 10 farmers to plant BF orchards	2017/18	Medium	TTT	PBSP
1.6	Consult with Craig Elevitch on BF orchards to include agroforestry systems	Visit and report by Craig on Fiji BF Orchards for forward steps	2017	Medium	PIFON	PBSP

1.7	Consult Richard Beyer to TRTC for BF flour making	Visit and report by Richard Beyer for TRTC	2016	High	TRTC	PBSP
1.8	Conduct feasibility study on interested farmers (reverse plan include nurseries)	Report on # of interested farmers	2016	High	NWC / PIFON	PBSP
1.9	NWC / MOA to be responsible for propagating BF suckers for mass planting and orchards	X numbers of new orchards developed	2017 - 2020	High	MOA / NWC / PIFON	PBSP / MOA
1.10	Advocate against Bait spraying, encourage Regional advocacy by PIFON members	1.Engagement of PHAMA 2. Resolution of bait spraying BQA requirement	2017	Medium	PIFON Fiji, Samoa, Tonga NIAs	PBSP
1.11	Awareness and training on BF propagation, planting & pruning to interested/ new farmers	X no. of field trainings	2017-2018	High	NWC / MOA	PBSP

11.2 Samoa

No	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
SAMOA						
2.1	Lobby Government to prioritise breadfruit research and development priorities	Government to call for meeting of all BF interested parties. MOU on national collaboration	2017	High	NIA	MTCP 2
2.2	Invite other FO's into PBSP national work	X number of FO's joined PBSP	2017	High	NIA	MTCP 2
2.3	Host Global BF Summit 2017	BF 2017 Global BF Summit	2017	High	NIA / MAF / SROS / PIFON	Various
2.4	Collate all BF information in Samoa and regionally including states	Report of BF information	2017	High	SROS / PIFON	Various
2.5	Increase planting material, production, start BF orchards	X planting materials available X BF orchards developed	2017 – 2020	High	NIA / SROS PIFON	PBSP
2.6	PIFON & CePaCT ensure BF species in Samoa are conserved	X Samoan BF species in long-term storage	2017 – 2020	Medium	SROS / MAF / PIFON / SPC	PBSP
2.7	Establish BF gene bank	Gene Bank established	2018/19	Medium	SROS / MAF	PAPP

2.8	Map wild BF trees	Map of Samoa BF trees	2017	Medium	SROS / MAF / SPC / PIFON	PBSP
2.9	Work with Global Mana for order of container for FO	Receipt of container	2018+	Low	NIA / Global Mana	PBSP

11.3 PNG

No	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
PAPUA NEW GUINEA						
Farmer						
3.1	Increase Breadfruit planting	X BF orchards established	2017 - 2020	High	NARI / NIA	PBSP / NARI
3.2	Breadfruit Awareness (Share information with family / community)	X communities visited Roundtable report distributed	2017	High	NIA	PBSP / NARI
Research						
3.3	BF germplasm diversity retention	Germplasm library established	2017	Medium	NARI	NARI
3.4	BF Research priority	Approval for BF research & funds issues BF included on national list of staple crops	2017	High	NARI	NARI

3.5	File Project proposal for BF: - Propagation - Processing (under project work)	Proposal report Project proposal approved	2017 2017	Medium Medium	NARI NARI	NARI NARI
3.6	Opportunity for Germplasm exchange	Exchange of Germplasm	2017	Low	NARI / CePaCT	PAPP
3.7	Link with contacts from BF Roundtable for BF works in PNG	Meeting minutes	2017 onwards	Low	NARI / NIA / PIFON	Various

11.4 Cook Islands

No	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
COOK ISLANDS						
4.1	Experiment with 2 varieties for chips	Chip product for Cook Islands	2018 - 2021	Medium	NIA / PIFON	**PBSP**
4.2	Introduce BF Chips to Chefs / Hotels	General Event of Farmers / Cooks / Hotels	2018 +	Medium	NIA /PIFON	**PBSP**
4.3	Target 10% of Import market of chips (value $17M)	Business proposal for BF chips Obtain financing for proposal Implement proposal	2018 2019 2020	Medium	NIA / PIFON	**PBSP**

4.5	Public awareness on Breadfruit	X number of community outreach activities	2016/17	Medium	NIA	PBSP
4.6	Establish program on propagation, incl. marcotting and farmer training	BF workplan for propagation Implement workplan X farmers trained on propagation methods	20172018-2021 2018-2021	High Medium Medium	NIA / MAFF / PIFON	PBSP PBSP PBSP
4.7	Source funding for breadfruit activities	MoU with Chamber of Commerce (COC) Funding agreement with COC	2017+		NIA	COC
4.8	Training on characterization of breadfruit	X farmers trained on BF characterization	2018	Low	PIFON / NIA	**PBSP**
4.9	Breadfruit Value Chain training	VC training for breadfruit in Cook Islands	2017	Medium	PIFON / NIA	PBSP

11.5 Tonga

No.	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
TONGA						
5.1	Knowledge dissemination of Roundtable outcomes	X number of KM engagements on Roundtable	2016	High	ALL – GroFed, MORDI, Nishi	PBSP
5.2	Public awareness for Breadfruit	x number of media engagement	2016 - 2018	High	ALL	PBSP
5.3	BF Roundtable De-briefing	Action items for 5.1; 5.2	2016	High	ALL	PBSP

5.4	Increase growers	X number of new growers	2017 +	High	ALL	PBSP
5.5	Increase production	X number of new plantings Establishment of X BF nurseries	2017 + 2017	High High	ALL ALL	PBSP PBSP
5.6	Stock take of current breadfruit	Report of BF on the ground	2017	High	ALL	PBSP
	Possible import of BF varieties from Fiji and Solomon Islands	Import of BF varieties from Fiji and Solomon Islands	2018	Medium	ALL + FJ & SI FOs	PAPP
5.7	Map a Breadfruit Masterplan for Tonga	Develop Breadfruit Plan	2017	High	ALL	PBSP
5.8	Meet with PHAMA + 3 Exporters	1. Develop workplan	2017	High	ALL	PBSP
5.9	Training	Training plan	2017	Medium	ALL	PBSP
5.10	Consider 20ft container with Global Mana	2 x container to mill breadfruit flour	2018 +	Low	GroFED, MORDI	PBSP

11.6 Solomon Islands

No	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
SOLOMON ISLANDS						
Immediate (12 Months)						
6.1	Breadfruit awareness (Media and workshop includes MAFF, NGO's)	X number of awareness events x number of media engagements	2017	High	ALL	PBSP

6.2	Evaluate and Characterization of breadfruit	Report on existing BF varieties	2017	High	ALL	PBSP
6.3	Document traditional knowledge	Report of BF traditional practices	2017	High	ALL	PBSP
6.4	Map and evaluate growers	Report of BF growers	2017	High	ALL	PBSP
Medium (2 – 5 Years)						
6.5	Increase propagation (work with Kaitu)	X number of suckers propagated	2018 -2021	Medium	ALL	PBSP
6.6	Increase production (work with Kaitu)	x number of BF orchards established	2018 - 2021	Medium	ALL	PBSP
6.7	Domestication : Improve technology	Introduce mapping system to farmers	2018	Medium	ALL	PSBSP
6.8	Domestication: Improve numbers of trees	X number of BF planted	2018 - 2021	Medium	ALL	PBSP
6.9	Promote commercialization	X number of BF orchards	2018 - 2021	Medium	ALL	PBSP
Long Term (+ 5 Years)						
6.10	Training and capacity building - Production	Training Plan & Implement	+ 2021	Low	ALL	PBSP
6.11	Training and capacity building - Processing	Processing Plan & Implement	+ 2021	Low	ALL	PBSP
6.12	Source resources (Funding & Information)	Funding Proposal	2017	High	ALL	

6.13	Work with PIFON to enhance activities	PBSP Workplan	2017	High	ALL	PBSP

11.7 Hawaii

No	Breadfruit Program Activity	Proposed Outputs	Timeframe	Priority	Responsibility	Funding
		HAWAII				
7.1	Protect Breadfruit, strengthen Global Breadfruit, keep local culture	Framework / Policy Brief	2017	High	GBHC / PIFON	GBHC / PIFON
7.2	Product development and samples	1. BF Ice cream 2. BF spaghetti 3. As demonstrated at Global BF Hawaii Summit	2017	Medium	GBHC	GBHC
7.3	Promote regionalism to stabilize – Stay together	Framework / Policy Brief	2017	High	GBHC / PIFON	GBHC / PBSP
7.4	Work with drones to characterize BF trees	X number of characterization report	2017	Medium	GBHC / PIFON	GBHC / PBSP
7.5	Find someone to work the dryer, slicers, peelers (20 ft container)	X number of orders for container	2017 – 2021	Medium	Global Mana	Global Mana / PBSP
7.6	Co-host 2017 Annual Global Breadfruit Summit in Apia	Annual Global Breadfruit Summit	2017	Medium	GBHC / MAFF Samoa / PIFON	Various

11.8 General Discussionon country roundtable remarks

1. Characterization was identified as a priority for many of the countries and there was already significant information available in the region and the methodology was well documented. Country participants were invited to contact the Secretariat and work in close collaboration with CePaCT to obtain this information and any technical support towards characterisation in their countries.

2. Related to breadfruit propagation, participants were encouraged to not rely too heavily on MAFFF nurseries. Where possible, private sector and or FO nurseries were encouraged to be developed to ensure that planting material was available.

3. Participants were advised to work closely with the private sector in these breadfruit development activities. Caution was advised if Governments or marketing boards were looking at investing heavily into processing. Historically there isn't much evidence that this model has ever been successful.

4. A question on Marcotting led to a clarification that only a mature branch (already borne fruit) should be used to ensure the early fruiting benefits were realised.

5. PIFON Secretariat were encouraged to map its members FOs expertise so that the Network would be able to tap into this resource to use.

6. A request to the SPC LRD was made for assistance to the FOs and the PIFON network on Pest & Disease Management for breadfruit to be an action item that had not been notated in the Country Work Plans.

7. A final comment was made that traditionally, if there are three fruits on a breadfruit branch, this signalled oncoming Hurricane. Traditional elders would advise people to eat one fruit, and preserve two for the bad days ahead.

12 Individual action plans and participant evaluations

In addition to the country work plans, all participants completed individual action plans.

The template required participants to list 4 action items that they will do when they return home based on the information that they had just received at the Roundtable.

It is PIFON's intention that a follow up monitoring of individual action plans of the participants proposed actions will be carried out and to be part of PIFON's Learning and Review Exercise (refer Key Outcomes 14.5)

Roundtable participants filling out their Evaluation forms at the end of the two days of Technical Sessions.

13 Day 2 Field visits

13.1 Breadfruit Plot at Talasiu

Taitusi Falakiseni, a MORDI staff member and participant in the Breadfruit Learning Exchange to Fiji explains how he and other members have been implementing their 'action plans' including planting of breadfruit in 'orchards'.

A four acre breadfruit farm that will be intercropped with watermelon and root crops.

Participants discuss a traditional Tongan method of directly transplanting large root suckers into the field.

Many Tongan farms are divided up into blocks with coconut trees planted on the boundaries of the blocks. This particular farmer has also incorporated breadfruit in these boundary plantings.

13.2 HTFA at the Domestic Airport

Shameem Khan of TEQM explains how the High Temperature Forced Air (HTFA) chamber is run for fresh breadfruit exports to New Zealand. HTFA was something that many countries in the Pacific have in common and many of the issues were similar.

13.3 Tupou College Breadfruit Orchard, Tolitoli Papaya Plantation, Tonga College Breadfruit.

Participants visiting Tupou college which is working in collaboration with Tonga Growers Federation to establish a 100 tree breadfruit orchard on the school farm.

A visit to Tonga college to observe the newly planted breadfruit orchard with vegetable intercropping.

A newly planted breadfruit root sucker at Tonga College.

14 Key Outcomes

14.1 Transfer of key technical information

The Pacific Breadfruit Roundtable had a strong emphasis on technical information transfer through presentations, field visits and hands on demonstrations. A significant amount of formal and informal breadfruit research is taking place in Fiji, Samoa and Tonga and the roundtable provided a unique opportunity to transfer this information to stakeholders from around the region. Important to note is that the information was transferred directly to farmers, farmer organisations or research agencies who are directly engaged in breadfruit development and therefore it is expected that this will have a significant impact.

14.2 Strengthening of national Farmer Organisation networks

The collaboration of farmer organisations (FOs) and research partners at the national level to plan and prioritise breadfruit development activities was a key outcome of the Pacific Breadfruit Roundtable. Many of the farmer and research organisations represented at the roundtable are not formally connected and often do not actively collaborate at the national level for a variety of reasons, however the format of the roundtable helped to strengthen these partnerships through the national planning platform. These strengthened partnerships at the national level are expected to bring significant impacts as each organisation brings to the table a different skill set and area of expertise.

14.3 Strengthening of regional Farmer Organisation networks

The roundtable brought together farmer organisations and research organisations from around the region with varying skills and expertise related to breadfruit. The roundtable allowed participants to learn first-hand what each other is doing related to breadfruit and how collaboration may take place. In the case of Samoa, breadfruit processing research and development is far advanced and within SROS and the private sector there exists a significant amount of expertise applicable to the rest of the region. Fiji is very advanced in terms of breadfruit nursery work and orchard establishment and this expertise is now well known within the PIFON network. Similar examples of expertise exist in each of the countries represented at the roundtable and a key outcome of this meeting was the strengthening of these regional networks. The impacts of these strengthened networks are already evidenced in the national work plans which reflect a number of technical exchanges and advisory inputs across the network.

14.4 Identification of key national breadfruit activities

A concrete outcome of the breadfruit roundtable was the identification and prioritisation of key national breadfruit activities. These activities listed in Section 11 of this report range from short term information dissemination activities to much more in-depth industry development activities. Some of the common national activities that were identified included:

- Further information dissemination and public awareness on breadfruit research, development activities and its nutritional and gluten-free status when processed.
- Advocacy and public awareness of Breadfruit as a traditional crop in the Pacific linking it to nutrition for the pacific people
- A concerted effort to support breadfruit orchard development in various scales and models.
- Increased breadfruit characterisation work and awareness of the different varieties available in each country. Translating this information into user-friendly charts for practical use by farmers, members and stakeholders.
- Regional collaboration and Farmer to Farmer Learning Exchanges
- Advocacy to government and other policy makers on issues impacting breadfruit research and development i.e. New Zealand requirement for bait spraying of fresh breadfruit exports.
- Advocacy and public awareness of breadfruit's nutritional value and its gluten-free status when processed. To develop cottage industry gluten-free flour processing at community level for food security, nutrition and livelihood programs linked to national nutritional platforms. More importantly as an import substitution to replace wheat flour

Critically important is that these plans were developed by the people/organisations who will be responsible for implementation and therefore the likelihood that these activities becoming a reality is much higher.

14.5 A very clear and concise focus for the PBSP work program

PIFON has been in staged implementation of this Pacific Breadfruit and Seed Program (PBSP) however it has yet to secure the core funding required for full implementation.

A concrete outcome of this roundtable has been the refinement of national and regional priorities which will further inform the work of the PBSP from 2017 onwards.

The onus is now on PIFON to clearly incorporate these priorities into the PBSP working document and work to identify suitable partners to support this work at the national and regional level. Some specific activities identified for PIFON under the PBSP including:

- Wider dissemination of the information shared/produced through the Pacific Breadfruit Roundtable
- Follow up with key stakeholders and plans to operationalise the country work plans using whatever resources may be available.
- Facilitate some of the identified technical exchanges
- Further strengthen and institutionalise some of the partnerships being developed with the University of Hawaii, SPC, Global Mana, SROS, NARI and others.
- Hosting a follow up Pacific Breadfruit Roundtable at a later date as a Learning and Review event from this first Pacific Breadfruit Roundtable to measure the Country Work plans objectives and its output.

15 Recommendations

15.1 Recommendations for Farmer Organisations

A clear recommendation coming out of the roundtable for farmer organisations was to consider the significance of breadfruit in the local context for addressing the challenges of climate change, nutrition, livelihoods and food security. The wide variety of applications of breadfruit in cropping systems make it a tree that should be considered by all farmers, and farmer organisations should make a concerted effort to raise awareness about breadfruit and its possible applications.

As outlined in the various presentations and in these proceedings, farmer organisations can be a facilitator and driving force in breadfruit extension and research and development in terms of:

- Characterisation of varieties and farmer awareness
- Sourcing, bulking and distribution of planting material
- Facilitating the planting of breadfruit in orchards, food gardens, school programs etc.
- Linking farmers to markets
- Providing ongoing training and support
- Influencing national policy related to prioritisation of traditional crops (like breadfruit).
- Advocating breadfruit processing into gluten free flour for local consumption and an import substitution to wheat flour.
- Highlighting its nutritional value and the gluten free status of breadfruit linking to national health platforms
- Cottage industry gluten free flour processing at community level for food security and livelihoods
- Studying the value chain of Breadfruit to Gluten free flour, examining the links and advocating the nutritional and health values linking it to NCD's at country levels
- Understanding that of the 17 SDG's[1] that have been endorsed, 10 can be directly achieved through the PBSP thus farmer organisations are assisting to help Transform the World which is the UN's agenda up to 2030.

Farmer organisations should consider the above list of 'roles' in terms of their own context and resources and determine what is feasible.

Farmer organisations should take advantage of the wealth of practical knowledge on breadfruit that exists within the PIFON network while implementing its activities.

1 SDG's – Sustainable Development Goals is a United Nations initiative officially known as Transforming our world: the 2030 Agenda for Sustainable Development is a set of seventeen aspirational "Global Goals"

15.2 Recommendations for Governments

Governments should consider the evidence presented through this roundtable report and other sources related to the importance of breadfruit for the Pacific region in terms of addressing the challenges of climate change, food security, livelihood and nutritional platforms. Governments should use this evidence to inform national plans and strategies related to the agricultural sector so that breadfruit is given the extension, research and development attention it requires.

Governments should consider the national work plans that have been developed through this roundtable and determine how the public sector can assist to facilitate and support these work plans.

Governments to look to strengthening partnerships with farmer organisations, research organisations and the private sector to work collectively towards breadfruit development at the national level. The organisations who participated in this roundtable provide a foundation for the partnerships required to further breadfruit development at the national level and governments may consider making resources available to these organisations through a partnership approach to achieve the targets set forth.

Governments to note that the Breadfruit Roundtable outcomes are directly linked to 10 of the 17 Sustainable Development Goals (SDGs), officially known as Transforming our world: the 2030 Agenda for Sustainable Development spearheaded by the United Nations. The specific SDG's are 1, 2, 3, 5, 8, 10, 11, 12, 13 and 15.[2] Governments are encouraged to work with PIFON and its farmer organisation members to work towards achieving its SDG's through this PBSP program.

2 1: End Poverty, 2: Zero Hunger; 3: Good Health and Wellbeing, 5: Gender Equality, 8: Decent Work and Economic Growth, 10: Reduced Inequalities, 11: Sustainable Communities, 12: Responsible Consumption and Production, 13: Climate Action and 15: Life on Land

15.3 Recommendations for Donor and Development Partners

Donors and development partners should consider the evidence presented through this roundtable report and other sources related to the importance of breadfruit for the Pacific region in terms of addressing the challenges of climate change, food security, import substitution, nutrition and livelihood platforms. Development partners should use this evidence to inform their development priorities related to the agricultural sector so that breadfruit is given the research and development attention it requires.

Development partners to also consider the national work plans that have been developed through this roundtable and determine mechanisms to assist in the operationalising of these plans, including building into bilateral and multilateral workplans and funding arrangements.

Development partners should look to strengthen partnerships with farmer organisations, research organisations and the private sector to work collectively towards breadfruit development at the national and regional level. The organisations who participated in this roundtable provide a foundation for the partnerships required to further breadfruit development at the national level. Their participation and input into their own workplans indicates the high level of commitment that can ensure immediate success of this program on its operationalisation as momentum has already started.

Development partners should consider the PIFON proposal for the Pacific Breadfruit and Seed Program (PBSP) as a mechanism to provide meaningful support and resources that reaches the farmers themselves and addresses all these important challenges of climate change, food security, nutrition, livelihoods and import substitution platforms.

Donors and development partners are encouraged to note that the PBSP and the Breadfruit Roundtable outcomes are directly linked to 10 of the 17 Sustainable Development Goals (SDGs). As the Breadfruit is a versatile crop, the benefits of this crop spread across several SDG's covering 1: No Poverty, 2: Zero Hunger; 3: Good Health and Wellbeing, 5: Gender Equality, 8: Decent Work and Economic Growth, 10: Reduced Inequalities, 11: Sustainable Communities, 12: Responsible Consumption and Production, 13: Climate Action and 15: Life on Land. Development partners are encouraged to consider working with the PBSP to achieving the 2030 Agenda of Transforming the World.

3 1: End Poverty, 2: Zero Hunger; 3: Good Health and Wellbeing, 5: Gender Equality, 8: Decent Work and Economic Growth, 10: Reduced Inequalities, 11: Sustainable Communities, 12: Responsible Consumption and Production, 13: Climate Action and 15: Life on Land

16 Annexes

16.1 Annex 1: Workshop Programme

Day 1: Thursday September 15th 2016	
Time	**Event/Topic**
8:00am	**Opening Ceremony** Opening prayer – Rev. Dr. 'Alifaleti Mone Welcome remarks – Mr. To'imoana Takataka, Chairman Growers Federation Welcome remarks – Mr. Afamasaga, PIFON Chairman Official Opening – Hon. Semisi Fakahau, Minister for Agriculture, Food, Forests and Fisheries Refreshments and Group Photo
9:00 am	**Introduction of participants**
9:30 am	**Keynote presentation -** Context for breadfruit development in the region – the role of farmer organisations and PIFON *Overview of the Roundtable Objectives and Programme*
10:00 am	**Roundtable country remarks –** Representative from each country (7 countries represented) to share their vision for breadfruit development and plans to achieve this. Participants have 5 mins to present – no PowerPoint necessary.
11:00 am	**Technical Session #1 – Breadfruit varieties and propagation** Overview of breadfruit diversity in the region – SPC CePACT Experience in breadfruit characterisation in Fiji – NWC/Tutu Methods of breadfruit propagation – root suckers, root cuttings, marcotting, stem cuttings and tissue culture – results from Marcotting trials and update on propagation field trials - NWC Mass propagation/collection of breadfruit germplasm - Experience from Fiji – NWC/Tutu *Discussion on Technical Session #1*

Day 1: Thursday September 15th 2016	
12:00 pm	**Technical Session #2 – Breadfruit production systems** Breadfruit in the agroforestry system (SI experience) - KGA Breadfruit production in Samoa (Experience of the Pacific's first breadfruit 'orchard') - SFA Developing commercial breadfruit orchards in Fiji (role of intercropping) - NWC *Discussion on Technical Session #2*
1:00 pm	**Lunch at Keleti Beach Resort**
2:30 pm	**Field Visits** - Nishi Farms - MAFFF Nursery at Tokomololo - Sioeli Kalaleti's breadfruit at Pea - Felipe's Breadfruit Orchard at Puke with hands on training in characterisation, marcotting and root sucker propagation.
5:30 pm	**Dinner at Filipe's Farm**
7:00 pm	**End of Day 1**

Day 2: Friday September 16th 2016	
Time	**Event/Topic**
8:00 am	**Update from 2016 Hawaii Pacific & Global Breadfruit Summit – Pacific Business Center Program (University of Hawaii)**
8:30 am	**Technical session #3: Fresh exports of breadfruit** Tonga experience with fresh breadfruit exports – GroFed/TEQM Samoan experience with fresh breadfruit exports - SFA Fiji experience with fresh breadfruit exports - NWC Breadfruit postharvest research in Samoa - SROS *Discussion on Technical Session #3*

9:30 am	**Technical session #4: Breadfruit Processing** Overview of breadfruit processing options/opportunities – Dr. Richard Beyer Breadfruit product development in Tonga – Nishi Trading and Tokyo University Breadfruit product development in Samoa – SROS Traditional breadfruit processing and cottage industry development – Solomon Islands Sourcing breadfruit processing equipment – Global Mana *Discussion on Technical Session #4*
10:30 am	**Country group activity** – Identifying priority research areas and learning exchange opportunities Roundtable Feedback
11:30 am	**Overview of PIFON PBSP** - opportunities for national and regional work - Identifying additional funding opportunities
12:00 pm	**Roundtable country remarks –** Representative from each country (7 countries represented) to share concrete 'next steps' for breadfruit development in their country and summary of capacity/resource constraints.
1:00 pm	**Wrap up and agreement on way forward**
1:30 pm	**Lunch - Women Group of Talasiu Village**
2:30 pm	**Field visit** Breadfruit Plot at Talasiu HTFA at the Domestic Airport Tupou College Breadfruit Orchard, Tolitoli Papaya Plantation, Yam Toutu'u at Vaini, Tonga College Breadfruit.
4:30 pm	**Return to town**
7:00 pm	Leave to 'Oholei Beach – Cultural Night and Farewell Dinner

Annex 2: Workshop Participant List

LIST OF PARTICIPANTS (16.09.16)

Name	Designation	Organisation	Country
Kyle Stice	Manager	PIFON secretariat	Fiji
Richard Beyer	Food Scientist/Consultant	Self employed	Fiji
Afamasaga Toleafoa	Chairman, PIFON Board	SFA	Samoa
Clement Hadosaia	PIFON Board Member	KGA	Solomon Islands
Serenia Maadigibuli	PIFON Board Member	TRTC	Fiji
Daniel Mataroa	President		Cook Islands
Peter Gendua	Research Manager	NARI	PNG
Peter Noho	Farmer	PNGWiADF	PNG
Philip John Tuivavalagi	Farmer	Samoa Farmers Association	Samoa
Kaitu Erasito	Breadfruit Technical Officer	NWC	Fiji
Erenimo Tui	Farm Manager	TRTC	Fiji
Lavinia Kaumaitotoya	Program Manager	PIFON Secretariat	Fiji
Alan Petersen	Chairman	Tei Tei Taveuni	Fiji
Lilian Ekbom	Treasurer	Tei Tei Taveuni	Fiji
Kunimere Finau	Researcher	SROS	Samoa
Moses Pelomo	Chairman	KGA	Solomons
Richard Pauku	President	NGASI	Solomons
Josh Sybrowsky	Engineer	Global Mana	Hawaii
Cheryl Thomas	Policy Research Officer	SPC	Fiji
Alipateresio Lovolevu	CePACT Research Officer	SPC	Fiji
Dr. Failautusi	Founder	GBHC	Hawaii
To'ifalefehi Moala	Extension Research Officer	MAFF	Tonga
Sinai Tuitahi	CEO	GroFed	Tonga
Taniola Hoponoa	Program Manager	MORDI	Tonga

Name	Designation	Organisation	Country
Minoru Nishi	Board Member	Nishi Trading	Tonga
Moala Latavao	Field Officer	MORDI	Tonga
Solomone Vaikeli	Production Manager	Grofed	Tonga
Tevita To'a	Field Officer	MORDI	Tonga
Paulo Muller	Field Officer	MORDI	Tonga
Taitusi Falakiseni	Field Officer	MORDI	Tonga
Ella Kafalava	Field Officer	Nishi Farm	Tonga
Mercy Kafalava	Field Officer	Nishi Farm	Tonga
Nomipa Napa'a	Field Officer	Grofed	Tonga
Filipe Filihia	Grofed Grower	Grofed	Tonga
Sione Foliaki	Deputy Director	MAFFF	Tonga
Tevita Tapaevalu	Principal Agriculture Officer	MAFFF	Tonga
Toilea Taholo	Corporate Service Manager	Grofed	Tonga
Sitiveni Fea'o	Grower	Hahake Growers	Tonga
Emeline 'Ahoafi	Techncial Officer Grade 1 at MAFFF	Grower	Tonga
Toni Afu	Breadfruit Exporter	Meletoni Fresh	Tonga
'Eseta Tamale	Breadfruit Exporter	Ha'amo Fresh	Tonga
Saia Lasike	Breadfruit Exporter	Exporter	Tonga
Salesi Tu'iono	Agriculture Tutor	Tupou College	Tonga
Sione T. Fakakovikaetau	Agriculture Tuto	Tonga College	Tonga
Owen Pau'u	Grower	Grofed	Tonga
Shameem Khan	Manager	TQEM	Tonga
Runte Likiafu	Program Manager	DFAT	Tonga
Taniela Hoponoa	Program Manager	MORDI/Live & Leaarn	Tonga
Malia Lasike		SUL Farm & Marketing Ent	Tonga
Emmanuel Mo'ale	Head of Extension	MAFF	Tonga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