

A REVIEW OF THE NATURE'S WAY COOPERATIVE (FIJI) LTD. RESEARCH AND EXTENSION PROGRAM AND PROPOSALS FOR THE FUTURE (2006-2016)



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Acronyms

ACIAR	Australian Center for International Agricultural Research
AMA	Agricultural Marketing Authority
AUD	Australian Dollars
BA	Biosecurity Australia
BAF	Biosecurity Authority of Fiji
BQA	Bilateral Quarantine Agreement
CAAF	Civil Aviation Authority of Fiji
CAD	Commercial Agricultural Development Project (USAID)
CEO	Chief Executive Officer
CePaCT	SPC's Centre for Pacific Crops and Trees
CTA	Technical Agricultural and Rural Cooperation
EDB	Ethylene Dibromide
ENSO	El Niño–Southern Oscillation
EU	European Union
FACT	Facilitating Agricultural Commodity Trade Project (EU
FAO	Food and Agricultural Organization of the United Nations
FDB	Fiji Development Bank
FPP	Fiji Papaya Project
GMOs	Genetically Modified Organisms
HTFA	High Temperature Forced Air Quarantine Treatment
MAF	Ministry of Agriculture (Fiji)
MAFF	Ministry of Agriculture Fisheries and Forests (Fiji)
MPI	Ministry of Primary Industries
NWC	Natures Way Cooperative
NZAID	New Zealand Agency for International Development
NZMAF	New Zealand Ministry of Agriculture and Forestry
PARDI	Pacific Agribusiness Research and Development Initiative (ACIAR)
PBP	Pacific Breadfruit Project
PHAMA	Pacific Horticulture and Agriculture Market Access Project (AusAID)
PPP	Private Public Partnership
PRV	Papaya Ring Spot Virus
QDPI	Queensland Department of Primary Industries
R&E	Research and Extension
REP	Research and Extension Partnership
SPC	Secretariat of the Pacific Community
IKSA	SPC Key Services to Agriculture Project
SPC LRD	SPC Land Resource Division
TAB	Technical Advisory Board
ТС	Tropical Cyclone
TTM	Taiwan Technical Mission
USAID	United States Agency for International Development
USDA	United States Department of Agriculture





l | Summary

Nature's Way Cooperative (Fiji) Ltd has continuously conducted reviews of its overall operations together with specific reviews of specific components of the business. This has been done to ensure that Nature's Way continues to operate in a manner that best serves the interests of its members and Fiji's horticultural export industry. This review which looks specifically at the performance of the Nature's Way's Research and Extension Programme (2006-2016). This particular review comes at the end of a three year NZ Aid funded extension programme (2013-2016) and provides insights for management as to the future direction of the research and extension program. The review is also intended to provide NWC partners with the 'bigger picture' of how these individual projects are linked and building on the previous projects and fit into the overall objectives of the NWC Research and Extension Programme to create a sustainable future for Fiji's horticultural export industry.

In 2001 the NWC Board initiated a performance review for the first 6 years of operations. The report provided the basis for a 5-year Strategic plan. A key recommendation of the Strategic Plan was that the Cooperative needed to be more directly involved in field operations with farmers. The appointment of an experienced Fruit Specialist to support NWC's Manager in field operations, to expand production and improved quality, was proposed. At the time NWC did not have the financial resources to fund a fruit specialist extension officer directly. Thus a request was made to the Ministry of Agriculture to second an officer to NWC to take up this position under the direction of the NWC Manager. The Ministry of Agriculture agreed to this proposal and so the Nature's Way Extension Service was "launched" in 2002. However, this arrangement proved to be ineffective, without clear lines of communication and responsibility.

It was not until 2007 that NWC was able to appoint its own full time field officer with two years funding from AusAID. NWC's financial contribution to the field service was the purchase of a 4WD vehicle and meeting operating costs. The expectation was that NWC would fully fund the field officer after two years as the projected throughput grew. Luke Tirimaidoka, formally a Senior Quarantine Field Officer, was appointed the NWC Field Officer. The focus of Luke's work was on papaya. Under his direction good progress was made in recruiting new farmers to grow HTFA commodities and in linking farmers to exporters. He began working with the exporters to systematically reduce reject rates at the treatment facility – this included the introduction of outturn and quality defect analysis. In particular he was able to provide the links between SPC, Fiji Quarantine and Koronivia Plant Protection. Tragically, Luke died at work in September 2008. The vacuum left by the death of Luke, was a major setback for NWC in the development of an out-reach program. However, his work had proven the value of a small focussed field service staffed by qualified people.

NWC's ability to fund its own field officer also suffered a major setback due to natural disasters. For the first 10-years of NWC operations the weather had had a relatively benign impact on throughput. This unfortunately changed dramatically in January 2009, with a "50-year" flood event. It took nearly a full year for throughput to be returned to normal levels. Thus there were no funds available to finance a field officer despite the recognition of the value of this position.

NWC's second Strategic Plan was prepared in 2009. This Plan identified a significant research and extension capability as a necessary requirement for a sustainable business. This Plan, endorsed by the Annual General Meeting, made a number of key recommendations for improving the quality and production of fruit from the field. These were that NWC should:

- be an agribusiness providing members more than just quarantine treatment services;
- be a body representing the needs of the horticultural export industry;
- operating an effective field service;
- continue to proactively support market access facilitation; and,
- be involved in Input supplies, where appropriate.

In 2009 the Cooperative throughput was still not sufficient to fund a program to improve the quality and production of fruit from the field without substantial public sector (donor agency) support. Thus the research and extension program has evolved over the last seven years based on the number of coordinated projects and activities supported by various donor and technical agencies. These were:

- Australian Centre for International Agriculture Research (ACIAR)
 - The Fiji Papaya Project (FPP)
 - The Pacific Breadfruit Project (PBP)
 - The NWC Research and Extension Network Partnership (REP)
- NZAID Support Programs
 - NWC Extension Program
 - NWC Research Program
 - Disaster preparedness and rehabilitation pilot projects.



ACIAR PROJECTS

The Fiji Papaya Project

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The four year FPP began in January 2009 and funded three field staff. The Project effectively became the research wing of NWC, focussing on papaya, and leveraging research inputs from Fiji (Ministry of Agriculture and SPC), Australia (QDPI) and Hawaii (private sector).

Papaya was seen to have the prospect of becoming a major horticultural export industry. Although there was considerable information on papaya production from Hawaii and elsewhere this was not "customised" for use by Fijian farmers and there was not any formal research into the issues facing the commercial papaya industry in Fiji. In the absence of sound, locally appropriate, production, harvest and post-harvest information it was recognised that there were serious quality and supply consistency issues that threatened the long term viability of the Fiji papaya industry.

The FPP had three primary objectives:

- To strengthen the capacity of the Fiji papaya industry to plan, conduct and adopt the products of problem-solving research.
- To expand and increase the resilience of the papaya industry in Fiji.
- To promote the adoption of project outputs in the Fiji Papaya industry and elsewhere.

With four main activity areas: sustainable seed supply and variety development; crop agronomy; pest and disease management; and, supply chain development. It was expected as a result of the Project there would be a threefold increase in exports of papaya (from around 600 tonnes in 2008 to some 4,000 tonnes by the end of the Project). This was a particularly ambitious target. However, it was seen as realistic given the:

- good agronomic conditions for growing papaya in western Viti Levu;
- identified market opportunities; and
- keen interest shown by growers and exporters.

While the projected increase in papaya exports was not achieved, a significant increase in exports was realised over the life of the Project. This was despite a series of major natural disasters. This increase can to a large extent be attributed to the FPP, which was recognised in a comprehensive independent project review undertaken by ACIAR. The ACIAR Review concluded the Project had "been very efficiently implemented and was timely, relevant, well focused with high potential impact for meeting excellent export market demand". The institutional structure of the Project's Technical Advisory Board (TAB) that linked NWC, the Industry, Ministry of Agriculture, Bio-Security, and SPC was deemed to have been particularly successful.

Nature's Way Cooperative provided a successful, research, information, extension, training system for the Fiji Papaya industry and other horticultural export industries. The project helped catalyse the successful establishment of an implementation model through partnering with a Farmer Based Organization (Nature's Way Cooperative), to implement the project with collaborators from government research and extension, other NGO's and all stakeholders in the Fiji Papaya industry as well as key advisors. The challenge is how to maintain this excellent initiative after project support ends. A follow-on system for information dissemination and technical research support after the project support concludes has not been developed, and this will be crucial to the future development of the Fiji papaya industry. The Review strongly recommended that this outreach function be part of any Phase II Papaya Project.

The successful development of an export industry based on a fruit tree crop needs to be seen as a long term process. Thus despite the success of the FPP much more needs to be done to build on what was achieved and to draw on the lessons that have been learned. Thus a proposal was prepared for ACIAR to support a Phase II of the Project. The proposed Phase II, was for four years and focused on five primary applied research themes:

- Sustainable production systems in the face of climate extremes and climate change
- Improving post-harvest handling
- Value chain improvement
- Papaya value adding and processing
- Promoting the adoption of the Fiji Papaya Project outputs

There was no precedent for eight years of continuously ACIAR support for one particular tree crop industry. ACIAR, faced with substantial overall budget cutbacks, thus agreed to provide additional funding for 1 year, to facilitate the implementation of some of the FPP important research findings. These included: sea freight to New Zealand; NWC's certified "Fiji Red" seed scheme; and, investment by NWC in hot water treatment for the control of fungal diseases.



The Pacific Breadfruit Project

NWC, in parallel to the FPP, implemented a second major ACIAR Project – the Pacific Breadfruit Project (PBP). This four year project began in January 2011. The PBP was implemented in collaboration with the Ministry of Agriculture and SPC's Centre for Pacific Crops and Trees (CePaCT). The Project funded an Activity Leader/Farm manager, Horticultural Specialist and a Research Officer.

NWC involvement with breadfruit dates from 2000, when the HTFA quarantine facility was certified for export of breadfruit to New Zealand. The NWC Strategic Plan (2002-2006) identified a market of 300 to 400 tonnes for fresh breadfruit in New Zealand. The Plan projected exports of 100 tonnes by 2006 and that these exports would exceed 200 tonnes by 2010. These projections were based on a combination of positive indicators: breadfruit's proven suitability to HTFA treatment; the existing production base; a large New Zealand market already in place; and; potential markets in Australia and the United States.

Two exporters were quick to respond to the fresh breadfruit export opportunity and began exporting in 2001, with 5 tonnes shipped. Yet, since that time there has been no growth in exports, with a maximum export of 12 tonnes achieved in 2005. Two fundamental reasons were identified for exports falling far short of what had been projected. These were:

- Breadfruit for export was "wild harvested". This created major production, harvesting and post-harvest handling constraints.
- The availability of breadfruit in proximity to NWC treatment facility was limited to only four to six weeks per year.

A two stage applied research program was identified to facilitate the launching of breadfruit into a significant commercial industry. The PBP was the first stage of the industry development program which dealt with commercial orchard production and post-harvest handling for fresh exports. A second future stage was proposed that would deal with the commercial processing of breadfruit. The key objective of the PBP was the establishment of breadfruit as a commercial small- holder based orchard crop. Achieving this objective had three core components: i) identifying varieties that will enable year-round production and develop systems for propagating them; developing best practices for the establishment and management of small scale commercial breadfruit orchards; and, establishing harvesting and post-harvest systems to meet export market requirements.

The PBP ended in December 2015. At that point 32 breadfruit orchards had been established with 1,464 trees planted of which 30 trees were already bearing. The number of trees was well below the target of 5,000 trees. However, this was seen as an excellent achievement given that most of the project's initial stock planting material was lost in the extreme flood of 2012 and the nurseries had to be re-established from scratch. Orchard trees began bearing within a little over two years compared with the four to five years normally expected for breadfruit. Fresh breadfruit exports to New Zealand would have commenced by the end of 2016 – had the fruit not been lost due to Cyclone Winston. However, the trees themselves proved to be remarkably resilient with less than 1% of trees lost in the main commercial orchards. It is now projected that the planting of 20,000 trees by the end of the decade would lead to 4,500 tonnes of marketable fruit.

A notable feature of the PBP, as with Fiji Papaya Project, was that it enabled NWC to coordinate with other stakeholders. This again focussed around the Technical Advisory Board (TAB). The coordination with SPC CePaCT was particularly effective, which enabled the planting out of breadfruit tissue culture material in orchard trials.

The PBP's presentation to the Fiji National Breadfruit Symposium in May 2015 recommended that if breadfruit orchard development were to realise its full potential, the following would be required:

- Further refinement of pruning and other orchard management techniques
- The continued development of intercropping to realise commercial viability for small holders.
- The on-going evaluation of planting material derived from different sources
- The development of commercial enterprises to collect, propagate and distribute planting material.
- Having a commercially viable bilateral quarantine agreement (BQA) in place;
- The generation of domestic commercial demand for breadfruit to be used for processing.

It is readily apparent that a long term applied research program is required if this "new" orchard crop is to start realising its very substantial full potential. ACIAR have agreed to provide four years of funding to NWC to continue its orchard development work.

The Research and Extension Network Partnership.

An important feature of both the Fiji Papaya Project and the Pacific Breadfruit Project was the Technical Advisory Board (TAB), chaired by the NWC CEO. For the sake of efficiency and effectiveness a decision was made in early 2014 to combine the two TABs into one NWC Research & Extension Partnership (REP) Committee. The REP coverage, unlike the previous TABs, was no longer project commodity specific. It dealt with research and extension issues of all HTFA quarantine treated crops (papaya, breadfruit, eggplant and mango) and potential HTFA treated



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crops (wi, jakfruit). The objectives of the NWC REP Committee is to provide: a platform for industry partners to discuss issues related to Fiji's HTFA commodities; regular feedback to industry partners on research findings, project accomplishments and emerging issues; guidance to industry partners in prioritizing research and extension activities related to HTFA crops; technical expertise in the implementation of research activities; and, assistance in the analysis and validation of research outcomes.

The creation of REP was a pre-emptive measure to ensure the sustainability of the successful coordination structure that had been created by the FPP and the PBP beyond the life of the projects. This was part of NWCs transition from research and extension projects to sustained research and extension program.

NZAID FUNDED PROGRAMS

NWC Extension

Climatically, 2012 proved to be a particularly challenging year for NWC with two major floods earlier in the year followed by Cyclone Evan at the end of the year. As a consequence there were very little exports in the first half of 2013. NWC, with virtually no revenue being generated, sought financial assistance from NZAID and AusAID to support the continuation of the Extension Program and fund an Export Stimulus Scheme. Three years of support for the NWC Extension Program was agreed to by AusAID and NZAID – channelled through NZAID. The funding provided for a part-time Extension Manager and two full time extension offices, a 4WD vehicle and its operating costs.

The overall vision of the Extension Programme was to increase total exports through expanding the supply base (new farmers) spread across a wider geographic region (expand production outside of the Sigatoka Valley). The Extension Programme had three specific goals:

- Increased number of farmers actively involved in the horticultural export industry as a means of increasing export volumes, to enhance the livelihood contribution of horticultural exports and reduce risk for NWC.
- Increased contributions of export produce from outside the Sigatoka Valley seen as a strategy to increase export volume and to reduce vulnerability to natural disaster by spreading the production area.
- Increased overall export volumes to increase the viability and sustainability of NWC.

By the end of 2015 considerable progress was being made in achieving these goals.

A number of key constraints are identified in the implementation of the NWC Extension Program. These were: high attrition rate of new exporters in target geographic areas; the wide geographical distribution of the target beneficiaries; and, a number of key issues requiring an applied research response. The key research issues included: the eggplant "disorder"; post-harvest rots for eggplant and papaya; inefficiencies with BQA agreements with New Zealand; and the high cost of airfreight requiring a transition to sea freight shipments.

A major challenge for NWC Extension Program is the natural disaster that struck in February (Category 5 Tropical Cyclone Winston) and March 2016 (the flooding associated with Cyclone Zena). In the months leading up to these cyclonic events the area was subject to a severe El Nino induced drought where the Extension Program was providing tailored advice to participating farmers on options for irrigation and in some cases advice on access to finance for securing the required equipment. Drought conditions have continued following the cyclones. An acid test of the effectiveness of the NWC Extension Program will be how well these farmers are able to recover from these disasters. NZAID has agreed to provide some additional financial support to help with this process. A particular focus of the NWC Research and Extension Program has now become adaptation to climate change and climate extremes.

NWC Research

In July 2015 NWC embarked on a three year, NZAID funded, applied research focussed Project entitled "Enhancing Fruit and Vegetable Exports from Fiji". The funding provides for a Research Manager, who also served as the NWC's Operations, a part-time Technical Advisor, two full time Research Officers. The team was supported by a 4WD vehicle and its operating costs, materials and transport costs. The NWC/ NZAID Research Program had 6 core components:

- Developing a website to enhance online presence of fresh fruit and vegetable exports.
- Developing an industry wide 'Fiji Red' papaya brand.
- Reducing treatment costs through improved market access with New Zealand.
- A sea freight and hot water treatment incentive scheme.
- Research and development activities for product improvement and new product development.
- Reviewing and updating of bilateral quarantine agreements (BQAs) between Fiji and NZ for Fruit Fly Host commodities.



Nature's Way's 2009 Strategic Plan: "A Strategic Plan to Achieve a Sustainable Future" projected throughput reaching 2,500 tonnes in 2011 and exceeding 3,200 tonnes in 2012. The 2015 Updated Corporate Direction projected an annual 2,500 tonnes by 2017. The NWC Research and Extension Program was a major part of the Plan to achieve these targets. Further it was projected that the NWC Research and Extension Program could be self-funded once the 3,000 tonne throughput target was achieved. However, in the meantime the Research and Extension Program would need to be funded as part of the public private sector partnership through donor funding.

The actual throughput performance fell well short of the 3,000 target, with the 1,287 tonnes being the highest level achieved in 2011. The significant shortfall is explained by a combination of factors:

- The impact of climate and disasters
- The failure in securing additional market access and bilateral quarantine agreement pathway reforms
- Limitations of the NWC Research and Extension Program

The impact of climate and disasters

The first decade of NWC existence was relatively benign in terms of climatic conditions – although there was a severe El Niño-induced drought in 1997/98. Prior to Cyclone Evan in December 2012, the last major cyclones that impacted on the Sigatoka Valley were Cyclones Wally (1980) and Kina (1993). During that first decade the main disruption to supply was the result of the political disturbances and trade bans associated with the 2000 Coup. In contrast the last decade has been characterised by a series of major events that have impacted the production of horticultural export crops. These events commenced with the "50 year" flood of January 2009 and were followed by:

- Category 3 Cyclone Mick Dec 2009
- Major floods of January and March 2012
- Category 3/4 Cyclone Evan in Dec. 2012
- Category 5 (northern Viti Levu) in February 2016
- Severe El Nino induced drought in the second half of 2015 and early 2016.
- Severe flooding associated with Cyclone Zena in April 2016

The various NWC research and extension activities did much to assist farmers and exporters in recovering from these events and to enhance resilience to future extreme climatic events. However, these measures have fallen far short of offsetting the impact of climatic extremes at least in the medium term. It remains to be seen what the next decade will bring in terms of the climate extremes in the production areas. The expectation is that the next decade is more likely to be a repeat of the last decade rather than a return to the conditions of the previous decade. However, it is of note that most climate change models suggest that there will be less frequent cyclones overall but a greater frequency of more severe cyclones of the intensity of the recently experienced Cyclone Winston. The horticultural export industry's overall ability to cope with natural disasters over the next decade has been enhanced by NWC's research and extension activities.

The non-performance of market access and bilateral quarantine agreement reform

In 1995, Fiji obtained approval to export HTFA quarantine treated papaya to New Zealand. HTFA treated eggplant and mango were approved for export to New Zealand the following year and breadfruit followed a year later. HTFA treated papaya was finally approved for export to Australia in Dec 2003. Since that time there have not been a single market access approval obtained – despite a number of clear cut candidates such as wi and jackfruit to New Zealand and papaya to the United States.

The program to develop new markets and new products has been a failure. The Ministry of Agriculture had not been able to meet its core market access responsibilities. The Ministry of Agriculture's Quarantine responsibilities were transferred to the Biosecurity Authority of Fiji (BAF) in 2008. However, to date, there has been no tangible progress in securing access for new products and new markets.

The 2009 Strategic Plan estimated the losses incurred in not being able to secure any new market access in the previous 5-years. The resulting annual loss of export earnings at the time was put around \$890,000 and farmer income about \$350,000. These losses will steadily increase in the future if nothing is done to rectify the situation and substantially increase the level of risk faced by NWC. The NWC Research and Extension Program is endeavouring to address this market access constraint through formal partnership arrangements with BAF, the agency with designated responsibility for market access. NWC continues to provide technical inputs, including hired consultancy inputs, to facilitate the process. Market access issues don't only lie on the Fiji side. Securing a reasonably timely response from the quarantine authorities in the importing countries also remains a major unresolved issue.



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The quarantine constraints to exports not only lie with new market access. There are also major problems with some of the BQAs for the existing products for which there is market access. Most of the components of these agreed pathways were put into place when market access was first secured some 20 years ago. They are by and large based on what the Fiji Ministry of Agriculture's Quarantine Department had put forward at the time. With the passage of time a number of the requirements relating to fruit flies have been found to be redundant from a quarantine perspective and yet are vigorously enforced because " the rules are the rules". Over the last 21 years, NWC has treated over 13,000 tonnes of fruit for export and there has not been a single fruit fly related interception. Requirements that are seen as being particularly unnecessary are some of the bait spraying requirements for mango and breadfruit and the seed source requirements for eggplant. Meeting these requirements places increased demand and cost on exporters and farmers and undermines the viability of already challenging businesses.

Limitations of the NWC R&E Program

While the field service itself has had some highly successful outcomes, the overall impact of the service has been less than what was envisioned in the Strategic Plans. Some of the reasons identified for this shortfall are:

- The difficulties encountered in leveraging the expected inputs from the Ministry of Agriculture and other entities.
- Field officer performance.
- The wide geographical distribution of the target farmers relative to the resources available.
- Management procedures with respect to the use of vehicles.

The major achievements of the NWC R&E effort

The throughput of Nature's Way Cooperative is still far short of the 3,000 tonne/annum throughput projections made in the Strategic Plans. On this basis it could be argued that the Research and Extension Program has not been successful. However, there are other major mitigating factors that have led to the treatment throughput being well below target - principally climate extremes and market access. It is likely that had the Research and Extension Program not been in place, the throughput would have been considerably less and the very viability of this quarantine treatment business would have been in doubt. A commercial quarantine treatment business is a necessary requirement for the development of Fiji's horticultural export industry.

The major achievements of the Nature's Way Research and Extension Program over the last decade can be listed as:

- The establishment of Fiji's capability to produce high quality "Fiji red" papaya seed.
- The development of the "Fiji Red" brand for papaya
- Facilitating the establishment of a network of small commercial seedling nurseries.
- The mounting of a successful rapid response to papaya "disorder" misinformation and thereby maintaining the Australian papaya market access.
- The creation of an orderly scientific response to eggplant "disorder"
- The introduction of commercially viable post-harvest treatment for fungal rots
- Facilitated the adoption of plastic crates as standard practice for Fiji fresh fruit and vegetable industries.
- Demonstrated the commercial viability of sea freight exports to New Zealand
- To provide the basis for significant breadfruit exports
- Providing scientific evidence necessary to reduce the cost of quarantine treatment.
- Providing information that allows farmers to adjust to climate change and to adopt sustainable agricultural practices.
- Providing information that has encouraged the entry of significant new investors in the industry



THE LIKELY CONSEQUENCES HAD THE NWC R&E PROGRAM NOT EXISTED

Had the NWC Research and Extension Program not existed it is unlikely the industry owned and operated quarantine treatment facility would still be in operation today and Fiji would not be exporting fresh papaya, eggplant, mango and breadfruit. Thus, there would be very little prospect of the industry expanding and realising its full potential. This conclusion is based on the following considerations:

- High quality certified Fiji Red papaya seed would not be available to the industry.
- The eggplant "disorder" would have caused crippling disharmony in the cooperative as the problem would have been blamed on the HTFA treatment facility.
- High postharvest losses for papaya would continue to be experienced during the wet season and this would add fuel to the disharmony, with the HTFA being blamed for the problem.
- Fiji would have lost market access for papaya to Australia
- There probably would not have been widespread adoption of plastic crates in the industry adversely affecting product quality.
- There would be little or no prospect of companies such as Fiji Water entering the industry.
- Exporters would not have received assistance following major disasters and the attrition rate amongst exporters would have been even higher.
- There would be little prospect of eventually securing market access for new products and markets; and improving the BQA protocols for existing products.
- Farmers would be overwhelmed in their endeavours to deal with extreme climatic events.
- There would be no prospect for developing breadfruit exports.
- There would be no prospect of sea freight exports to New Zealand.

STRENGTHS AND WEAKNESSES OF THE R&E PROGRAM

The strengths of the NWC Research and Extension Program can be listed as:

- The program is industry and market driven, focussing on key issues and constraints.
- A permanent institutional structure (NWC Research & Extension Partnership (REP) Committee) has now been established that facilitates high level coordination with key stakeholders.
- The long term involvement of competent and motivated management and staff which has gained the confidence of stakeholders.
- The confidence of funding agencies has now been established through a track record in terms of results, reporting, consultation and financial acquittals.
- Has become a model public private partnership which has been able to attract additional necessary donor funding.

The weaknesses can be listed as:

- The R&E Program remains largely donor funded due to treatment throughput not being at a level for significant self-funding.
- Has not yet been able to achieve the desired level of coordination with the Ministry of Agriculture staff at the field level.
- A too wide geographical dispersion given the small size of the service and the restrictions placed on vehicle use.

RECOMMENDATIONS FOR THE NWC R&E PROGRAM

The case has been made of the importance of the Research and Extension Program for the viability of NWC and the future of the horticultural export industry. Without the input of the R & E Program over the last decade it is unlikely that NWC would have survived, let alone the horticultural export industry expanding to start realising its substantial potential. Bitter past experience in Fiji, and elsewhere in the Pacific, has shown that quarantine treatment facilities cannot be operated by government or parastatal organisations such as the Agricultural Marketing Authority (AMA) or BAF. However, there is considerable scope to improve the performance and impact of the R&E Program. In this respect recommendations are made on:

- The future focus of the R&E Program
- Linkages with the Ministry of Agriculture



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- Greater input from the exporters in the R&E Program
- The input supply role of NWC and the R&E Program
- The desirability and feasibility of NWC's direct involvement in marketing
- Organisational structure and staffing and operational procedures

The reality is that substantial donor funding, through an appropriate public private sector partnership, will be required until NWC can achieve the level of throughput necessary to largely self-fund its R&E service. Previous estimates put the necessary throughput at around 3,000 tonnes annually.

Future focus

It is recommended that there be a re-emphasis on the traditional production areas in the Sigatoka Valley. However, this should not be at the expense of the program in the new production areas. The following measures are recommended to achieve a more appropriate balance:

- the appointment of one additional field officer;
- the purchase of an additional vehicle for the R&E Program;
- the adoption of more appropriate rules with respect to vehicle usage to allow more time to be spent with farmers on their own farms;
- a field officer to be based in Sigatoka to service the Valley;
- hiring of paid locality reps in selected locations;
- a systematic effort be made to enhance collaboration with the Ministry of Agriculture locality officers; and,
- greater input and buy-in from exporters in the R&E Program.

Linkages with the Ministry of Agriculture

From the outset it was never expected that NWC would deliver the entire research and extension for the horticultural export industry. Even if Nature's Way was able to reach the target throughput of 3,000 tonnes, horticultural exports would still be a relatively small industry in a small country. NWC's R&E efforts have always been strongly supported by the Ministry's Management. However, this collaboration has broken down at the locality level. To address this problem it recommended that following each quarterly REP Committee a formal meeting be scheduled at NWC in which Principal Agricultural Officer (Western), the Senior Agricultural Officers (SRO) from the West, and the appropriate staff from Sigatoka and Leglega Research attend. On the research side an important area that needs greater attention is the declining soil productivity of the traditional Sigatoka Valley production areas. Such a research effort will require close collaboration with NWC R&E Program and the Ministry's research staff.

The hiring of paid locality reps in selected areas

Even if the measures listed above are successfully adopted, it is unlikely that the time spent in "face to face" contact with farmers on their own farms will be sufficient – particularly for new entrants to the industry in new locations. Thus it is recommended that a network of locality representatives of the NWC R&E Program be established.

Greater input and buy-in from exporters in the R&E Program

An important lesson learned from the experience of NWC Field Service over the last decade is the need to maximise the involvement of the exporters to the extent feasible. By so doing, this is seen as a means of effectively spreading the impact pf NWC's small R&E Programme.



THE DESIRABILITY AND FEASIBILITY OF NWC DIRECT INVOLVEMENT IN EXPORTING

From the outset it has been NWC's policy that the Cooperative should not be directly involved in exporting. In recent years it has become apparent that in certain areas the existing exporters have not adequately provided the service expected of them. Two particular short comings have been identified:

- Exporters have largely been absent from some of the new production areas, such as the upper Sigatoka Valley and the Ba/Rakiraki corridor.
- A substantial export market has been identified for fresh breadfruit in New Zealand. A major effort has been made over the last four years to develop breadfruit orchards so this market can be efficiently supplied. Over this period, the one exporter who was previously involved in fresh breadfruit exports no longer exports HTFA products.

It has thus been suggested that NWC could become involved in these two areas on an interim basis until private exporters are able to meet these identified needs.

Exporting products grown by member farmers in areas not currently serviced by existing exporters

The servicing of farmers from more remote locations was the main justification for establishing the National Marketing Authority (NMA) back in the early 1970s. It has continued to be a justification for NMA's successor parastatal marketing organisations - National Trading Company (NATCO) and more recently Fiji Agromarketing. All these government funded marketing bodies have failed in this endeavour. NWC's involvement in direct market marketing could expect to suffer the same consequences. Despite the proven competence of NWC's Management, it has no experience in the specialised business of exporting, an area in which there is a particularly high attrition rate. Failure could have disastrous consequences for NWC's core quarantine treatment business and could lead to destabilising acrimony amongst shareholders.

It is recommended that a sounder approach would be to provide incentives to link existing exporters to farmer members located in areas that are currently not well served. An appropriate incentive would be a quarantine treatment rebate for products from the nominated isolated locations.

Initiating breadfruit exports by introducing "best practice"

A case could be made for NWC's initial involvement in breadfruit exporting to introduce "best practice". However, even NWC's involvement in exporting in such circumstances should be approached with considerable caution. Past experience has shown that what starts as a temporary interim activity becomes a permanent arrangement. Again, the most appropriate approach would be to encourage private exporters (current and potentially new) to become involved in breadfruit exporting.

ORGANISATIONAL STRUCTURE AND STAFFING ARRANGEMENTS

The organisational structure of the NWC Research and Extension Program has tended to be built around the donor funded projects that are being funded at that particular point in time.

It is recommended that a permanent basic organisational structure be established for the NWC Research and Extension Programme, with the various donor funded activities integrated into this structure. The proposed structure is presented below.

It is envisioned that the proposed R&E team will be largely made up of the existing Research and Extension staff. However, it will be necessary to make one additional full time staff appointment. Also there will need to be an additional vehicle added to vehicle fleet if the three areas are to be adequately and efficiently serviced. It is recommended that one of these vehicles be allocated to the R&E Manager. It would not be a requirement that this vehicle be parked at the NWC Headquarter overnight. It is estimated that the annual operating cost of this R&E Program would be approximately FJD 200,000

Overall there needs to be greater flexibility in the rules governing the use of vehicles, if this small team is going to adequately service the needs of the NWC members. The rules covering vehicle usage need to, as a matter of course, allow for R&E staff to attend farmer meetings extending well beyond normal "civil service" office hours and not have to park the vehicles overnight at NWC. A system based on a combination of trust, recording keeping and reporting need to be devised to ensure the maximum contact of NWC shareholders with the R&E team.



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It is not envisioned that over time there would be any increase in the number of the NWC R&E staff – although some increase in the number of locality representatives could be expected. What is expected is that over time that the NWC R&E program will be able to lever and coordinate more effective inputs from the Ministry of Agriculture and facilitate and assist exporters in their farmer outreach program.

Figure 1: Organisational Structure for Nature's Way Cooperative Research and Program

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2 | Background

2.1 THE ORIGINS OF NWC

Nature's Way Cooperative (NWC) was a product of the United States Agency for International Development (USAID)'s Commercial Agricultural Development (CAD) Project for the South Pacific. CAD commenced in 1991, with the objective to increase high agricultural value agricultural exports from the region. The Project had two broad areas of focus: i) sustainable commercial agriculture technology transfer; and, ii) work with industry associations. One of CAD's main activities was to introduce to the South Pacific Region high temperature forced air (HTFA) quarantine treatment for fruit fly host commodities. Fiji and Tonga were selected as the initial target countries for this technology transfer. Fiji at that time had lost its major fruit and vegetable export markets (Australia and New Zealand), due to the banning of the chemical ethylene dibromide (EDB) that was used as a quarantine treatment for fruit fly host products.

There were two interrelated components of CAD's quarantine treatment work. The first component was to transfer the HTFA technology developed by the United States Department of Agriculture (USDA) to Fiji and Tonga. The other was to develop the business to commercially operate the quarantine treatment facility. USAID's requirement was that the quarantine treatment facility be operated by the private sector (the industry). This represented a major departure from the tradition of government operated quarantine treatment in the Pacific islands. In both countries, there was considerable resistance to the concept of industry operated quarantine treatment. In Fiji the concept prevailed – while in Tonga quarantine treatment remained in government hands until very recently.

The HTFA facility at the Nadi International Airport was commissioned in June 1995. USAID provided the treated chamber and ancillary equipment for a total cost of \$249,000. USAID also met the cost of the Manager for a 1-year and provided technical assistance to establish the facility. The Civil Aviation Authority of Fiji (CAAF) provided the site for the treatment facility and the Ministry of Agriculture provided the funds for the building (around \$250,000). Nature's Way was registered as a Cooperative in August 1995, with Sant Kumar officially appointed manager and Tim Casey (General Manager of Southern Development Company) as Chairman.

The HTFA facility was certified for export of papaya to New Zealand on November 29th 1995. However, the first commercial treatment of papaya did not occur for almost another year. The delay of first exports was primarily the result of the closing of the CAD Project soon after the commissioning of the HTFA facility. USAID withdrew from the South Pacific after the election of President Clinton. The flow on consequence was that the CAD Project closed a year earlier than was planned. This left the newly created quarantine treatment business in a very precarious financial position. Funds that had been allocated by USAID for staff training, business development support and most importantly working capital, were now not forthcoming. Loan request for start-up working capital made to all the commercial banks and the FDB were turned down on the grounds of lack of security. Thus NWC faced the prospect of being aborted before it even started business and quarantine treatment operations being passed back to government. Fortunately, the turning point for NWC and the Fiji fruit and vegetable industry came with the visit to the facility of New Zealand Minister of Foreign Affairs, Don McKinnon. He recognized the critical importance of the success of this venture for produce exports from the Pacific islands and immediately authorized the release of \$40,000 as start-up capital for NWC. A desirable consequence of NWC's start-up capital requests being rejected by the commercial banks is that it began commercial operations debt fee. The business has been able to maintain this status through the adoption of an appropriate Private Public Partnership (PPP) approach to development.

In the first year (1996), 33 tonnes of papaya were exported to New Zealand. In the following year (1997), market access approval to New Zealand was given for eggplant, mango and breadfruit to New Zealand, thanks to the effort of the SPC's Regional Fruit Fly Project. In that year 63 tonnes of papaya, 12 tonnes of mango and 49 tonnes of eggplant were exported – the first export of breadfruit occurring in 2001. Over the next decade there was steady growth in NWC treatment throughput (figure 2), revenue generated and the number of shareholders (figure 3).

2.2 THE 2001 PERFORMANCE REVIEW AND STRATEGIC PLAN (2002-2006): IDENTIFYING THE NEED FOR A NWC FIELD SERVICE

In 2001 the NWC Board initiated a performance review for the first 6 years of operations on the basis of which a 5-year Strategic plan was prepared. A result of this review and strategic plan was the concept of the Cooperative having its own extension capability.



2.2.1 Key findings of the 2001 Performance Review

The key findings relevant to this Research and Extension Review are:

- The steady growth in throughput to nearly 500 tonnes despite the trade embargos that were imposed by New Zealand in 2000.
- While papaya exports grew from 33 tonnes in 1996 to 157 tonnes in 2001, this export level was well below expectations. The Review noted:

HTFA treatment was developed in Hawaii for papaya. When NWC was formed, papaya was the only commodity for which HTFA treatment was being utilized. Thus the initial feasibility study was based entirely on papaya. It was projected that within a few years of operation, around 500 tonnes of papaya would be treated annually. A study of the New Zealand market undertaken by the CAD Project in 1995 concluded "that papaya sales in New Zealand of 1,000 tonnes at remunerative prices would seem to be readily achievable provided there was continuity of supply and good quality fruit". As is so often the case with Fiji agriculture, this continuity of supply was not forthcoming.

It had been assumed that exports to the Australia market would recommence soon after New Zealand. During the 1980s, Fiji was a significant exporter of papaya to Australia. However, approval to export HTFA treated papaya to Australia is yet to be given. The non-availability of the Australian market has been a constraint to significant investment in the papaya industry. Had the business relied solely on papaya treatments, it would not have survived financially.

• Eggplant proved to be a major success story of the early years of operations and without it NWC would not have been commercially viable. The Review specifically noted:

HTFA treated eggplants were certified for export to New Zealand in July 1997, and the first commercial shipment was made on August 8th , 1997. This was a world's first for HTFA quarantine treatment and a major achievement for NWC. HTFA treated eggplant proved to be a real success story, with exports to New Zealand increasing rapidly due to the superior keeping quality of HTFA treated fruit compared with EDB fumigated fruit. Eggplant is now exported year round to New Zealand and not just during the winter window as was previously the case. In 2001, over 250 tonnes were exported. This compares with an average of 43 tonnes exported during the last 3 years of EDB treatment (Quarantine Records). The unexpected success of HTFA eggplant has provided the basis for Nature's Way achieving financial viability during its first 6 years of operation.

• The HTFA facility has proven to be remarkable robust. No exports have been lost due to a break down in the equipment during six years of operation. The Review attributed this impressive record of operational reliability to combination of the quality of the equipment and components used, the back-up and support training provided by Dr. Michael Williamson who commissioned the facility and the competence and mechanical and electronic aptitude of Dhirendra Nath, a seconded MAFF quarantine officer, who was seconded to NWC.

Comment: It is now 15-years on, and the HTFA chambers are aging, their supporting software is becoming obsolete. NWC will need to be proactive on this issue and find a new engineering firm that will build newer versions of the chambers that use modern software. This presents itself as a major applied research issue which will require significant funding support.

- Nature's Way's HTFA treatment facility has met the quarantine requirements without having a deleterious effect on fruit quality. The six-fold increase in eggplant exports above those achieved during EDB is testimony to this improved quality.
- NWC's financial results show a close inter-relationship between throughput and financial viability. The review noted:

This is an enterprise that has a high proportion of fixed costs; the most important items being administration (salaries), depreciation of fixed assets and insurance expenses. There are also large once off expenditure items, such as major repairs, certification and confirmatory tests. In any one-year these costs are largely independent of throughput. Hence, increasing throughput decreases treatment cost by spreading fixed costs over more treatment units. Conversely, a significant drop in throughput leads to a sharp increase in the cost per kg for treatment. Such was the situation in Financial Year 2000. If throughput had remained at the 2000 level the business could have only survived by substantially increasing its treatment charges above 40c/kg.

Comment: NWC is still yet to achieve a throughput level that will ensure sustainable long term viability.





Figure 2: Nature's Way Cooperative Treatments: 1996-2015 (tonnes)

Figure 3: NWC treatment revenue, fob value of export, farm gate value of exports, shareholder numbers, active exporters: (1996-2015)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue Generated																				
Revenue due to NWC(\$)	13,215	17,000	156,532	148,000	116,126	193,776	183,931	184,516	262,658	317,848	470,593	397,916	345,559	278,829	435,572	926,670	456,225	484,204	695,856	6 7,353
Reported fob value(\$)	69,378	361,190	820,075	612,440	752,094	990,567	1,306,557	1,289,689	1,879,425	2,294,916	3,803,743	3,089,310	2,631,368	2,523,809	2,473,269	3,820,376	1,339,435			
Reported farm gate value(\$)	23,126	123,274	254,187	261,000	204,577	357,279	344,393	353,189	539,579	652,734	372,850	387,463	350,421					67,532	1,082,931	1,121,946
Shareholders																	229	257	287	304
Active exporters															12	14	14	11	13	11

The long-term viability of the quarantine treatment business depends on the shareholders understanding its operations and what their roles and responsibilities are. The Review noted:

It is only then that can shareholders be expected to make decisions that are in the interest of their industry. Informed shareholder participation is particularly critical when things go wrong - which they inevitably will.

Comment: In recent years such a case has been when a number of exporters were blaming post-harvest damage occurring to eggplant on the HTFA treatment.

Nature's Way Cooperative owes its existence to the support received from the Fiji Government. In particular the review noted:

That the Ministry of Agriculture had the foresight to embrace USAID's CAD Project, which led to the transfer of HTFA quarantine treatment technology to Fiji and the creation of industry business to operate the treatment facility. The Ministry provided the funds for the HTFA building and facilitated the secondment of a technically competent officer to Nature's Way. In the initial years the Principal Quarantine Officer (Western) served on the Board of NWC. His support, particularly during those early years, has been critical. However, in some areas the performance of Government has been inadequate and has been at a cost to NWC and it members. The two major areas of weaknesses have been in development of treatments protocol and in day-to-day quarantine operations.

Comment: The two identified major areas of weakness remain the case today. To this has to be added the recent rent demand by Air Ports Fiji Ltd. commercial rent rates for the land on which the treatment facility is situated, land that was provided free of charge by CAFF as part of the Public Private Sector Partnership



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A REVIEW OF THE NATURE'S WAY COOPERATIVE (FIJI) LTD. RESEARCH AND EXTENSION PROGRAM AND PROPOSALS FOR THE FUTURE

The inadequacy in the development of treatment protocols and BQAs. In particular the review noted:

The development of an HTFA protocol for papaya, mango, eggplant and breadfruit export to New Zealand is an outstanding achievement. Full credit needs to be given to the Ministry of Agriculture's Fruit Fly team in developing these protocols in close collaboration with the NWC's management. However, NWC's financial performance would have been far better had papaya exports to Australia commenced. A more than 5-year delay in the approval of HTFA treated papaya can be blamed on Biosecurity Australia (BA) – particularly, until recently, Australia's scientifically unacceptable confirmatory test methodology. However, part of the responsibility also lies with Fiji Quarantine, who have not proactively engaged BA and supplied data in a timely fashion. No eggplant data has yet been sent to BA to at least initiate the long approval process.

Comment: There has been no progress on the market access front – resulting in substantial loss of revenue and affecting livelihoods which in turn undermines the financial viability of NWC.

Comment: This remains the case, so a major reform is required.

• The inappropriateness of some Fiji formulated pathway requirements. The review noted:

It is in the interest of the industry to have the requirements of the commodity pathway to be rigorously enforced without fear or favour. However, there are a number of regulations that cannot be justified from quarantine security or a quality improvement perspective.

Comment: This remains the case. The current bait spray requirements for breadfruit is an important example which poses a major constraint to the commercial development of this industry.

The pace of new protocol development needs again to step up if the substantial export potential outlined in the projections is to be realized. The review very pertinently concluded that:

HTFA has proven a more than effective alternative to EDB in meeting the necessary quarantine requirements. The initial concern that the treatment might be limited to only papaya has been dispelled, with Fiji developing new treatments for eggplant and breadfruit. It now seems clear that HTFA will be technically suitable for a whole range of fruit fly host products. Fiji now has the opportunity to develop export protocols for fruits such as bitter gourd, bottle gourd, wi, tomato, lime and passion fruit. Part of the success in protocol development can be attributed to the close working relationship that HTFA management developed with SPC's Regional Fruit Fly Project and MAFF's Research Division's Fruit Fly Team. However, recent years have seen a loss of momentum in the development of new treatment protocols. This can be largely attributed to the lack of apparent interest and action on the part of the Quarantine Division's Management. The pace of protocol development needs again to step up if the substantial export potential outlined in the projections is to be realized.

Comment: This remains the greatest failure in the PPP - nearly 20-years have now elapsed no new markets have been accessed.

2.2.2 The appointment of a fruit specialist a key recommendation of the Strategic Plan (2002-2006)

A key recommendation of the Strategic Plan was that NWC need to be more directly involved in field operations with farmers. The appointment of an experienced Fruit Specialist to support NWC's Manager in field operations, to expand production and improved quality, was proposed. The scarring of eggplant, apparently caused thrips, was identified as the type of quality problem that would be addressed by a NWC field service. The expectation was that the Fruit Specialist would be in a position to coordinate the Ministry of Agriculture research and extension efforts to derive an appropriate solution to such problems. At the time Nature's Way did not have the financial resources to fund a fruit specialist extension officer directly. Thus it was proposed that a request be made to the Ministry of Agriculture to second an officer to NWC to take up this position under the direction of the NWC Manager. The request was for the Fruit Specialist to come with a vehicle the operating cost of which would be met by NWC. The expectation was that NWC would be able to fund this position within 5-years. The Ministry of Agriculture agreed to this proposal and so the Nature's Way Extension Service was "launched" in 2002, at least in name. However, this arrangement proved to be ineffective, without clear lines of communication and responsibility. As is common in such arrangements access to vehicles proved to be a major constraint and within a year the service ceased to operate. It had become readily apparent for a Nature's Way field officer to be effective this person would need to be directly responsible to the NWC Manager and have access to transport. However, the Cooperative itself did have the funds available to make such an appointment.

2.2.3 The Strategic Plan (2002- 2006) throughput projections

The Strategic Plan projected that by 2006 NWC would be treating 1,500 tonnes annually – a more than three-fold increase. This increase was primarily driven by a substantial (more than fourfold) increase in papaya exports - a 15% annual growth in papaya exports to New Zealand and entry into the Australian market. Eggplant treatments were projected to double over the planned period to reach 500 tonnes. This projection



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is based on a combination of continued steady growth in the New Zealand market and the re-emergence of the Australian market. Mango exports were projected to remain steady at around 50 tonnes annually to New Zealand. Breadfruit treatment that commenced with 2 tonnes shipped to New Zealand in 2001, which were projected to increase to 150 tonnes in 2006 – mainly to New Zealand, but with some shipments to Australia later in the period.

The 5-year period was expected to herald the entry of a range of new products for the New Zealand market. These included: bitter gourd, other gourds, wi, jak fruit. All of these products have good identified markets and would be suitable for HTFA treatment. The Strategic Plan noted that: Confirmatory tests need to be undertaken and the data submitted to New Zealand and Australian authorities, together with an up to date pest list. The financial projections that accompanied the expanded throughput projections from 500 to 1,500 tonnes showed a significant improvement in financial viability. All foreseeable repairs and maintenance could be funded by the enterprise, with funds available to finance investment in increasing efficiency and expanding capacity and adequate liquidity available to provide for reasonable contingencies that might arise.

2.2.4 Performance in meeting Strategic Plan projections

By 2006, NWC achieved a throughput of nearly 1,200 tonnes. While falling short of the projected 1,500 tonnes this was seen as a creditable achievement. The Strategic Plans risk analysis identified four major threats to achieving the 1,500 target. These being: cyclones, delays in developing protocols, insufficient airfreight capacity being available, and the incursion of exotic fruit flies. Of these four risks only one (delays in developing protocols) materialised over the 5-year period. Apart for market access for papaya to Australia, none of the other expected markets became available over this period and to this day have still not become available. If the expected market access had become available it is likely that the 1,500 target would have been realised. In subsequent years cyclones and floods have emerged as major risk factors that now need to factored in and mitigated against.



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| NWC Research and | Extension Service

3.1 THE CREATION OF NWC'S OWN FIELD SERVICE IN 2007

It was not until 2007 that NWC was able to appoint its own full time field officer with two years funding from the AusAID Fiji Rural Enterprise Development (RED) Initiative. Under the AusAID Initiative three activities NWC activities were funded:

- The preparation of an updated Strategic Plan: "The NWC Strategic Plan for Sustainable Future".
- The funding of a NWC Field Officer for a two year period (AUD 75,000).
- The provision of seed capital for the bulk purchase of plastic field crates (AUD 34,000)

NWC's financial contribution to the field service was the purchase of a 4WD vehicle and meeting operating costs. The expectation was that NWC would fully fund the field officer after two years as the projected throughput grew.

Mr Luke Tirimaidoka, formally a Senior Quarantine Field Officer, was appointed the NWC Field Officer in July 2007. In the previous year Luke had been a major contributor to NWC's "A Manual for the Growing and Marketing of Breadfruit for Export".

The focus of Luke's work was on papaya, the identified priority commodity. Under his direction good progress was made in recruiting new farmers to grow HTFA commodities and in linking farmers to exporters. He began working with the exporters to systematically reduce reject rates at the treatment facility – this included the introduction of outturn analysis and quality defect analysis. With his quarantine background Luke was able to collaborate closely with Dr Armstrong in preparing the US market access submission. In particular he was able to provide the links between SPC, Fiji Quarantine and Koronivia Plant Protection. Tragically, Luke died at work in September 2008. The vacuum left by the death of Luke, was a major setback for NWC in the development of an out-reach program. However, his work had proven the value of a small focussed field service staffed by qualified people.



Figure 4: Luke Tirimaidoka (1st on left) attending a meeting at Mahen Exports in 2005, accompanied by Ralulu (Principal Quarantine Officer Western) and Sant Kumar the Foundation Manager of NWC

NWC's ability to fund its own field officer also suffered a major setback due to natural disasters. For the first 10-years of NWC operations the weather had had a relatively benign impact on throughput. This unfortunately changed dramatically in January 2009, with a "50-year" flood event. This led to most treatments being suspended for nearly four (4) months and a collapse of the company's cash flow. It took nearly a full year for throughput to be returned to normal levels. Fortunately, NWC had put aside some \$105,000 in a fixed deposit to cover such a "rainy day" contingency. However, there were no funds available to finance a field officer despite the recognition that this was critical to the future of Fiji's horticultural exports.





Table 1: The impact of the January 2009 flood on NWC's financial position.



3.2 THE 2009 STRATEGIC PLAN IDENTIFIES A SIGNIFICANT RESEARCH AND EXTENSION CAPABILITY AS A NECESSARY REQUIREMENT FOR A SUSTAINABLE BUSINESS

Natures Way Cooperative (Fiji) Ltd: A Strategic Plan to Achieve a Sustainable Future, February 2009 concluded:

With the completion of the current capital investment program NWC's theoretical capacity to treat is around 3, 800 tonnes per annum. A realistic maximum capacity is likely to be more in the order of 3,000 tonnes per annum". With the Fiji fresh fruit and vegetable export industry starting to realise its full potential, treatment requirements may in the not too distant future exceed this expanded capacity. At this stage, the volumes handled by some of the larger exporters would be sufficient to justify investment in their own quarantine treatment facility.

NWC is a business established to service the fruit and vegetable export industry. It should not feel threatened by any future establishment of a competing private treatment facility. Such a development would be a measure of success in being able to encourage sufficient production to justify private investment in quarantine treatment facilities. Competition in quarantine treatment would be beneficial to the horticultural export industry – reducing risk and hopefully reducing cost. In the longer term it is conceivable that through its own success NWC could do it self out of a job. However, more likely NWC would continue to provide treatment services for small exporters whose volumes don't justify their own facility.



¹This is based on the following assumptions:

The treatment facility operates 350 days per year.

[•] There are two working shifts per day – allowing for two full treatments/chamber/day.

All treatments are under taken in bins, allowing for 3.6 tonnes per chamber per treatment.

Thus it is recommended that NWC make no more investment in treatment capacity. The emphasis should now be on improving the efficiency of operations within the existing capacity and improving the quality and production of fruit coming from the field.

The 2009 Strategic Plan, endorsed by the Annual General Meeting, made a number of key recommendations for improving the quality and production of fruit from the field. These were that NWC should:

• be an agribusiness providing members more than just quarantine treatment services;

While NWC's core business should remain quarantine treatment, there are opportunities to take advantage of NWC's strategic position to raise funds to undertake other service activities on behalf of the horticultural export industry. Such activities should not undermine NWC's ability to provide efficient quarantine treatment services.

be a body representing the needs of the horticultural export industry;

NWC has become the de facto body representing the horticultural export industry in discussions with government and with donor and technical assistance organisations. NWC already has the facilities and the capacity to continue to undertake this useful role as required.

operating an effective field service;

Providing an effective field service closely supports the core business of providing quarantine treatment services.

continue to proactively support market access facilitation; and,

Through necessity over the last few years NWC has taken on an activist role in seeking market access. This involved the coordination of market access submissions for papaya and breadfruit for the United States. All stakeholders, including the then Quarantine Department, appreciated these efforts. It is recommended that this initiative now be expanded to the coordination of market access submissions to Australia and New Zealand. Following the US market access model, this requires hiring experienced consultants from the target countries to coordinate the market access submissions. NWC funds should not be used for this purpose - donor support should be sought.

• **NWC should be involved in Input supplies, where appropriate.** NWC has commenced a program of bulk purchase of field crates and papaya seed on behalf of its members. Seed capital to establish a revolving fund for purchase of crates was provided by AusAID. The revolving fund is now self-sustaining. This small scale activity has proven highly successful – providing a valuable service to members and small profit to business.

3.3 DONOR SUPPORTED PROJECTS AND ACTIVITIES TO INCREASE THE VOLUME AND QUALITY OF PRODUCT FROM THE FIELD

At the commencement of the 2009 Strategic Plan, NWC's annual throughput was still less than 1,500 tonnes. Thus the agribusiness was not in a position to fund a program to improve the quality and production of fruit from the field without substantial public sector (donor agency) support. Thus the research and extension program has evolved over the last seven years based on the number of coordinated projects and activities supported by donor and technical agencies. These were:

- Australian Centre for International Agriculture Research (ACIAR)
 - o The Fiji Papaya Project
 - o The Pacific Breadfruit Project
 - o The NWC Research and Extension Network Partnership
- NZAID Support Programs
 - o NWC Extension Program
 - o NWC Research Program
 - o Disaster preparedness and rehabilitation pilot projects.

These are discussed briefly below



3.3.1 The Fiji Papaya Project (FPP)

What the Fiji Papaya Project (FPP) was all about

The Fiji Papaya Project (Strengthening the Fiji Papaya Industry through applied research and information dissemination)was a four (4) year project which began in January 2009, with total funding of AUD 869,350. The project was funded through SPC and implemented by the agricultural project management company Koko Siga Pacific (Fiji) Ltd. in partnership with Nature's Way Cooperative and in collaboration with the Ministry of Agriculture. The Project funded a horticulturalist (Kyle Stice) as full time Team Leader based at NWC where a Project office was established. Two field staff (Livai Tora and



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Timote Waqainabete) were directly funded by the Project. The Project effectively became the research wing of NWC, focussing on papaya, and leveraging research inputs from Fiji (Ministry of Agriculture and SPC), Australia (QDPI) and Hawaii (private sector).



Figure 5: Fiji Papaya Project field staff from left Kyle Stice, Timote Waqainabete, Livai Tora and Joe Turaga (field officer for exporting company PSL)

Papaya now has the prospect of becoming a major horticultural export industry. Market studies (New Zealand, Australia, US and Japan)², funded by the EU Facilitating Agricultural Trade (FACT) Project, confirmed the availability of remunerative markets to absorb a substantial increase in papaya production provided high quality standards are achieved and continuity of supply is maintained. Many new growers were taking up papaya farming. Although there was considerable information on papaya production from Hawaii and elsewhere this had not been "customised" for use by Fijian farmers and there had not been any formal research into the issues facing the commercial papaya industry in Fiji. In the absence of sound, locally appropriate, production, harvest and post-harvest information it was recognised that there were serious quality and supply consistency issues that threatened the long term viability of the Fiji papaya industry. Hence the justification for a substantial ACIAR supported four (4) year project.

²Kyle Stice, Andrew McGregor, Sant Kumar and Vinesh Prasad (2009). The market for papaya from Fiji and other Pacific Islands – New Zealand Study. A Project Under the EU –Funded Facilitating Agricultural Commodity Trade Project (FACT). July 2009; Kalara McGregor, Andrew McGregor, Lex Thomson and Kyle Stice (2009). Difter Market for papaya from Fiji and other Pacific Islands – Australia Study. A Project Under the EU –Funded Facilitating Agricultural Commodity Trade Project (FACT). July 2009; Kalara McGregor (2009). The market for papaya from Fiji and other Pacific Islands – Australia Study. A Project Under the EU –Funded Facilitating Agricultural Commodity Trade Project (FACT). July 2009; Kalara McGregor and Andrew McGregor (2009). The market for papaya from Fiji and other Pacific Islands – Japan Study. A Project Under the EU –Funded Facilitating Agricultural Commodity Trade Project (FACT). September 2009. Kyle Stice (2009) United States Market Analysis – Fiji and



The FPP had three (3) primary objectives:

- To strengthen the capacity of the Fiji papaya industry to plan, conduct and adopt the products of problem-solving research.
- To expand and increase the resilience of the papaya industry in Fiji.
- To promote the adoption of project outputs in the Fiji Papaya industry and elsewhere.

With 4 main activities:

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Sustainable seed supply and variety development

- o Introduce best practice for collecting seed from superior inbred papaya lines.
- o Establish a program for selecting locally adapted solo sunrise.
- o Undertake variety trials in traditional and new growing areas.
- o Establishing certified commercial nurseries for the supply of seedlings according to best practice.

Crop agronomy

- o Evaluation of the performance of papaya under different agronomic conditions.
- o Comparison of conventional vs organic papaya planting
- o Comparison of irrigated vs non-irrigated papaya planting.

• Pest and diseases

- o The preparation of a biosecurity plan for the Fiji papaya industry
- o Preparation of a guide to pests and diseases on papaya in Fiji
- o Establish demonstration plots for the control of phytophthora
- o A monitoring program for irregular fruit set, speckled fruit, hard limps and anthracnose.

• Supply chain

- o Analysis of post harvest loses and causes.
- o Post HTFA storage and monitoring of sample cartons
- o Sea freight trials

It was expected as a result of the Fiji Papaya Project there would a:

- a threefold increase in exports of papaya (around 600 tonnes in 2008 to some 4,000 tonnes by the end of the Project, earning around FJD 7 m. in export income and about FJD 3.5 m. farm income);
- a doubling of persons involved in the papaya industry (600 people directly);
- a 50% reduction in culled fruit from the farm; and,
- an increase in competitiveness of Fiji papaya on the export market through the use of sea freight.

The achievements of Fiji Papaya Project (FPP)

The Fiji Papaya Project had particularly ambitious targets in terms of production and exports. However, they were seen as realistic given the:

- good agronomic conditions for growing papaya in western Viti Levu;
- identified market opportunities; and
- keen interest shown in growers and exporters.

The target of a three (3) fold increase in papaya exports was not achieved. Yet a significant increase in papaya exports was realised over the life of Project, despite a series of major natural disasters. This increase can to a large extent be attributed to the Fiji Papaya Project, which was recognised in the compressive project review undertaken by ACIAR. Prior to existence of the FPP, very little information or support was available to assist farmers and exporters.



Figure 6: Fiji papaya exports: 1996 – 2015 (tonnes)



The major achievements of the FPP can be summarized as:

• A collaborative approach to research and extension, focussing on papaya, was established. An effective research and extension network was established through the project's Technical Advisory Board (TAB). The FPP, through its close integration with NWC, became recognised as a coordinated initiative for which the industry assumed ownership. The Project gained wide enthusiastic support from farmers, exporters and public sector players. A major achievement of the TAB was its ability to leverage additional funding and technical inputs from other stakeholders such as EU/FACT, MPI research, SPC and the Taiwan Technical Mission.



Figure 7: Industry Stakeholders attending a FPP TAB at NWC

• **On-farm trials.** A number of field trials generated significant data that was being adopted by the industry for scaling up and replication. Of particular importance was the seed block trial to introduce the package of best practice to collect seed from inbred papaya lines. This provided the basis to initiate a programme for selection of a locally adapted solo sunrise variety and certified seed producer's scheme using best practice seed production techniques. This means that the best possible papaya seed can be secured locally and the quality and quarantine risk of importing seed is avoided.



Figure 8: The FPP utilized a farmer participatory research model which meant that all field trials were conducted on members' farms



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• **Off-farm trials.** The most important of these were: harvest and post-harvest assessments to identify critical areas where physical damage was occurring on the product; a successful sea freight trial to New Zealand (of particular importance following the reduction in the reduction of wide body airfreight capacity); an assessment of Fiji papaya out-runs on the Melbourne market; and, investigation of post-harvest treatments in conjunction with HTFA for the control of fungal diseases.



Figure 9: FPP collaborators stand beside Fiji's first commercial sea freight consignment of papaya to New Zealand

• **Training and awareness programs for farmers and exporters.** Training and awareness among growers and exporters as to best practice harvest and post-harvest practices in order to minimize physical damage. An important innovation has been the use of low cost newspaper as a liner for harvesting bins and as an alternative packing material for export cartons.



Figure 10: On-farm postharvest training to highlight the benefits of using newspaper to minimize post-harvest damages whilst transporting fruit from the field to HTFA treatment plantZealand



The achievements of the FPP

ACIAR conducted a comprehensive independent Review of the FPP in August 2012. The Review was led by tropical fruit specialist, Keith Chapman, and concluded that the Project "been very efficiently implemented and was timely, relevant, well focused with high potential impact for meeting excellent export market demand". The institutional structure of the Project's Technical Advisory Board (TAB) that linked NWC, the Industry, Ministry of Agriculture, Bio-Security, SPC was deemed to have been particularly successful. The TAB that meet on a quarterly basis, enabled the "project to focus on and address real issues across the whole, production, post-harvest management export chain". The Review noted that

Nature's Way Cooperative provided a successful, research, information, extension, training system for the Fiji Papaya industry and other horticultural export industries. The project helped catalyse the successful establishment of an implementation model through partnering with a farmer based organization (Nature's Way Cooperative), to implement the project with collaborators from government research and extension, other NGO's and all stakeholders in the Fiji Papaya industry as well as key advisors. The challenge is how to maintain this excellent initiative after project support ends. A follow-on system for information dissemination and technical research support after the project support concludes has not been developed, and this will be crucial to the future development of the Fiji papaya industry.

The Review strongly recommended that this outreach function be added to a Phase II proposal.

Other relevant conclusions of the Review were:

- The appropriateness of targeting a winning fruit for export with excellent impact potential, based around very good export markets, demand and an ability to quickly recover from disasters like cyclones and floods etc.
- Over the project period exports of papaya have essentially doubled, much of which can be attributed to the FFP noting that although exports are currently and temporarily at a low ebb following flood damage early in 2012. However, the overall output levels achieved by the industry were certainly well below the ambitious targets of the original project document.
- Key markets in Australia, New Zealand, Hong Kong, Japan and potentially USA for organic papaya have been clearly identified. Bio-security and Plant Quarantine protocols have been established except for the USA.
- The Fiji Red based on the Sunrise Solo selections has been established as the export standard and seed production and certification methods established with MPI providing government certification of growers and seed from bagged flowers to avoid cross pollination contamination, which was observed in non-bagged trials.
- The project has provided best practices for seed production based on field trials.
- The commercial seed and seedling production systems in place ensured rapid recovery after the two major floods in February-March 2012
- The project pioneered methods of papaya seedling production for mini and micro nurseries using best practices across many locations.
- The project successfully supported, with additional AusAID support, a rapid response on seeds, seedlings and essential inputs for replanting areas destroyed by floods.
- An approach to future disaster management has commenced but needs much further inputs to prepare for both disasters and longer term climate effects and this is a proposed objective for the project extension period.
- Field trials have demonstrated organic production methods can be economically and successful. However, more work is needed on verification and a third party certification process put in place for Fiji papaya.
- Post-harvest research completed to date include successful identification of where physical and post-harvest disease damage occurs in air-freight to Australia and NZ and successful shipping by sea freight to NZ pinpointing packaging, carton, treatments required, ripening in NZ and resolving Plant quarantine, Bio-security protocols. An important initiative was the successful development of a protocol using newspaper as a cheap effective packaging material with substantial cost savings to exporters.
- There was one simulation, static storage trial of sea-freight to Australia (15-21 days) using a range of post-harvest treatments for diseases, including hot water treatment, low temperatures and Modified Air Packaging, with and without ethylene adsorbent for some bags has been completed. Results show positive outcomes for development of an export protocol for longer duration sea freight. Full sea freight trials are still needed in future. These should be conducted in the proposed project extension phase. The development of a sea freight export strategy for papaya had become critical to increase competitiveness and to maintain market access in the light of reduction of wide-body airfreight capacity.



A REVIEW OF THE NATURE'S WAY COOPERATIVE (FIJI) LTD. RESEARCH AND EXTENSION PROGRAM AND PROPOSALS FOR THE FUTURE

- Successful resolution of a number of post-harvest treatments for Fiji Red papaya including hot water dips with and without chlorine and combinations of Prochloraz dips in conjunction with the High Temperature Forced Air (HTFA) protocol for control of post-harvest diseases.
- Eight workshops and farmer field days were successfully completed with 300 farmers trained and 9 important information sheets for farmers and exporters developed as well as the Certified Seed Production Guide protocol.
- Training and awareness among growers and exporters as to best practice harvest and post-harvest practices in order to minimize physical damage.

The proposal for a phase 2 of the Fiji Papaya Project

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The successful development of an export industry based on a fruit tree crop needs to be seen as a long term process. Thus despite the success of the four (4) years, FPP needs much more to be done to build on what had been achieved and to draw on the lessons that have been learned. Thus a proposal was prepared for ACIAR to support a Phase II of the Project. The proposed Phase II, was entitled "Applied Research and Development for the Fijian and Australian papaya industries". This would also be a four (4) year project that would be implemented through the structure established by the initial Papaya Project. For the Fiji industry the proposed Phase II was to focus on four primary applied research themes:

- Sustainable production systems in the face of climate extremes and climate change
- Improving post-harvest handling
- Value chain improvement
- Papaya value adding and processing
- Promoting the adoption of the Fiji Papaya Project outputs

The justification of these primary research themes is presented briefly below, together with a number of the specific activities that were proposed in response to the priority issues raised:

Sustainable production systems in the face of climate extremes and climate change: Natural disasters e.g. flooding and cyclones continue to be a limiting factor affecting supply in both Fiji and Australia. Crop specific research into potential mitigation and recovery strategies has not been specifically examined with papaya.

Improving post-harvest handling: The Fiji Papaya Project had identified that fruit handling; ripening temperature, post-harvest disease control and transport temperature, all have an important bearing on management of fruit disease. Despite gains made through the Project to improve post-harvest handling systems, numerous challenges remained, specifically in the area of post-harvest disease management. Post-harvest losses continue to be high and it was expected that further research and extension could reduce these reject rates. The recent reduction in air freight capacity required a greater emphasis on sea freight, if exports were to remain competitive and to further expand. With a significantly longer transit time, sea freight posed many significant challenges.

Value Chain Improvement: A better understanding was required of consumer, retailer, wholesaler, exporter and grower requirements and how they can be combined to improve value to all members along the papaya export value chain.

Papaya Value Adding and Processing: As papaya production grows, there will be significant volumes of good quality fruit rejected for export for various reasons. Thus, lower cost raw materials will be available for value added processing. The development of markets for "reject" fruit will increase the returns to papaya growers and overall contribution of the papaya industry to the economy. The investigation of local processing options was proposed in terms of both technical and economic feasibility to determine the required capital investment and projected returns for papaya processing.

Promoting the adoption of the FPP outputs: It had been recognised that the FPP was successful in meeting most of the proposed research outcomes. A major challenge now was to realise the sustained adoption of these research outcomes by farmers and exporters.

The Project Review recommended that ACIAR provide an additional funding to Fiji Papaya Project for a further two (2) years but not for the four (4) years that had been requested in the Phase II proposal submitted by NWC. There was no precedent for eight (8) years of continuous ACIAR support for one particular tree crop industry. Thus despite the recognised success of the FPP, ACIAR, faced with substantial overall budget cutbacks, agreed to provide additional funding for I year. This additional funding was essentially to facilitate the implementation of some of the FPP important research findings, in particular:

- Sea freight to New Zealand
- NWC's certified "Fiji Red" seed scheme.
- Investment by NWC in hot water treatment for the control of fungal diseases.
- The completion of the Papaya Production Manual.



3.3.2 The Pacific Breadfruit Project (PBP)

What the PBP was all about

NWC, in parallel to the FPP, implemented a second major ACIAR Project – the Pacific Breadfruit Project (PBP). This four (4) year project began in January 2011, as part of ACIAR's Pacific Agribusiness Research and Development Initiative (PARDI), with total funding of AUD 530,335. The project was funded and implemented through Koko Siga Pacific (Fiji) Ltd. in partnership with Nature's Way Cooperative, in collaboration with the Ministry of Agriculture and SPC's Centre for Pacific Crops and Trees (CePaCT). The Project funded an Activity Leader/Farm manager (Livai Tora) and Horticultural Specialist (Kyle



Stice). The team was based at NWC, where an office and secretariat was shared with the Fiji Papaya Project. Kaitu Erasitu, was appointed by CePaCT as a full time Research Officer to work on the PBP. He was based with the team in Nadi.

NWC involvement with breadfruit dates from 2000, when the HTFA quarantine facility was certified for export of breadfruit to New Zealand. The NWC Strategic Plan (2002-2006) identified a market of 300 to 400 tonnes for fresh breadfruit in New Zealand, selling largely to the Samoan community. The Plan projected that Fiji would be exporting 100 tonnes by 2006 and that these exports would exceed 200 tonnes by 2010. These projections were based on a combination of positive indicators:

- breadfruit's proven suitability to HTFA treatment;
- the existing production base;
- a large New Zealand market already in place; and;
- potential markets in Australia and the United States.

Overall it was estimated that a fresh export market approaching 1,000 tonnes existed in New Zealand, Australia and the United States could realistically be developed over the next decade. These estimates were based on a detailed market study in NZ focussing on the Samoan community.

Two exporters were quick to respond to the fresh breadfruit export opportunity and began exporting in 2001, with 5 tonnes shipped. Yet, since that time there had been no growth exports, with a maximum exports of 12 tonnes achieved in 2005. Two fundamental reasons were identified for exports falling far short of what had been projected in NWC's Strategic Plan. These were:

- Breadfruit for export was "wild harvested" from trees found in breadfruit "forests" or from trees found around villages. This created major production, harvesting and post-harvest handling constraints.
- The availability of breadfruit in proximity to NWC treatment facility was limited to only four to six weeks per year.



Figure 11: The inaugural of the Pacific Breadfruit Project TAB held at NWC



To address these fundamental constraints, the Pacific Breadfruit Project (PBP) was designed as part of ACIAR's Pacific Agribusiness Research and Development Initiative (PARDI). The focus was on commercial orchard development. It was further identified that by overcoming these constraints to fresh exports, the foundation could be laid for developing a major agro processing industry producing flour and starch products for local consumption and export.

Globally, there was little or no experience in development of commercial breadfruit orchards. Thus it was necessary to develop, essentially from scratch, nursery and orchard nursery systems for this "new" commercial fruit tree crop. Basic applied research and extension activities were required in such areas as: planting material selection; propagation and distribution (including commercial private sector nursery development); orchard management practices (including intercropping to ensure financial viability); and post-harvest handling. A major constraint is the limited number of outstanding identified varieties (seedless triploids) from a commercial perspective. Thus there has been a need to mass propagate these selected varieties to establish orchards with elite planting material.

A two stage applied research program was identified to facilitate the launching of breadfruit into a significant commercial industry. The PBP was the first stage of a proposed industry development program which dealt with commercial orchard production and post-harvest handling for fresh exports. A second future stage was proposed that would deal with the commercial processing of breadfruit.

The underlying methodology of the PBP was to follow a value chain approach. A substantial market was identified that was not being supplied due to a combination of inter-related supply constraints. The design and implementation of the PBP was focussed on the removal of these constraints. The value chain analysis undertaken by Nature's Way Cooperative showed:

- Situation: Large market exists, lots of breadfruit trees but very little breadfruit exported.
- Weakness in chain: Breadfruit wild harvested not possible to maintain quality and keep costs low.
- Action to be taken: A project (the PBP) to assist moving from "wild" harvest to orchard production

The resulting key objective of the PBP was the establishment of breadfruit as a commercial small- holder based orchard crop. Achieving this objective had three (3) core components that involved a number of activities. The core components were:

- To identify varieties that will enable year-round production and develop systems for propagating them.
- To develop best practices for the establishment and management of small scale commercial breadfruit orchards.
- To establish harvesting and post-harvest systems to meet export market requirements.

The achievements of the Pacific Breadfruit Project

The PBP formally ended in in June 2015, after being provided a 6-month no cost extension. At that point 32 breadfruit orchards had been established with 1,464 trees planted of which 30 trees were already bearing. The number of trees was well below the target of 5,000 trees. However, this was seen as an excellent achievement given that most of the project's initial stock planting material was lost in the extreme flood of 2012 and nurseries had to be re-established from scratch. Orchard trees bearing within a little over two (2) years compared with the (4) to five (5) years normally expected for breadfruit. Fresh breadfruit exports to New Zealand would have commenced by the end of 2016 – had the fruit not been lost due to Cyclone Winston. However, the trees themselves proved to be remarkably resilient with less than 1% of trees lost in the main commercial orchards. It now projected that the planting of 20,000 trees by the end of the decade would lead to 4,500 tonnes of marketable fruit.



Figure 12: A breadfruit orchard on Johnston Rd, one week after Cyclone Winston



Figure 13: Legalega breadfruit orchard one week after Cyclone Winston





Figure 14: The main Nadi breadfruit orchard one month after Cyclone Winston

Figure 15: A breadfruit at the same orchard broken by Cyclone Winston – but regrowing 6-months later

A notable feature of the PBP, as with Fiji Papaya Project, was that it enabled NWC to coordinate with other stakeholders. This focussed around the Technical Advisory Board (TAB) model that was also adopted by PBP. As with the FPPP TAB this was chaired by the NWC CEO. The coordination with SPC CePaCT was particularly effective, which enabled the planting out of breadfruit tissue culture material in orchard trials

Unlike the Fiji Papaya Project there was no comprehensive review conducted of the Pacific Breadfruit Project. The PBP was reviewed as one component of the overall PARDI Project that covered 4 countries and a significant number of agriculture, forestry and marine sectors. The final PARDI Project Report concluded with respect to the PBP:

Forty-two participating farmers in Fiji's Western Division have planted 2,240 breadfruit trees on 18 hectares of land using planting material developed by the PARDI breadfruit project. Farmer-owned demonstration orchards are coming into production some 18 months ahead of expectations, greatly improving the expected viability of breadfruit as a commercial crop. The largest breadfruit orchard of 2.5 ha (312 trees) was established adjacent to the international airport in Nadi. Orchard-sourced fruit will form the basis of Fiji's breadfruit exports from 2016 onwards. The foundation has also been laid for commercial breadfruit processing in Fiji into gluten-free flour and starch products.

The PBP's presentation to the Fiji National Breadfruit Symposium in May 2015 recommended that if breadfruit orchard development were to realise its full potential, the following would be required:

- Further refinement of pruning and other orchard management techniques
- The continued development of intercropping to realise commercial viability for small holders.
- The on-going evaluation of planting material derived from different sources
- The development of commercial enterprises to collect, propagate and distribute planting material.
- Having a commercially viable bilateral quarantine agreement (BQA) in place;
- The generation of domestic commercial demand for breadfruit to be used for processing.

It is readily apparent that a long term applied research program is required if this "new" orchard crop was to be able to start realising its very substantial full potential. ACIAR have agreed to fund some of the orchard development components, focussing on pruning techniques, as part of such a program. In April 2016, NWC signed a contract with University of the Sunshine Coast to implement a four (4) year breadfruit activity in Fiji. The total value of this contract is AUD 100,000 and is part of ACIAR Regional Fruit Tree Development Project. Nature's Way is now seeking funding support for other key components of the long term breadfruit development program.



3.3.3 The NWC Research and Extension Network Partnership

An important feature of both the Fiji Papaya Project and the Pacific Breadfruit Project was the Technical Advisory Board (TAB). Both TABs that meet on a quarterly basis, were Chaired by the CEO of NWC. The two TABs were essentially made of the same membership – meeting alternatively at six (6) weekly internals. Thus for the sake of efficiency and effectiveness a decision was made in early 2014 to combine the two TABs into one NWC Research & Extension Partnership (REP) Committee that would meet every three (3) months. The first REP meeting was held in February 2014.

The REP coverage, unlike the previous TABs, was no longer project commodity specific. It dealt with research and extension issues of all HTFA quarantine treated crops (papaya, breadfruit, eggplant and mango) and potential HTFA treated crops (wi, jackfruit). The objectives of the NWC REP Committee are to:

- provide a platform for industry partners to discuss issues related to Fiji's HTFA commodities;
- provide regular feedback to industry partners on research findings, project accomplishments and emerging issues;
- guide industry partners in prioritizing research and extension activities related to HTFA crops;
- provide technical expertise to the project team in implementation of research activities; and,
- provide assistance in the analysis and validation of research outcomes.

The membership of the NWC REP are:

- Chairperson (NWC CEO)
- NWC R&E Manager
- The Chairman of the NWC Supervisory Committee
- Deputy Permanent Secretary Agriculture
- Director of Extension
- Director of Research
- Principal Research Officer Horticulture
- Principal Agriculture Officer Western
- Sigatoka Research Station Representative
- Senior Scientific Officer Biosecurity Authority of Fiji
- SPC Technical Officers Plant Pathology and Entomology.
- Team leaders of current projects in which NWC is directly involved (in February 2014 these were the Fiji Papaya Project and the Pacific Breadfruit Project)
- Project officers from current projects in which NWC is directly involved
- Representatives of other relevant current projects (e.g. TTM, SPC-IKSA, PHAMA)
- Exporter Rep; Farmer Rep; and, Nursery Rep.)

The creation of REP was a pre-emptive measure to ensure the sustainability of the successful coordination structure that had been created by the Fiji Papaya and the Pacific Breadfruit Projects beyond the life of the projects. This was part of NWCs transition from research and extension projects to sustained research and extension program. The REP was seen as the long term coordinating structure for this program. A total of eight (8) REP meetings have now been held – including two beyond the formal completion of the FPP and PBP. At each of these meetings

a NWC Research and Extension Newsletter is presented for the approval of the REP Committee – after which it is posted on the NWC web-site and distributed through other networks. (http:// webmediawisp.com/nature/)

The creation of the NWC Research and Extension Partnership and it REP Committee provided a framework for attracting further donor support from NZAID and AusAID, which is discussed below:



otember 2016

3.3.4 The NZAID funded Extension Program

Climatically 2012 proved to be a particularly challenging year for NWC with two major floods earlier in the year followed by Cyclone Evan at the end of the year. As a consequence there were very little exports in first half of 2013. NWC, with virtually no revenue being generated, sought financial assistance from NZAID and AusAID to support the continuation of the Extension Program and fund an Export Stimulus Scheme.

Three (3) years of support for the NWC Extension Program was agreed to. This support commenced June 2013, with a total funding allocation of FJD 380,000. This included AUD 72,000 in co-funding from AusAID that was channelled through NZAID. The funding provided for a part-time Extension Manager and two full time extension offices, a 4WD vehicle and its operating costs, materials and transport for farm exchanges.

NZAID, in parallel to the Extension Program allocated a further FJD 175,00 for a post disaster exporter stimulus scheme. Under this stimulus scheme exporters received rebate of \$0.40/kg on their treatment charges of \$0.75/kg treated. This scheme was in place for 1 year – ending June 2014.

The overall vision of the Extension Programme was to increase total exports through expanding the supply base (new farmers) spread across a wider geographic region (expand production outside of the Sigatoka Valley). The Extension Programme had three specific goals:

- Increased number of farmers actively involved in the horticultural export industry as a means of increasing export volumes, to enhance the livelihood contribution of horticultural exports and reduce risk for NWC.
- Increased contributions of export produce from outside the Sigatoka Valley seen as a strategy to increase export volume and to reduce vulnerability to natural disaster by spreading the production area.
- Increased overall export volumes to increase the viability and sustainability of NWC.

Some of the specific activities of this programme were to:

- establish cluster groups in key locations;
- provide value chain training for exporters utilising the just published SPC/CTA "Agricultural Value Chain Guide for the Pacific Islands: Making value chain analysis a useful tool in the hands of farmers, trader and policy makers" which had the Fiji papaya export value chain as one of its main case studies;
- distribute inputs (seedlings and fertiliser) to farmers as part of the post-disaster rehabilitation program;
- support to the NWC Certified "Fiji Red" Papaya Seed Scheme;
- support to expanded organic papaya production;
- provide Post-harvest disease monitoring, in support of NWC capital investment in hot water treatment; and,
- provide a standby advisory service for new and existing NWC members (farmers and exporters).

Progress in achieving the goals of the Extension Programme

By the end of 2015 it was apparent that considerable progress was being made in achieving the goals of increasing the number of farmers involved in the horticultural export industry, expanding production beyond the traditional production areas in the lower and mid-Sigatoka Valley, and expanding the volume of HTFA crops exported. This progress, can in large measure, be attributed to the Extension Program as discussed briefly below:

Goal #1 – Increased number of farmers actively involved in the horticultural export industry

The NWC/NZAID Extension Project Progress Report #5 records a high number of new farmers planting HTFA crops (approximately 120 over the first 28 months of the project). However, as the Progress Report notes the real measure of success is when "new farmers succeed in supplying fresh produce to an exporter". The report further notes that from "past experience with promoting export diversification with new farmers suggests that only around 20% of all new farmers will succeed in supplying an exporter in their first year of planting export crops".

Analysis of BAF data showed by the end of 2014, there was a 31% increase in new farmers supplying HTFA products – increasing from 164 to 216 farmers over the year. The number was expected to be even higher at the end of 2015. Regrettably this situation was dramatically reversed in February 2016 with Cyclone Winston that severely impacted growers in the Ba and Ra provinces; followed in April by severe flooding associated with Cyclone Zena that impacted growers in the Sigatoka Valley and Nadi area. These extreme climatic events present a major challenge to the NWC Extension Programme and to the growers they serve.

Goal # 2 - Expanding production outside of the Sigatoka Valley







Figure 16: Total destruction of Fiji Waters 7 acre papaya block at Yaqara by TC Winston



Figure 17: A commercial papaya block at Moto, Lautoka

Figure 18: One of the main seed blocks at Kavanagasau, Sigatoka Valley, two weeks after the Cyclone Zena floods

Eight farmer cluster groups were established outside the Sigatoka Valley. These were Sabeto West Bank (Nadi); Sabeto East Bank (Nadi); Legalega/Votualevu (Nadi); Solovi/Saunaka(Nadi); Momi (Nadi); Johnson Rd (Lautoka); Moto Rd (Ba); and, Town area (Ba). In addition cluster groups were also established in the upper Sigatoka Valley. These cluster groups became the focus of the NWC extension effort. By the end of 2014, there was a 31% increase in new farmers supplying HTFA products, with 31 new farmers supplying from outside the Sigatoka Valley. The increase was greatest in the Nadi area where there was a 142% increase in number of farmers supplying HTFA products by the end of 2014. Further increases were expected by the end 2015. It now remains to be seen how these farmers in new locations recover from the disasters on February and April 2016.

Goal #3 - Increased export volumes of HTFA crops

There was a sharp fall in exports in 2012 as a result of the major natural disasters that occurred in that year. The next three years saw a steady recovery of exports (figures 1). The Extension Program and the Exporter Stimulus Scheme are seen as important contributors to this recovery.



Additional benefits NWC Extension Program

A number of additional benefits can be attributed to the NWC/NZAID Extension Programme. These include:

- The entry of new active exporters. As a result of the support offered to new potential exporters, three became active exporters. Significantly an international company (Fiji Water), that has substantial involvement in horticultural industries in the United States, made a significant investment in papaya at Yaqara, Ra. This involved a 7 acre irrigated block. The decision to invest followed consultation and follow-up inputs from the NWC Extension team. Regrettably, Cyclone Winston destroyed the new plantings and the supporting infrastructure (figure 12). However, encouragingly, the company has decided to reinvest. The company made the business decision to reinvest based on the probability of a similar event ever occurring again within a reasonable time frame.
- Enhanced sustainability of the NWC Certified Seed Scheme. The staff recruited for the NWC Extension Programme, were also tasked with the follow up and mentoring of commercial papaya seed producers that were established under the ACIAR Funded Fiji Papaya Project. Certified seed production has now become a worthwhile enterprise for these farmers, which augers well for long term sustainability.



Figure 19: Fiji Red papaya seed in its new foil packaging with extended seed viability

- Increased local market sales. The increase in the number of farmers and overall acreage led to a substantial increase in volumes
 of papaya and eggplant for the local market. Project reports estimate that around 300 tonnes annually of additional produce
 has entered into the domestic market (tourist and non-tourist). NWC indirectly benefits from increased local market supply, by
 reducing price competition from the local market and thus encouraging supply continuity for the export market.
- Increased interaction of the Cooperative with its farmer membership. With NWC's large and dispersed membership, Management
 has always struggled to achieve the desired interaction with farmer membership, which now total over 300. Hitherto interactions
 and information dissemination had been largely confined to the once a year Annual General Meeting. As a consequence farmers
 are often ill-informed about the activities of the business of which they are shareholders. The NZ Aid funded Extension Programme,
 has enabled NWC to have a much larger presence in the field where its farmer membership resides. However, with the focus
 on production outside of the Sigatoka Valley, this interaction has favoured the members in the Nadi Rakiraki corridor.

Key constraints to the implementation of the NZAID funded Extension Program

A number of key constraints are identified in the implementation of the NWC Extension Program, which are discussed briefly below:

High attrition rate of new exporters in target geographic areas

The fresh produce export business is very competitive with high risks associated with weather and other factors. These risks are compounded by the low working capital levels of most exporters. The attrition rate amongst the thirty (30) or so companies that have been licensed to



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export HFTA treated commodities over the last twenty (20) years has been high. Over the course of the NZ Aid funded programme, four export companies who were sourcing from the target geographic areas have gone out of business. The loss of these exporters has resulted in a significant gap in the 'market pull' factor for farmers in the Nadi – Rakiraki corridor. In the case of Rakiraki there is currently no exporter based in this area which means that farmers are not able to confidently plant HTFA products. This in part explains the increase in papaya entering the local market.

NWC in good faith has not encouraged farmers to plant an HTFA product unless there is an identified exporter who has agreed to purchase from the farmer. Therefore the absence of key export businesses has been a significant constraint to expanding production and increasing export volumes. As a consequence an important part of the Extension Program has been to providing key information and support services to exporters (including potential new investors) who have shown interest in working in target areas. Perhaps the most significant development in this respect has been the decision of Fiji Water Ltd. to make significant investment in papaya production – with the expectation that the company would also later be involved in exporting and operate as a nucleus for smallholders in the surrounding area.

The wide geographical distribution of the target beneficiaries

The target beneficiaries of the Extension Program were spread from the upper Sigatoka Valley to Rakiraki. These were serviced by an Extension Manager and two Extension Officers, one of whom was dismissed after 18 months because of poor performance. The Extension teams have full time access to a 4WD vehicle. However, a management requirement was that this vehicle had to be parked every evening at NWC premises. As a consequence the Extension Services resources were spread very thinly. The underlying principle behind the NWC Extension Service was that it would lever and focus the resources of the Ministry of Agriculture and other related service providers. However, the achievement of this goal remains very much a work in progress. This contrasts with the good level of collaboration that has been achieved with Sigatoka Research Station staff.

Issues requiring an applied research response

There were a number of key issues that required an applied research response to problems that were adversely affecting the effectiveness of the Extension Program. In particular these were:

- The eggplant disorder
- Post-harvest rots for eggplant and papaya
- Inefficiencies with some of the existing BQA agreements with New Zealand
- The high cost of airfreight requiring a transition to sea freight shipments.

To address these, and other, issues in July 2015 NWC entered into a four year Research Partnership Agreement with NZAID entitled "Enhancing Fresh Fruit and Vegetables Exports from Fiji". NZAID/NWC Research Partnership is discussed below.

Climatic extremes

Category 5 Tropical Cyclone Winston struck on February 20th 2016 and had a devastating impact - particularly in areas of northern Viti Levu which were the focus of the Extension Program. The rapid assessment conducted by NWC Research and Extension Team only two days after the cyclone reported the following losses for papaya. Sigatoka – 20% loss, 80 % damage; Nadi – 50% loss, 50% damage but flooding/ standing water will be a problem later; Lautoka – 80% loss, 20% damaged but surviving - flooding/standing water will be a problem later; Ba – 100% loss; Tavua – 100 % loss; and, Yaqara – 100% loss. The Sigatoka Valley production areas emerged from Cyclone Winston relatively unscathed only to be severely damaged by the floods associated with Cyclone Zena a month later. The major damage this time included the new papaya production areas of the upper Sigatoka Valley that were also a focus of the Extension Program.

In the months leading up to these cyclonic events the area was subject to a severe El Nino induced drought where the Extension Program was providing tailored advice to participating farmers on options for irrigation and in some cases advice on access to finance for securing the required equipment. Drought conditions have continued following the cyclones.

An acid test of the effectiveness of the NWC Extension Program will be how well these farmers are able to recover from these disasters. NZAID has agreed to provide some additional financial support to help with this process. A particular focus of the NWC Research and Extension Program has now become adaptation to climate change and climate extremes. Bearing this in mind an important extension message to the participating farmers in areas severely impacted by Cyclone Winston is that such an extreme event is unlikely to be experienced again for another generation³. However, largely El Nino induced, floods, droughts and cyclones will continue to be part of the climate environment to which farmers will have to adapt if they are to continue to have worthwhile livelihoods.

³The consensus of most climate change models is that in the future tropical cyclones are likely to become less frequent but more intense (Taylor Mary, Andrew McGregor and Brian Dawson (2016). Vulnerability of Pacific Island agriculture and forestry to climate change. Secretariat of the Pacific Community.



3.3.5 The NWC/NZAID Research Program

In July 2015 NWC embarked on a three year, NZAID funded, applied research focussed Project entitled "Enhancing Fruit and Vegetable Exports from Fiji". The total funding provided for this Project is \$638, 362. The funding provided for a Research Manager, who also serves as the NWC 's Operations, a part-time Technical Advisor and two full time Research Officers. The team is supported by a 4WD vehicle and its operating costs, materials and transport costs.

The NWC/NZAID Research Program has 6 core components, which are discussed briefly below:

Component I: Developing a website to enhance online presence of fresh fruit and vegetable exports

The NWC website (www.nwcfiji.com) that will be officially launched in July 2016 has the following objectives:

- To raise the online profile of NWC and its members
- To provide stakeholders and potential buyers with easy access to key information resources related to the four key commodities
- To provide a reference point for the 'Fiji Red' Brand and 'Fiji Red' Certified Seed Scheme.

Eligible exporters have the opportunity to have their own page/profile on the website that can be used to send to potential clients. Already 6 exporter profiles have been loaded on the website.

 'Fiji Red' papaya comes from foundation seed of Solo sunrise developed by the University of Hawaii Seed Lab. This foundation seed has been improved in Fiji over several generations to produce a variety with highly desirable eating and keeping qualities that performs well under Fiji conditions. 'Fiji Red' has a freckled greenish-yellow skin that turns yellow as the fruit ripens, but inside is a juicy, dramatic red-orange color flesh. The characteristics of Fiji Red' are as follows: exceptional sweetness and flavour (high brix: 12%-15%), strong red coloured flesh, good size characteristics (400 to 600 gm) good keeping qualities. 	'FIJI RED' PAPAYA	
Figure 20: A snapshot of the invive wedsite	 ¹Fiji Red⁴ papaya comes from foundation seed of Solo sunrise developed by the University of Hawaii Seed Lab. This foundation seed has been improved in Fiji over several generations to produce a variety with highly desirable eating and keeping qualities that performs well under Fiji conditions. ¹Fiji Red⁴ has a freckled greenish-yellow skin that turns yellow as the fruit ripens, but inside is a julcy, dramatic red-orange color flesh. ² The characteristics of ¹Fiji Red⁴ are as follows: ³ exceptional sweetness and flavour (high brix 12%-15%). ⁴ strong red coloured flesh. ⁴ good size characteristics (400 to 600 gm) ⁴ good keeping qualities. 	

Component 2: Developing an industry wide 'Fiji Red' papaya brand

"Fiji Red" papaya is seen as a unique high quality origin product that should be promoted and marketed as such. Following marketing in New Zealand a "Fiji Red" brand and label was established, which all NWC members will be entitled to use.

Component 3: Reducing treatment costs through improved market access with New Zealand

NWC current treatment charge is \$0.75/kg of fruit treated. This charge is not sufficient to meet NWC's costs at the current levels of throughput. However, for exporters this amount represents a major element in their overall costs. It significantly impacts on their competiveness and the amount that they can pay to farmers. A number of elements of the current quarantine treatment protocol that have been identified as unnecessary and their reform would lead to significant reduction in treatment costs. Two elements in particular have been identified:

- The required holding time of 20 minutes after the treatment temperature of 47.20 °C has been reached. This holding time requirement was a part of the NWC's original treatment protocol that was established in 1996 for papaya. It was based on the Cook Islands protocol for export of papaya to New Zealand at that time, which was adopted in its entirety for Fiji's papaya exports to New Zealand. The 20 minute holding period does not apply to United States Department of Agriculture protocol for export of HTFA treated papaya from Hawaii to the US Mainland despite the fact that Hawaiian fruit fly are significantly more heat tolerant than the Fijian fruit fly species. Thus there is seen to be no quarantine justification for this long standing 20 min holding time requirement. Removing this holding time requirement from the treatment protocol would lead to significant energy and labour cost savings
- <u>The use of lugs rather than bins for the treatment of eggplant</u>. Up until 2013 the treatment of eggplant was undertaken in bins rather than treatment lugs. This allowed for a larger volume to be treated at any one time and significantly lower capital cost was incurred. However, in 2013 in response to the discovery of the Atherigona on eggplant New Zealand MAF insisted that the treatment of eggplant be conducted in lugs. It has been subsequently shown that this change has no relevance to the control of thrips. Furthermore HTFA quarantine treatment is only scientifically proven for the treatment of fruitfly and not for any other pest.



NWC has hired the services of a New Zealand market access consultant, Kevin Nalder, to work with BAF and the Fresh Produce Importers Association to put the case for changing these two protocols. Kevin Nalder was formerly the NZ MAF quarantine officer responsible for the Pacific islands and later was employed as a representative of the New Zealand Fresh Produce Importers Association.

Component 4: Sea freight and hot water treatment incentive scheme

These two incentive schemes focussed on the commercialisation on previous NWC applied post-harvest research activities.

- Sea freighting to New Zealand. Sea freight exports has become a necessary condition if there is to be a significant expansion of papaya exports. Sea freight has become necessary with the loss of wide-body aircraft by Fiji Airways in 2014. Under the Fiji Papaya Project a successful sea freight trial was conducted. As a result of this research infrastructure investment was made at the HTFA facility to facilitate sea freight exports. Under the Scomponent 4, an incentive scheme has been put into place to encourage exporters to invest in sea freight shipments. Under the scheme eligible NWC exporters are offered a rebate of \$5000 for each sea freight export consignment made over an 8 month period. In addition to the financial resources, NWC R & E team will also provide technical support to ensure the sea freight consignments have the highest likelihood of success. While there has been considerable interest in utilising this facility unfortunately there has been inadequate supplies of papaya to activate its use. A reassessment of the sea freight incentive scheme at the end of year 1, will be undertaken to determine if it should be extended or the funds need to be re-allocated to another activity.
- Post-HTFA hot water treatment. During the wet season substantial post-harvest losses were being incurred due fungal diseases. Under the Fiji Papaya Project research was conducted on the use of hot water as a post HTFA treatment. The trials showed that losses could be substantially reduced through hot-water treatment. As a result NWC invested in a hot-water treatment facility and an incentive scheme was put into place to encourage exporters to use this facility. Under the scheme each exporter is entitled to a treatment charge rebate of up to \$3000 during the 2015/2016 rainy season. The rebate will be applied at the time of billing and the exporter will receive a statement describing how much of the rebate has been utilised. As part of this scheme, exporters are also assisted with post-harvest assessments to help them to determine the economic thresholds of their post-harvest losses. Several exporters have taken advantage of this scheme and have been involved in post-harvest assessments. However, due to the dry weather conditions, disease levels have been relatively low and therefore the hot water treatment was not required.

Component 5: Research and development activities for product improvement and new product development

This is seen as the core component of the NWC Research Program and has involved activities for eggplant, papaya, breadfruit and wi. These activities included:

Eggplant.

- Establishing and convening the Eggplant "Disorder" Research Taskforce involving the MPI Research Div., Exporters and BAF.
- Designing and undertaking trials in collaboration with Sigatoka Research Station Staff.

The eggplant "disorder" was identified by industry as the highest current research priority.

During 2014, eggplants were significantly impacted by the increasing frequency of the disorder leading to reject rates of around 50% for some consignments. The affected fruits have skin lesions which make them unmarketable. These occurrences of the disorder adversely impacted on the business of the exporters as well as their supplying farmers and the other actors in the supply chain. The problem created considerable disharmony – with HTFA treatment often being incorrectly blamed as the cause of damage. For the this reason it was decided by the NWC Research Technical advisor that component 6 would be to focus on activities of the Fiji Eggplant "Disorder" Taskforce.

Papaya

- Completion of papaya quality assessment.
- Support to the 'Fiji Red' seed producers scheme

Breadfruit

- Initiation of trial work on 'stem cuttings' for breadfruit
- Updating of Fiji Breadfruit Manual

Wi (Spondius dulcis)

Initiation of literature review, with the expectation that market access would be forthcoming in the near future.

In this work there was continual close collaboration with staff at the Sigatoka Research Station.



Component 6: Review and updating of bilateral quarantine agreement (BQA) between Fiji and NZ related to Fruit Fly Host commodities.

A number of the BQA pathways of HTFA products pose major constraints to commercially viable exports. Some of the procedures are seen as out dated and not justified on quarantine security grounds and need reform. In particular it is noted that NWC has been treating produce for export to New Zealand for some 20 years, with over 13,000 tonnes of produce exported and there has never been a fruit fly intercepted.

A specific issue is the appropriateness of the existing bait spray requirements. A major concern is that the nature of the present mandatory requirements. These undermine the commercial viability of breadfruit exports – a product that has huge economic potential. Another important pathway issue relates to seed source for eggplant, which is seen to be of no quarantine relevance.

Despite commitment from the Biosecurity Authority of Fiji (BAF) to this BQA Review process, the first six stages of implementation were difficult because of the environment created by a series of non-fruit fly pest interceptions by NZ MAF related to eggplant followed by a suspension of the pathway based on a procedural breach. In this climate, it was very difficult to convene meetings of a BQA Review Taskforce given that most parties had been preoccupied with meeting NZ MPI requirements to resume exports. Securing and maintaining the effective collaboration from BAF remains a major challenge. In the meantime the NWC BQA Review Facilitator has continued to collect the relevant information for the review and carry out informal consultations.

3.3.6 NWC Disaster rehabilitation initiatives

Over the last six (6) years the business of Nature's Way Cooperative (NWC) and its members has become highly vulnerable to disruptions in supply caused by natural disasters. The major climatic events over that period impacting on the industry have been:

- The "50 year" flood on January 2009
- The major floods of January and March 2012
- The category 3/4 Cyclone Evan in December 2012
- The category 5 (northern Viti Levu) in February 2016
- The severe El Nino in the second half of 2015 and continuing into 2016.
- The severe flooding experienced in the Sigatoka Valley/Nadi area associated with Cyclone Zena in April 2016

These consequences of these climatic events demonstrated the priority need for NWC to become more proactive in dealing with natural disasters – both in terms of the short term rehabilitation of its members and their longer term adaptation to climate change and to climate extremes. NWC has been successful in securing donor support in its efforts to become proactive in facilitating a positive response from industry.

Rehabilitation

The 2013 Export Stimulus Scheme

An export stimulus scheme was introduced in June 2013, to encourage exporters to recommence shipments after the major floods and Cyclone Evan of 2012. NZAID provided FJD 175,000 for one-year to provide a treatment charge rebate of \$0.40/kg from the treatment charge of \$0.75/kg. With the exporters facing serious cash flow constraints the treatment charge rebate of \$0.40/kg proved a useful incentive for exporters to actively source fruit for export and contributed significantly to the recovery of exports in 2014.

The 2012 Flood Rehabilitation Pilot Project

In March 2012 NWC entered into an agreement with AusAID to carry out both flood rehabilitation and preparedness work on behalf of its members. The total amount initially provided was \$91,900, with a further \$33,100 provided after the March 2013 floods. This pilot project was implemented by the NWC Extension Program Team and involved both direct rehabilitation assistance and disaster preparedness.

Farmers were assisted with planting material (papaya and eggplant seedlings), land preparation and fertilizers for the establishment phase. Drainage works were provided to assist farms that were affected but not destroyed by the flood. These drainage works served to rehabilitate the existing crops as well as, prepare the farm for the eventuality of more excessive rain events.

Some thirty (30) NWC farmers have been directly assisted with farm inputs and papaya/eggplant seedlings. In total 14,300 papaya and 16,000 eggplant seedlings were supplied. To this has to be added seedling supplied by the Taiwan Technical Mission and the Ministry of Agriculture.



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Technical assistance and training or nursery rehabilitation and future sustainability

NWC contracted eight nurseries to grow papaya and eggplant seedlings for distribution to affected NWC members. The decision to engage these small and micro nurseries with commercial seedling orders was to encourage future sustainability of seedling supply. It was envisioned that a network of nurseries spread out in different geographic areas would be critical to rehabilitation efforts for the horticulture sector following natural disasters. Leading nursery person Sant Kumar, was recruited as Nursery Technical Advisor (TA) to provide assistance and training to these small and micro nurseries. He visited each nursery at least once very two weeks over the 5- month period. He provided advice in such areas as:

- assessed required inputs for seedling orders (seed, trays, potting mix etc.);
- production planning (how much to sow and when) in order to meet standing orders;
- setting prices based on real costs of production;
- communication with the client as the seedlings are growing; and
- troubleshooting in the nursery (poor germination, poor vigour, pest and diseases etc.)

This nursery work was deemed as highly successful, with all the nurseries requesting that the TA continue. They continue to operate and as a result Fiji now has a base of small commercial nurseries that can be drawn on for horticultural planting material at the time of disaster.





Figure 21: System developed by Sant Kumar for protecting seedlings in a container during a cyclone event

Figure 22: Nursery operators meeting at NWC in May 2016 (following TC Winston and Zena) to discuss the seedling distribution program for the Research and Extension Program

Disaster preparedness

Research

This funding provided the opportunity to undertake applied research on post-disaster response measures that could be used in response to future natural disasters by farmers and exporters. These were in two particular areas:

- Assessment of post-harvest treatments, for the control of anthracnose and phytophthora following high rainfall events.
- An assessment of methods to control fruit sunburn caused by defoliation after a Category 1-3 cyclone.

Both these research activities were undertaken in close collaboration with the Fiji Papaya Project that was still operational at the time.

The hot water treatment (48°C for 20 minutes) was proven to provide very good control of disease with no adverse effects on fruit quality. As a result of this research, together with subsequent benefit cost analysis, NWC subsequently invested in a commercial hot water unit.





Figure 23: Commercial hot water disease control facility at NWC

The sun burn control research found that the use of cotton material used to cover exposed fruit within 3 days following a cyclone significantly reduced the amount of sunburn damage and still enables the farmer to market his fruit and this was found to be highly cost effective. It was encouraging to note that there was some adoption of this technique after Cyclone Winston in the Sigatoka Valley, where the winds were not as severe as in other locations.



Figure 24: Defoliated trees in Sabeto Valley protected from sun burn



Figure 25: Post-harvest assessment to determine quality of fruit

Bulking up of planting material

Availability of quality papaya and eggplant seed was seen as a major ongoing constraint to the export industry. Natural disasters greatly exasperated this constraint and undermined rehabilitation efforts. In the past, in the case of papaya, Fiji turned to the University of Hawaii to replenish seed stock. This source was no longer a viable option in terms of availability of quality and quarantine considerations. For the previous two years the NWC research team had been working with Sigatoka Research Station to develop the certified papaya seed scheme, which by June 2013 had become operational. However, the buy-in from the private sector in seed production was not sufficient. The Flood Rehabilitation Pilot Project funding provided the opportunity to involve the private sector in papaya seed bulking up to address future natural disaster rehabilitation needs. There were also plans to develop a similar seed production scheme for eggplant.



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NWC entered into an agreement with 11 selected farmers to produce 'Fiji Red' papaya seed. A Memorandum of Understanding (MOU) was entered into with these farmers that gave NWC access to 10% of their best trees to bag and collect fruit from. The fruit from these trees was purchased by NWC and the seed then became the property of the Cooperative. The selected farmers were provided with cash inputs, technical support and on-site training. Under this scheme the MPI Research Division was expected to provide an auditing and certification service to the participating seed producers. However, the auditing certification service still remains a work in progress. By the end of 2015, over 15kg had been produced by the certified seed scheme, of which around 4kg was in stock at the time of TC Winston. As a consequence the papaya industry was in a better position to rehabilitate itself for the disasters of early 2016. However, due to the high demand prior to these disasters, there were still insufficient seed available to meet post-disaster needs. Thus it was still necessary to supplement this seed supply with stocks from the Sigatoka Research Station. However, even the quality of the MPI seed benefited from the technical inputs and advice provided by the NWC "Fiji Red" Seed Scheme. Important lessons have been learnt by NWC Seed Scheme in stock management, which are now being implemented.

NZAID funded rehabilitation activities for the fresh produce export Industry: Post TC Winston and the floods associated with Cyclone Zena.

In May 2016, NWC entered into an agreement with NZAID aimed at rehabilitating the fresh produce export industry. The amount allocated was \$455,000 to spend over a 14 month period. This involved two activities:

- An exporter stimulus scheme (\$350,000)
- A seedling and agro import scheme (\$105,000)

The Export Stimulus Scheme

NWC's proposal to NZAID indicated that as a result of these disasters, there was very real danger due to increased costs, exporters will stop exporting for a period of time until full production resumes. Such action would have serious consequences for the supplying growers, service providers (including NWC) and Fiji's overall competitive position in the market. There was also the distinct possibility that some exporters may completely go out of business if they face too long a period without any income. This was the case with several exporters after the 2009 floods and TC Evan in 2012.

In 2013 the cost impacts on exporters were partially mitigated by a pilot export stimulus scheme funded by NZAID that provided a rebate on quarantine treatment charges. This rebate scheme was credited to making a significant contribution to recovery of exports over that year. Thus it was agreed to fund a similar treatment charge rebate following the 2016 disasters. The same level rebate was provided in 2013 (with NWC making a small contribution). However, the total funding provided was significantly larger and the duration longer.

The Seedling and Agro Import Scheme

The substantial gap in the supply of HTFA commodities due to these two disasters was expected to be further compounded by the short fall in plantings due to the severe drought of 2015. Thus NWC requested funding for a seedling and an input distribution scheme to be implemented in partnership with exporters. Under the agreed scheme each active exporter at NWC is offered a quota of seedlings and agroinputs. The exporters are required to provide the list of farmers to be rehabilitated, and their input needs. NWC through its research and extension service will facilitate and monitor the distribution of rehabilitation inputs in close collaboration with the exporters. It is the exporters who are responsible for distributing the inputs to their farmers. If an exporter does not utilize the quota, then the balance is redistributed to other interested exporters.

This arrangement that directly involves the exporters, is a significant departure from the previous NZAID funded post–disaster input distribution scheme, where NWC distributed inputs directly to farmers. NWC providing inputs directly to farmers was found to be fraught with distribution challenges and misunderstanding amongst exporters and the recipients of the inputs. There was also a degree of wastage in terms of the goal of stimulating exports, inputs going to farmers who were not significant suppliers of export crops. An important lesson learned from that experience is that it is far better to channel the rehabilitation inputs through the exporter and give them the responsibility for distribution.

The seedlings are to be grown by commercial nurseries on contract with NWC and distributed using the exporters transport. The exporter will also have the responsibility of monitoring land preparation with farmers to ensure that seedlings are planted in a timely manner. The number of farmers to be assisted under the scheme will likely range from 40-60, however these farmers will all be actively involved in the export industry and therefore the likelihood of this rehabilitation support translating to actual exports is expected to be high.

This new approach on the part of NWC is to transition exporters into playing a much more active role in providing support services to their members and therefore strengthen business relations along the export value chain. It is expected that under this arrangement, there will be some farmer members who will not receive assistance, but this will only encourage them to strengthen their relationships with exporters and visa a versa.



3.3.7 NWC's 2015 Updated Corporate Direction

The NWC 2009: "A Strategic Plan to Achieve a Sustainable Future" was updated with the NWC "2015 Updated Corporate Direction", which is summarised as follows:

Vision: "To see that the fresh fruit and vegetable export be a major contributor to the prosperity of the people of Fiji."

Mission: "Provide world class HTFA quarantine treatment and other services to the Fiji fresh fruit and vegetable export industry."

Goals for the end of 2017:

To increase:

- the volume of treatment to at least 2,500 tonnes by end of 2017;
- the number of exporters to at least 18 for four commodities;
- the development of new production areas by at least 300 acres;
- active membership base to at least 350 growers and exporters; and
- net operational savings of at least \$ 500,000 by end of 2017.

NWC Research and Extension Program was identified as having a key role in achieving these goals.

3.4 THE IMPACT AND RELEVANCE TO DATE OF THE NWC RESEARCH AND EXTENSION PROGRAM

3.4.1 The Overall Performance of Nature's Way Cooperative

The Food and Agriculture Organisation of the United Nations (FAO) in 2009 conducted a series of case studies on agriculture for growth in the Pacific islands⁴. Nature's Way Cooperative was chosen as one of the case studies. The FAO Report concluded:

Despite identified market opportunities, the Pacific island countries (PICs) have not been a part of the global horticulture revolution. Fiji is finally starting to prove an exception to the rule, with horticultural exports becoming a lead growth sector. This coincides with the demise of the Fiji sugar industry and where the diversification of export and rural livelihood opportunities is urgently required if a major calamity is to be avoided.

An industry owned business, Nature's Way Cooperative (Fiji) Ltd, is playing a lead role in the development of this new growth export industry. NWC is a registered cooperative owned and operated by the Fiji fresh produce export industry. NWC's core business is the quarantine treatment of fruit fly host products. Over the last decade NWC has grown from a small business handling just 30 tonnes of papaya to an agribusiness treating 1,200 tonnes fruit (papaya, mango, eggplant and breadfruit) annually for export. Currently NWC annually generates around FJD 2million in export earnings and FJD 800,000 in farmer income. Because of the capital investment made by NWC a threefold increase in export earnings and farmer income is now feasible.

A number of key factors have contributed to the success of NWC. These are:

- The quality and continuity of management.
- There has been no government interference in the operations of the business.
- An appropriate public private sector partnership.
- Shareholders have not interfered in the day to day operations.
- Quarantine treatment fees have been set at an economic rate from the outset enabling the business to meet operating costs, fund repairs and maintenance, invest in expansion and make rainy day provisions for events such as cyclones and trade bans.
- The business was able to quickly move to a level of plant utilisation that yielded to a positive cash flow.

The current year (2016) has seen some strain with respect to some of these success factors that have attributed to long term success. These relate to an appropriate public private sector partnership (AFL wanting to impose a commercial rent rate for the land) and shareholders interfering with day to day operations (the demands for a Special Annual General Meeting). However, these issues would appear to have now resolved at least for the immediate future.

Nature's Way's 2009 Strategic Plan: "A Strategic Plan to Achieve a Sustainable Future" projected throughput reaching 2,500 tonnes in 2011 and exceeding 3,200 tonnes in 2012. The 2015 Updated Corporate Direction projected an annual 2,500 tonnes by 2017. The NWC Research and Extension Program was a major part of the Plan to achieve these throughput targets. Further it was projected that the NWC

⁴FAO Agriculture for Growth: learning from experience in the Pacific – 2009. All Agricultural Commodities Program 2010.



Research and Extension Program could be self-funded once the 3,000 tonne throughput target was achieved. However, in the meantime the Research and Extension Program would need to be funded as part of the public private sector partnership through donor funding.

The actual throughput performance is well short of the 3,000 target, with 1,287 tonnes being the highest level achieved in 2011. The significant shortfall is explained by a combination of factors:

- The impact of climate and disasters
- The failure in securing additional market access and bilateral quarantine agreement pathway reforms
- Limitations of the NWC Research and Extension Program

The impact of climate and disasters

The first decade of NWC existence was relatively benign in terms of climatic conditions – although there was a severe El Niño-induced drought in 1997/98. Prior to Cyclone Evan in December 2012, the last major cyclones that impacted the Sigatoka Valley were Cyclones Wally (1980) and Kina (1993). During that first decade the main disruption to supply was the result of the political disturbances and trade bans associated with the 2000 Coup. In contrast the last decade has been characterised by a series of major events that have impacted on the production of horticultural export crops. These events commenced with the "50 year" flood of January 2009 and were followed by:

- Category 3 Cyclone Mick Dec 2009
- Major floods of January and March 2012
- Category 3/4 Cyclone Evan in Dec. 2012
- Category 5 (northern Viti Levu) in February 2016
- Severe El Nino induced drought in the second half of 2015 and early 2016.
- Severe flooding associated with Cyclone Zena in April 2016

The various NWC research and extension activities did much to assist farmers and exporters in recovering from these events and to enhance resilience to future extreme climatic events. However, these measures have fallen far short of offsetting the impact of climatic extremes at least in the medium term.

It remains to be seen what the next decade will bring in terms of the climate extremes in the production areas. The expectation is that the next decade is more likely to be a repeat of the last decade rather than a return to the conditions of the previous decade. However, it is of note that most climate change models suggest that there will be less frequent cyclones overall but a greater frequency of more severe cyclones of the intensity of the recently experienced Cyclone Winston⁵. Also it should be noted that around the trends of temperature, rainfall, and cyclones there are climatic cycles. For the Pacific islands the most dominant of these influences is the El Niño–Southern Oscillation (ENSO). ENSO is a naturally occurring global phenomenon that has existed for millennia. For Fiji, droughts and cyclones are more frequent during El Niño periods. ENSO cycles occur every five to eight years or so and an extreme ENSO cyclone is just ending for Fiji. Thus it can be expected that it will be at least several years before there is another El Niño. Thus a period of less climatic extremes might reasonably be expected.

It is also expected that the horticultural export industry's overall ability to cope with natural disasters over the next decade has been enhanced by NWC research and extension activities. These have:

- spread the production base of the industry away from an overwhelming concentration of the Sigatoka Valley;
- enhanced the capability of the exporters and farmers ability to recover from a particular disaster; and,
- increased the resiliency of farmers and exporters to extreme climatic events.

The failure in securing additional market access and bilateral quarantine agreement pathway reforms

Market access

In 1995 Fiji obtained approval to export HTFA quarantine treated papaya to New Zealand. HTFA treated eggplant and mango were approved for export to New Zealand the following year and breadfruit followed a year later. HTFA treated papaya was finally approved for export to Australia in Dec 2003. Since that time there has not been a single market access approval obtained – despite a number of clear cut candidates such as wi and jackfruit to New Zealand and papaya to the United states.

⁵Mary Taylor, Andrew McGregor and Brian Dawson (2016), Vulnerability of Pacific Island agriculture and forestry to climate change. Secretariat of the Pacific Community.



The Strategic Plan (2002-2006) was optimistic that a considerable number of additional quarantine treatment protocols, opening up new products and new markets, would be developed over the Plan period. This would substantially increase the utilisation of the facility and the viability of the business. To quote the Plan:

The realization of the projections depends on the timely development of new commodities and markets. A long time frame has been allowed for new protocols development, considering the past record in this area. It is hoped that this time frame is conservative and that the exports of some commodities will commence earlier, thereby enhancing NWC's financial results.

The products and markets that were projected to come on stream during the Plan period were: papaya to the United States; egg plant and breadfruit to Australia; wi, jackfruit, bitter gourd and other gourds to New Zealand.

The program to develop new markets and new products has been a complete failure. In most cases even the first step in the process, undertaking confirmatory tests, has not been undertaken. The confirmatory test data should have been submitted to New Zealand and Australian authorities, together with an up to date pest list. The Ministry of Agriculture failed in meeting its core market access responsibilities. The Ministry of Agricultures Quarantine responsibilities were transferred to the Biosecurity Authority of Fiji (BAF) in 2008. However, to date, there has been no tangible progress made in securing access for new products and new markets.

The 2009 Strategic Plan estimated that losses incurred in not being able to secure any new market access in the previous 5-years. These loss estimates were:

- \$0.5 million in treatment revenue to NWC.
- \$3.7 million export earnings to the nation.
- \$1.8 million in farmer income.

The resulting annual loss of export earnings at the time was put around \$890,000 and farmer income about \$350,000. These losses will steadily increase in the future if nothing is done to rectify the situation and substantially increase the level of risk faced by NWC. The Strategic Plan noted that after the floods on January 2009: "Only breadfruit was immediately available for export. It will be four months before significant supplies of eggplant and nine months before significant supplies of papaya will be available. Wi and jackfruit are available and had export protocols been in place these products could have helped fill some of this gap".

The NWC Research and Extension Program is endeavouring to address this market access constraint through formal partnership arrangements with BAF, the agency with designated responsibility for market access. NWC continues to provide technical inputs, including hired consultancy inputs, to facilitate the process. It remains to be seen if BAF has the will and the technical competence to address this long standing market access constraint.

Market access issues don't only lie on the Fiji side. Securing a reasonably timely response from the quarantine authorities in the importing countries also remains a major unresolved issue⁶. A case in point is the Fiji application of market access for wi (Spondias dulcis) to New Zealand, which has been with New Zealand authorities since early 2010, along with applications for karalla – bitter melon (Momordica Chanrantia) and Jackfruit (Artocarpus heterophyllus). NWC is not aware of any response to this application, despite no apparent outstanding quarantine issues. It had been hoped the AusAID Pacific Horticulture and Agriculture Market Access (PHAMA) Project would have helped facilitate the process. However, from the industry's view point, the performance of PHAMA has been very disappointing.

Existing bilateral quarantine agreements

The quarantine constraints to exports not only lie with new market access. There are also major problems with some of the bilateral quarantine agreements (BQA) for the existing products for which there is market access. The BQA for most of these products has in place a pathway of activities that must be adhered to before a phytosanitary certificate for export is issued. Most of the components of these agreed pathways were put into place when market access was first secured some 20 years ago. They are by and large based on what the Fiji Ministry of Agriculture's Quarantine Department had put forward at the time. With the passage of time a number of the requirements relating to fruit flies have been found to be redundant from a quarantine perspective and yet are vigorously enforced because "the rules are the rules". Some progress was made in how the pathways were administered during the short period when Luke Tirimaidoka (formally a Senior Quarantine Field Officer) served as NWC field officer.

As previously mentioned over the last 21 years, NWC has treated over 13,000 tonnes of fruit for export and there has not been a single fruit fly related interception. Requirements that are seen as being particularly redundant are some of the bait spraying requirements for mango and breadfruit and the seed source requirements for eggplant. Meeting these requirements places increased demand and cost on exporters and farmers and undermines the viability of already challenging businesses.

⁶See Brown, M.F. and McGregor, A.M. (2015). Levelling the playing field with Pacific Island horticultural market access. Acta Hortic. 1105, 295-300 DOI: 10.17660/ActaHortic.2015.1105.42 http://dx.doi.org/10.17660/ActaHortic.2015.1105.42



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Component 6 on the current NWC/NZAID Research Program is to "the Review and updating of bilateral quarantine agreement (BQA) between Fiji and NZ related to Fruit Fly Host commodities". Success in implementing this component will depend on the engagement and commitment of BAF and subsequently securing a timely response from New Zealand Department of Agriculture.

3.4.2 Limitations of the NWC Research and Extension Program

From the time that a field service was first proposed as part of NWC 2001 Strategic Plan, it was never expected that the Cooperative would operate the entire research and extension program for HTFA products. It was always envisioned that Nature's Way with its own core field service could focus and leverage the inputs from the other key partners – and in particular the Ministry of Agriculture, the Quarantine Service, SPC and related donor funded projects. Furthermore, the expectation was that once treatment throughput reached around 3,000 tonnes annually, the research and extension service would be funded by the cooperative itself.

To date HTFA treatment throughput has fallen far short of the 3,000 threshold that would provide for the financial sustainability of the field service. This shortfall can be largely explained, as discussed above, by the impact of climate and disasters and the non-performance of market access and bilateral quarantine pathway reforms. Also, while the field service itself has had some highly successful outcomes, the overall impact of the service has probably been less than what might have been envisioned in the Strategic Plans. Some of the reasons for this shortfall can be listed as follows:

- The difficulties encountered in leveraging the expected inputs from the Ministry of Agriculture and other entities.
- Field officer performance below expectations.
- The wide geographical distribution of the target farmers relative to the resources available.
- Management procedures with respect to the use of vehicles.

These are discussed briefly below:

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Leveraging inputs from the Ministry of Agriculture and other entities.

The NWC's research and extension efforts have always enjoyed high level of support from the Ministry of Agriculture. This support became institutionalized with the establishment of NWC Research & Extension Partnership (REP) Committee in 2014. These quarterly meetings were regularly attended by the Acting PS/Deputy PS and his senior staff. There was particularly close and effective collaboration between Sigatoka Research Station Staff and the NWC Research Team – working on research issues relating to papaya seed and eggplant diseases. The needed collaboration between the Ministry's extension staff in the localities, however, has been less than satisfactory and often disconnected. This can in part be explained by a combination of factors: the wide range of duties locality officers are responsible; chronic transportation constraints for extension officers the short period of time MPI field officers spend in a particular location; and in some cases, the lack of commitment on the part of senior Extension Officers. Recommendations are made below on how coordination with the Ministry of Agriculture Extension staff could be enhanced.

Coordination with quarantine authorities has always been problematic but it seems to have become more difficult in recent years with the corporatisation of quarantine under BAF, where "turf" is rigorously protected by management. Relationships became particularly tenuous when exports to New Zealand were temporarily suspended in early 2016, following the non-adherence to procedural requirements by the responsible BAF Officer. It is hoped that collaboration will now improve with formal integration of BAF into activities under the NWC/NZAID Research Program.

Field officer performance

The NWC Research and Extension Program over the last decade has involved a small number of highly competent and dedicated staff with good leadership. A feature of the program has been the training and overall development of the staff. This small group has been able to achieve a great deal. However, the performance of the field officer who was recruited under the 2013 NZAID Extension Program was poor and he had to be dismissed and replaced. This was a set back to the credibility and performance of field service, the consequences being magnified by the small size of the service. A flow on implication of this dismissal has been the imposition of rigid controls on the use of vehicles, which has had negatives impacts on the effectiveness of the field service. The obvious lesson learned is that far greater attention needs to be given to the staff recruitment process. Being a successful field officer working directly with small holders requires far more than an 8 to 4 work ethic.

The wide geographical distribution of the target farmers

The Fiji Papaya Project has been NWC's most successful research and extension project to date. The FPP received significant financial support and focussed on one product in a relatively confined geographical area – the traditional papaya production areas in the lower and mid Sigatoka Valley. The FPP team were able to work closely with staff from Sigatoka Research Station in the implementation of a number of key activities.



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The focus of the NZAID Research and Extension Program extended beyond the traditional areas – with targeted farmers located from the upper Sigatoka Valley to Lautoka/Ba/Tavua corridor. Increasing the number and extending the geographical distribution of target farmers was well justified in terms of reducing risk, increasing production and spreading the benefits of horticultural exports. However, with the limited interaction with the Ministry of Agriculture's locality extension officers, the resources made available to cover this expansion was not commensurate with outputs expected. As a consequence, the necessary on-farm face-to-face contact was severely limited. The time available for this direct contact was even further constrained by the requirement that vehicles had to be parked over night at the NWC premises.

The expanding of focus to these new areas inevitably meant that less attention was given to the traditional production areas in the Sigatoka Valley. Given the identified continuing needs of farmers in these traditional production areas there are likely to have been adverse supply consequences. While recognising the field service needs of these new production areas these should be at the expense of the traditional horticultural Sigatoka Valley production area.

3.4.3 Major achievements of the NWC Research and Extension Program

The throughput of Nature's Way Cooperative is still far short of the 3,000 tonne/annum throughput projections made in the Strategic Plans. The Research and Extension Program was expected to be a major instrument in achieving this goal. The analysis presented in the Plans indicated that once this target was achieved the Industry (NWC) would have sufficient financial resources to maintain the core Research and Extension Program and needing donor funding support specific focussed activities. On this basis it could be argued that the Research and Extension Program has not been successful. However, as discussed above, there are other major mitigating factors that have led to the treatment throughput being well below target. These were principally climate extremes and market access. It is likely that had the Research and Extension Program not been in place, the throughput would have been considerably less and the very viability of this quarantine treatment business would have been in doubt. A commercial quarantine treatment business is a necessary requirement for the development of Fiji's horticultural export industry. This is an industry that has been identified to offer the greatest opportunity to diversify Fiji's export agriculture .

The major achievements of the Natures Way Research and Extension Program over last decade can be listed as:

- The establishment of Fiji's capability to produce high quality "Fiji red" papaya seed.
- The development of the "Fiji Red" brand for papaya
- Facilitating the establishment of a network of small commercial seedling nurseries.
- The mounting of a successful rapid response to papaya "disorder" misinformation and thereby maintaining the Australian papaya market access.
- The creation of an orderly scientific response to eggplant "disorder"
- The introduction of commercially viable post-harvest treatment for fungal rots
- Facilitated the adoption of plastic crates as standard practice for Fiji fresh fruit and vegetable industries.
- Demonstrated the commercial viability of sea freight exports to New Zealand
- To provide the basis for significant breadfruit exports
- Providing scientific evidence necessary to reduce the cost of quarantine treatment.
- Providing information that allows farmers to adjust to climate change and to adopt sustainable agricultural practices.
- Providing information that has encouraged the entry of significant new investors in the industry

These are discussed briefly below:

The capability to produce high quality "Fiji red" papaya seed.

Fiji now has, thanks to the NWC Fiji Red certified seed program, a premium quality market preferred papaya variety that is well adapted to local conditions. There is now no need to import papaya seed. The establishment of the Fiji papaya industry, dating back to the late 1980s, was based on solo sunrise sourced from the University of Hawaii. This sweet red fleshed papaya performed well in the conditions found in the Sigatoka Valley and western Viti Levu. However, over time Hawaii became an increasingly less desirable source of seed for a combination of reasons. With the incursion of papaya ring spot virus (PRV) in most of Hawaii's papaya producing islands in the late 1980s Solo Sunrise ceased to be a commercial variety in Hawaii. The Hawaiian industry, by necessity, shifted to genetically modified (GM) varieties that were resistant to PRV. This reduced the domestic commercial demand for the seed of non-PRV resistant such as Solo Sunrise. As a consequence

⁷See McGregor Andrew "The export of horticultural and high-value agricultural products from the Pacific islands". Pacific Economic Bulletin Volume 22 Number 3 October



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the quality of Solo Sunrise seed fell. Importing PRV resistant lines is not an option for Fiji, which does not have PRV and GM fruit would be precluded access to certain remunerative markets (organically certified market and the Japanese market as a whole). "Fiji Red" papaya originally derived from "Solo Sunrise" is an inbreed variety. Overtime, yields and fruit quality are improved by selecting seed trees that perform best in the local conditions. Thus thanks to NWC certified seed program the fruit derived from "Fiji Red" seed today is superior than that derived from the original "Solo Sunrise" seed from Hawaii. In addition to the declining quality of UH seed there is a quarantine risk associated with importing seed. Globally, bacterial crown rot (Erwinia papayae), is major papaya disease, which can be transmitted via seed. Fiji and Australia are currently free of this disease - while Tonga now has this disease- reportedly derived from seed imported from Asia⁸.

A network of small commercial seedling nurseries

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Fiji has an exceptionally flavoured red fresh papaya that was originally derived from Hawaiian Solo Sunrise papaya. Market studies undertaken in NZ, Australia, US and Japan for the Fiji Papaya Project have shown a strong consumer preference for this fruit and the Fiji name⁹. This

potentially provides Fiji a significant market advantage as they compete with papaya from Philippines and Australia. However, individual Fiji exporters are too small to have the financial resources to capture the brand and thereby differentiate their product in the market. NWC has been able to develop the "Fiji Red" brand, with appropriate labelling and packaging on an industry wide basis on their behalf. It is now up to the exporters to take advantage of this opportunity that has been provided to them.



Mounting of a successful rapid response to papaya "disorder" misinformation

A Queensland Department of Primary Industry technical officer visited Fiji in 2011 and inspected a number of papaya production areas. In locations well away from the commercial production areas in the Sigatoka Valley he observed papaya plants with disease symptoms resembling bacterial crown rot. His trip report suggested

that Fiji had bacterial crown rot, which had earlier been found in Tonga¹⁰. As a result Biosecurity Australia (BA) was under considerable pressure from the Australian papaya industry to stop the import of papaya from Fiji. A BA delegation was immediately dispatched to Fiji. In the meantime BAF ordered the quarantining and destruction of significant areas of papaya production. Fortunately, the Fiji Papaya Project was able to meet with the BA team and organise an immediate scientifically based response. In collaboration with SPC LRD (Plant Protection) samples of the papaya "disorder" were collected from the locations that it had been identified. These were then dispatched to CABI for analysis. The analysis showed that the "disorder" was the result of common fungal disease that manifested itself in the aftermath of Cyclone Mick and was not of any quarantine relevance. Without the Fiji Papaya Project, that was able to provide a rapid scientific bases response, it is likely the Australian market would have been closed to Fijian papaya. This would have had disastrous implications for the future development of the papaya industry and for the viability of Natures Way Cooperative.

An orderly scientific response to eggplant "disorder"

Since 2014 eggplant plant exports have been plagued by eggplant "disorder" in which affected fruit have skin lesions which make fruit unmarketable. At its peak during the wet season reject rates were as high as 50% on some consignments. This defect usually only become apparent several days after shipment. Thus exporters were quick to blame the HTFA machinery for the damage – with some seeking compensation for their losses. This created considerable acrimony between some of the exporters and NWC Management. In response to the problem an Eggplant "Disorder" Taskforce was established through the NWC Research & Extension Partnership (REP) Committee. The Taskforce included the NWC Research and Extension Team, staff from the Sigatoka Research Station, the SPC plant pathologist and a representative from BAF. Through the application of systematic scientific method it was clearly demonstrated that the fault did not lie with the HFTA treatment but was rather related to conditions and management practices in the field. The research team is now focussing in on the specific infield causes and practical measures to address the problem.

A commercially viable post-harvest treatment for fungal rots on papaya

⁸Fullerton RA, Taufa L, Vanneste JL, Yu J, Cornish DA, Park D (2011) First Record of Bacterial Crown Rot of Papaya (Carica papaya) Caused by an Erwinia papayae-Like Bacterium in the Kingdom of Tonga. Plant Disease 95(1), 70.

¹⁰Lynton Vawdrey and Plant Health Australia (2011). Threat Specific Contingency Plan - Bacterial Crown Rot (Erwinia papaya) Plant Health Australia, Papaya Australia and Queensland Gov July 2011



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In recent years papaya, during the wet season, has been experiencing increasingly high reject rates in the market due to rots. This resulted in significant losses to exporters and undermined the image of Fiji papaya. As with the eggplant disorder, some exporters were attributing this to the quarantine treatment. Research undertaken through the Fiji Papaya Project demonstrated that it was fungal diseases that caused these rots. The FPP team, in collaboration with colleagues from the Queensland Department of Agriculture, developed a commercially viable post HTFA treatment hot-water dip that substantially reduced the incidence of fungal rot. As a result of this applied research, NWC invested in a hot-water dip facility. Use of this facility during the wet season protects the quality image of Fiji Red papaya in the markets, and at current throughput levels, has the potential of saving the industry \$2 million annually.

Facilitating the adoption of plastic crates as standard industry practice

The use of plastic field crates is now widespread throughout the horticultural export industry and there is also now significant uptake of plastic crates with fresh fruit and vegetables sold on local markets. This simple innovation has made a major contribution to the quality of fresh fruit and vegetables and reduced the losses incurred by farmer, traders and exporters. Hitherto fresh fruit and vegetables were transported from the farm in wooden boxes, buckets or worse used polypropylene bags. This important innovation can be entirely attributed to NWC who first bulk imported plastic crates as part of the initial field officer program that was supported by AusAID in 2007. Since that time NWC has imported more than a dozen sea freight containers of plastic crates. When the size of the market became apparent the agricultural supply company Marco Polo began importing plastic crates in bulk from China and thereby spreading the impact of this simple innovation that was initiated by NWC.

Demonstrating the commercial viability of sea freight exports to New Zealand



Figure 27: The introduction of plastic field crates by Nature's Way Cooperative has led to a significant uptake in this technology and an improvement in quality.

Significant future expansion of Fiji horticultural exports will be dependent on being able to sea freight fresh produce. This is necessary from both a cost and capacity perspective – both of which have been made more problematic by the aircraft type changes made by Fiji's national carrier – Fiji Airways. Applied research undertaken by NWC for sea freight shipments of papaya to New Zealand demonstrated a 50% reduction in freight cost with no adverse impact fruit quality. As a result of these research findings NWC has invested in facilities that will enable regular sea freighting of papaya to New Zealand. There are plans to extend this research to sea freight papaya shipments to Australia and for breadfruit shipments to New Zealand.

Providing the basis for significant breadfruit exports

A market of some 300 tonnes has been identified for fresh breadfruit in New Zealand and equivalent markets in Australia and United States



once market access issues have been resolved. However, it was soon apparent that these could never be realised with breadfruit as wild harvest crop as it has traditionally been. Thus NWC, through the Pacific Breadfruit Project, has led the way in the commercial transformation of breadfruit from a traditional wild harvest crop to an orchard based crop. Without this involvement such an income earning opportunity could never be realised.

Providing the scientific evidence necessary to reduce the cost of quarantine treatment

Quarantine treatment charges (currently 75c/kg treated) represent a major cost element in the value chain for HTFA treated products. There are two ways that treatment charges can be reduced without undermining the viability of the quarantine treatment business:

- Significantly increasing throughput and thereby reducing overhead costs per unit treated.
- Reducing operating costs in a manner that does undermine the quality of the service provided.

The provisions in the current BQAs have had adverse impacts in both these areas.

NWC would have substantially more throughput if it had market access for more products and more markets - wi, jackfruit, bitter gourd and other gourds to New Zealand; eggplant and breadfruit to Australia; papaya and breadfruit to the United States. NWC Research staff together with SPC entomologists and contracted consultants have obtained much of the information necessary to secure market access for these products. However, this market access effort is yet to pay dividends. This is due to shortcoming on part of the designated quarantine authorities in Fiji and in the importing countries. It is hoped that the fruits of NWC market access efforts over the last decade will soon start to be realised – starting with wi to New Zealand and papaya to the United States. Had NWC not been involved in the gathering of this data there would have been little or no prospect of gaining access for new products or new markets.

Two areas have been identified where operating costs are unnecessarily high due to aspects of the treatment protocol that cannot be justified on quarantine grounds. These, which were discussed above, are:

- The 20 minute holding time once the temperature reaches the required 47.20°C (increase electricity and labour costs)
- The use of lugs instead of bins for the treatment of eggplant (increased capital cost for the purchase of the lugs and the reduced treatment capacity of lugs)

The NWC Research and Extension Program have hired specialised expertise to show these requirements are redundant from quarantine prospective. It is now up to relevant authorities in Fiji and New Zealand to process this information and to have the BQAs amended accordingly.

Providing information that allows farmers to adjust to climate change and to adopt sustainable agricultural practices

The leader of the NWC Research Team, Kyle Stice, wrote the Chapter on horticultural products in the recently published book "Vulnerability of Pacific Island agriculture and forestry to climate change"¹¹. This chapter outlines the significant threat that climate change and climate extremes pose to Fiji's horticultural export industies together with the implications of non-sustainable production practices. However, the Pacific Climate Change and Agriculture Book argues if Fijian farmers are able to adapt to this situation their comparative advantage with respect to competitors could well be enhanced at least for the medium term. If they are are unable to adjust to this situation and adopt sustainable agricultural practices then they have a bleak future even in the relative short term. Thus climate change adaptation and sustainable agricultural practices has become an increasing focus of the NWC Research and Extension Program and is expected to be increasingly so in the future.

Providing information and support that encourages the entry of significant new investors in the industry

The horticultural export industry is desperately in need of significant new investors. The NWC Research and Extension Team has tended to be the first contact point for potential investors, providing them with critical information upon which to base their investment decisions. Amongst these important investors in recent years have been:

• Kumu Farms - the largest organic papaya producer in the United States, producing Solo Sunrise papaya on the island of Molokai. Molokai is free of papaya ring spot virus and thus does not need to plant genetically modified seed (not acceptable for organic certification). However, because of the threat of GMOs entering Molokai, Kumu Farms were looking at Fiji as an alternative source of organically certified papaya. FPP team members visited Kumu Farms and the owner of Kumu has visited Fiji on a number of occasions for consultation with the Papaya Project. As a consequence, Kumu Farms went into partnership with Aviva Farms Organic Papaya Producers and made significant investment in the joint venture. Regrettably, due to the protracted delay in Fiji securing market access for papaya into the United States, Kumu Farms eventually had to withdraw his involvement in the joint venture.

¹¹Tayor, Mary, McGregor Andrew and Brian Dawson (2016). "Vulnerability of Pacific Island agriculture and forestry to climate change" Secretariat of the Pacific Community and Australian Aid.



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Fiji Water is a company with considerable involvement with horticultural tree crops in the United States. The company after detailed consultations with the NWC Research and Extension Team, including a number of field visits, decided to make a substantial investment in papaya production in Rakiraki area in early 2016. The investment included a state of the art irrigation system. Unfortunately these planting plus the infrastructure were destroyed by Cyclone Winston. However, encouragingly Fiji Water has decided to re-establish the infrastructure and replant the papaya. The company plans to operate as a substantial nucleus orchard, which would support and buy from surrounding small holders. It is unlikely that Fiji Water would have become involved in the Fiji

3.4.4 The likely consequences had not the NWC R&E program had not existed

papaya industry had there not been for the NWC Research and Extension Program.

Had the NWC Research and Extension Program not existed it is unlikely the industry owned and operated quarantine treatment facility would still be in operation today and Fiji would not be exporting fresh papaya, eggplant, mango and breadfruit. Thus, there would be very little prospect of the industry expanding and realising its full potential. This conclusion is based on the following considerations:

- High quality certified Fiji Red papaya seed would not be available to the industry.
- The eggplant "disorder" would have caused crippling disharmony in the cooperative as the problem would have been blamed on HTFA treatment facility.
- High postharvest losses for papaya would continue to be experienced during the wet season and this would add fuel to the disharmony, with the HTFA being blamed for the problem.
- Fiji would have lost market access for papaya to Australia
- There probably would not have been widespread adoption of plastic crates in the industry adversely affecting product quality.
- There would be little or no prospect of companies such as Fiji Water entering the industry.
- Exporters would not have received assistance following major disasters and the attrition rate amongst exporters would have been even higher.
- There would be little prospect of eventually securing market access for new products and markets; and improving the BQA protocols for existing products. .
- Farmers would be overwhelmed in their endeavours to deal with extreme climatic events.
- There would be no prospect for developing breadfruit exports.
- There would be no prospect of sea freight exports to New Zealand

3.4.5 Strengths and Weaknesses

Strengths

The strengths of the NWC Research and Extension Program can be listed as follow:

- The program is industry and market driven, focussing on key issues and constraints.
- A permanent institutional structure (NWC Research & Extension Partnership (REP) Committee) has now been established that facilitates high level coordination with key stakeholders (Ministry of Agriculture, SPC, BAF, the managers of other projects operating in the sector, exporters and farmers).
- The long term involvement of competent and motivated management and staff which has gained the confidence of stakeholders, particularly farmers and exporters.
- The confidence of funding agencies has now been established through an excellent track record in terms of results, reporting, consultation and financial acquittals. This has become a model public private partnership which has been able to attract additional necessary donor funding.

Weaknesses

- The R&E Program remains largely donor funded due to treatment throughput not being at a level for NWC to provide significant funding for R&E.
- Has not yet been able to achieve the desired level of coordination with the Ministry of Agriculture staff at the field level.
- A too wide geographical dispersion given the small size of the service and the restrictions placed on vehicle use.



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3.5 RECOMMENDATIONS FOR THE NWC R&E PROGRAM

The case has been made for the importance of the Research and Extension Program for the viability of NWC and the future of the horticultural export industry. Without the input of the R & E Program over the last decade it is unlikely that NWC would have survived, let alone the horticultural export industry expanding to start realising its substantial potential. Bitter past experience in Fiji, and elsewhere in the Pacific, has shown that quarantine treatment facilities cannot be operated by government or parastatal organisations such as the Agricultural Marketing Authority (AMA) or BAF¹². However, there is considerable scope to improve the performance and impact of the R&E Program. In this respect recommendations are made on:

- The future focus of the R&E Program
- Linkages with the Ministry of Agriculture
- Greater input from the exporters in the R&E Program
- The input supply role of NWC and the R&E Program
- The desirability and feasibility of NWC direct involvement in marketing
- Organisational structure and staffing and operational procedures

The reality is that substantial donor funding, through an appropriate public private sector partnership, will be required until NWC can achieve the level of throughput necessary to largely self-fund its R&E service. Previous estimates put the necessary throughput at around 3,000 tonnes annually.

3.5.1 Future focus

The traditional source areas of export HTFA products has been the lower and mid-Sigatoka Valley. However, the NWC Board made a decision in 2013 to actively encourage expanding the HTFA supply base to other areas along the Nadi – Rakiraki corridor and the Upper Sigatoka Valley. The justification for this expansion was:

- To spread the risk impact of natural disasters. The impact of natural disasters is usually confined to particular geographical areas a cyclone that destroyed production in the Sigatoka Valley would not normally impact significantly on production in the Ba area or vice versa;
- To achieve an overall general increase in NWC throughput.
- To increase the active participation of the significant number of NWC's farmer shareholders who were located outside the lower and mid-Sigatoka valley. In particular a substantial number of NWC shareholders came from the upper Sigatoka Valley.

All these reasons remain fully justified. However, the spreading of the target area of the outreach program came at a cost with respect to the effectiveness of the overall R&E program. Relatively long distances now had to be travelled by the team who shared two vehicles. All the staff were stationed at the NWC facility in Nadi, where the vehicles had to be parked overnight. Thus much of the team's time was spent travelling and little time was available for "face to face" interaction with farmers. Farmers in some of the new locations, such as the upper Sigatoka Valley, had little or no experience growing crops such as papaya. Thus even though they were given priority, probably did not receive the attention needed. While farmers in the traditional production areas received far less attention than they had under the Fiji Papaya Project – despite the fact that they faced major issues adapting to climate change, declining soil fertility and disease management. Thus it is recommended that there be a re-emphasis on the traditional production areas in the Sigatoka Valley. However, this should not be at the expense of the program in the new production areas. The following measures, discussed below, are recommended to achieve a more appropriate balance:

- the appointment of one additional field officer;
- the purchase of an additional vehicle for the R&E Program;
- the adoption of more appropriate rules with respect to vehicle usage to allow more time to be spent with farmers on their own farms;
- a field officer to be based in Sigatoka to service the Valley;
- hiring of paid locality reps in selected locations;
- a systematic effort be made to enhance collaboration with the Ministry of Agriculture locality officers; and,
- greater input and buy-in from exporters in the R&E Program.

¹²See: FAO (2009) Agriculture for Growth: learning from experience in the Pacific. All Agricultural Commodities Program 2010.



3.5.2 Linkages with the Ministry of Agriculture

From the outset it was never expected that NWC would deliver the entire research and extension for the horticultural export industry. Even if Nature's Way was able to reach the target throughput of 3,000 tonnes, horticultural exports would still be a relatively small industry in a small country. The industry would never approach the size of PNG's large commodity industries of oil palm and coffee, where industry companies are entirely responsible for Research and Extension. The intention has always been that NWC would facilitate coordination to provide coordination and focus and leverage for the R & E inputs of the Ministry of Agriculture and other entities. To date the collaboration with the Ministry of Agriculture has been below expectation, particularly with field officers at the locality level.

NWC's R&E efforts have always been strongly supported by the Ministry's Management. This relationship was formalised in February 2014, with creation of the NWC Research & Extension Partnership (REP) Committee. The quarterly meetings REP have always been well attended by senior staff – and important decisions concerning the industry are made. However, this collaboration has broken down at the locality level. To address this problem it is recommended that following each quarterly REP Committee a formal meeting be scheduled at NWC in which Principal Agricultural Officer (Western), the Senior Agricultural Officers (SRO) from the West, and the appropriate staff from Sigatoka and Leglega Research attend. These local REP meetings would also be held on a quarterly basis. A key person to attend these meeting will be the newly appointed SAOs responsible for the BQAs. There has been a recent budget allocation of \$100,000 to appoint BQA responsible field officers. It is expected these officers are the extension staff with which the NWC R&E Programme will have the greatest collaboration.

On the research side an important area that needs greater attention is the declining soil productivity of the traditional Sigatoka Valley production areas. On Taveuni, where there has been significant declines in dalo yield due to over cropping and inappropriate use of chemical fertilizer, some growers have been able to achieve remarkable success in reversing this trend through using the cover crop mucuna bean (*Mucuna pruriens*). :https://www.youtube.com/watch?v=HFSRegSufuw&feature=youtu.be

Mucuna has also helped with reducing chemical and labour requirements for weeding. Similarly in Hawaii extensive use is made of pinto peanut (Arachis pintoi) as a crop in fruit tree orchards including papaya. These cover crops are worthy of a priority applied research effort for papaya in Fiji, particularly in the traditional Sigatoka Valley production area. Such a research effort will require close collaboration with the NWC R&E Program and the Ministry's staff both in Sigatoka (planting material, securing soil samples) and at Koroniva (timely evaluation of soil sample).



Figure 28: Widespread use of mucuna bean with taro planting at Tutu Taveuni

Figure 29: Use of pinto peanut as a cover crop in an organic mixed fruit tree farm on Oahu, Hawaii

3.5.3 The hiring of paid locality reps in selected areas

Even if the measures listed above are successfully adopted, it is unlikely that the time spent in "face to face" contact with farmers on their own farms will be sufficient – particularly for new entrants to the industry in new locations. Thus it is recommended that a network of locality representatives of the NWC R&E Program be established. It is envisioned that this would commence as a pilot, starting with say 3 or 4 such locality field reps. The locality rep would be lead farmers from the location and serve as the contact person for the R&E Program. These locality representatives would facilitate a regular follow-up for the R&E Program in the location and provide the necessary two way flow of information. The locality reps would be paid a modest honorarium for the service provided. What is proposed is based on the extension model that was used by the Fiji tobacco industry to service a large number of small holders¹³. Today's widespread use of mobile phones can be expected to greatly enhance the effectiveness of these locality reps.

¹³Eaton, C.S. 1988. Directed small-holder farming in Fiji: a case study of Virginia tobacco production. M.A. Thesis. School of Social and Economic Development. University of the South Pacific. Suva

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3.5.4 Greater input and buy-in from exporters in the R&E Program

An important lesson learned from the experience of NWC Field Service over the last decade is the need to maximise the involvement of the exporters to the extent feasible. Problems have been encountered when NWC was involved in supplying disaster relief inputs directly to farmers. The approach now adopted is to give the exporters far greater responsibility in the distribution of such inputs, with the NWC Field Service playing a facilitating role. Similarly it would be highly desirable if exporters can take on more responsibility for supplying extension input to their farmers with NWC playing a facilitating/ technical supporting role. By so doing, this is seen as a means of effectively spreading the impact pf NWC's small R&E Programme. Consideration should be given to introducing an element of "user pays" to some of the services provided for NWC R&E Program. However, as treatment throughput increases, it is expected that all exporters will make a contribution to the cost of operating the R&E Program through the treatment charges they make.

3.5.5 The desirability and feasibility of NWC's direct involvement in exporting

From the outset it has been NWC's policy that the Cooperative should not be directly involved in exporting. The reason for this were twofold:

- 1. NWC's core business is quarantine treatment, with NWC playing a facilitating role in assisting exporters and farmer members to increase the quantity and improve the quality of products exported.
- 2. The direct involvement of NWC in exporting would create unfair competition with existing private exporters who are fully capable of providing this service.

However, in recent years it has been become apparent that in certain areas the existing exporters have not adequately provided the service expected of them. Two particular short comings have been identified:

- Exporters have largely been absent from some of the new production areas, such as the upper Sigatoka Valley and the Ba/Rakiraki corridor. These are areas where there are significant number of NWC members, who deserve access to export markets.
- A substantial export market has been identified for fresh breadfruit in New Zealand. A major effort has been made over the last four years to develop breadfruit orchards so this market can be efficiently supplied. Over this period, the one exporter who was previously involved in fresh breadfruit exports no longer exports HTFA products.

It has thus been suggested that NWC could become involved in these two areas on an interim basis until private exporters are able to meet these identified needs. The desirability of NWC becoming directly involved in exporting in these two areas is discussed briefly below.

NWC exporting products grown by member farmers in areas not currently serviced by current exporters

The servicing of farmers from more remote locations was the main justifications for establishing the National Marketing Authority (NMA) back in the early 1970s. It has continued to be a justification for NMA's successor parastatal marketing organisations - National Trading Company (NATCO) and more recently FijiAgromarketing. All these government funded marketing bodies have failed in this endeavour. The Fiji Agricultural Marketing: A Policy Framework Report prepared in 2002 concluded¹⁴:

The National Market Authority was established in 1971 and was located in the Ministry of Commerce. It then moved to the Ministry of Agriculture where it took over the function of the Fijian Affairs Marketing Board, where its emphasis was on providing marketing outlets for produce, particularly dalo from the outer-islands. Despite high calibre management, the early NMA accumulated substantial losses in its dalo trading operations and was unable to meet the unrealistically high expectations of farmers. It gravitated into being a buyer of last resort, where it faced the unenviable task of disposing of quantities of poor quality high cost produce. The Authority's own Corporate Plan (1985-89) conceded that it failed in this area – "for the Authority, direct trading activities on domestic markets for commodities such as dalo tended to undermine the operation of existing middlemen, without any sustained benefits to farmers" (p, 69).

NWC's involvement in direct market marketing could expect to suffer the same consequences. Despite the proven competence of NWC's Management, it has no experience in the specialised business of exporting, an area in which there is a particularly high attrition rate. Failure could have disastrous consequences for NWC's core quarantine treatment business and lead to destabilising acrimony amongst shareholders.

It is recommended that a sounder approach would be to provide incentives to link existing exporters to farmer members located in areas that are currently not well served. An appropriate incentive would be a quarantine treatment rebate for products from the nominated isolated locations. The scheme would be in operation for a limited time period, of say two (2) years, until a firm business relationship was established between the exporter and farmer. NWC has a successful track record in operating such rebate schemes as part of aid funded

¹⁴Andrew McGregor and Waisiki Gonemaituba (2002) Fiji Agricultural Marketing: A Policy Framework. Report prepared for the Ministry of



disaster mitigation programs. In addition the NWC R and E Program would provide on-ongoing targeted technical support to the farmers and exporters operating in these identified areas.

Initiating breadfruit exports by introducing "best practice"

Breadfruit orchards are now coming on stream. Unfortunately, over the period these orchards were being developed the company exporting breadfruit went out of the fresh produce export business. There are currently issues that need to be resolved in terms of the bait spray requirements under the Breadfruit BQA and post-harvest handling. Thus a strong case could be made for NWC's initial involvement in breadfruit exporting to introduce "best practice". However, even NWC's involvement in exporting in such circumstances should be approached with considerable caution. Past experience has shown that what starts as a temporary interim activity becomes a permanent arrangement. Again, the most appropriate approach would be to encourage private exporters (current and potentially new) to become involved in bread fruit exporting. This involves working through NWC's Research and Extension Program (including utilising the new breadfruit funding provided by ACIAR Fruit Tree Development Project) to:

- provide information on the extent of the market, both current and future, and the likely cost and returns from exporting ;
- reform the breadfruit BQA pathway, in collaboration with BAF and the Ministry of Agriculture; and,
- undertake applied research and demonstrations improve post-harvest handling of breadfruit

A current NWC exporter member is actively involved in the export of frozen breadfruit – shipping 2 tonnes a month during the season in mixed containers during the breadfruit season. This exporter has recently invested in freezing facilities which are in close proximity to the main, newly developed breadfruit orchard. This provides an immediate market for the fruit from this orchard that will come on stream by the end of year. This exporter should be given priority focus by the NWC breadfruit team. Consideration should also be given on providing a rebate of treatment changes for breadfruit exports for one season to get breadfruit exports up and running again.

3.5.6 Organisational structure and staffing arrangements

The organisation structure of the NWC Research and Extension Program tends to be built around the donor funded projects that are being funded at that particular point in time. As of June 2016, the projects and the positions and persons funded are as follows:

Donor funded project	Commencement and end date	Positions funded				
NZAID NWC Extension Project	June 2013- June 2016	Part-time funding for team leader (Kyle Stice)				
		Part-time funding for extension officer (Livai Tora)				
NZAID NWC Research Project	July 2015 – July 2018	Part-time funding for team leader (Kyle Stice)				
		Funding for two full time field officers (Joeli Nataki, Kaitu Erasito)				
ACIAR Fruit Tree Project	July 2016 – July 2020	One (1) full time field officer (Kaitu Erasito)				
NZAID TC Winston and Flood Rehabilitation and Disaster Preparedness	May 2016 – May 2018	No funding to be provided for staff position – to be implemented by existing staff				

All the project staff come under the direction of the NWC CEO, who in turn reports to the NWC Board.

It is recommended that a permanent basic organisational structure be established for the NWC Research and Extension Programme, with the various donor funded activities integrated into this structure. The proposed structure is presented in figure 30.



Figure 30: Proposed Structure for the NWC Research and Extension Program

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It is envisioned that the proposed R&E team will be largely made up of the existing Research and Extension staff. However, it will be necessary to make one additional full time staff appointment. Also there will need to be an additional vehicle added to the vehicle fleet if the three areas are to be adequately and efficiently serviced. It is recommended that one of these vehicles be allocated to the R&E Manager. It would not be a requirement that this vehicle be parked at the NWC Headquarter overnight.

It is estimated that the annual operating cost of this R&E team would be approximately FJD 200,000 as outlined in table 2.

Table 2: Estimated annual operating cost of the proposed NWC R&E Program (FJD)

Item	Unit cost	Total cost	
Annual salary for Research and Extension Manager	I	\$ 50,000	\$ 50,000
Annual salary for 3 Research and Extension Officers	3	\$ 25,000	\$ 75,000
Annual operating costs for three 4x4 vehicles	3	\$ 12,000	\$ 36,000
Research expenses (trial fruit, agro-inputs etc.)	I	\$ 10,000	\$ 10,000
Training expenses (workshop catering, materials etc.)	I	\$ 6,000	\$ 6,000
Support to lead farmer locality reps	3	\$ 6,000	\$ 18,000
Office expenditure & printing costs (phone,email,printing etc)	I	\$ 7,000	\$ 7,000
TOTAL (FJD)			\$ 202,000



Overall there needs to be greater flexibility in the rules governing the use of vehicles, if this small team is going to adequately service the needs of the NWC members. The rules covering vehicle usage need to, as a matter of course, allow for R&E staff to attend farmer meetings extending well beyond normal "civil service" office hours and not have to park the vehicles overnight at NWC. A system based on a combination of trust, recording keeping and reporting need to be devised to ensure the maximum contact of NWC shareholders with the R&E team.

It is not envisioned that over time there would be any increase in the number of the NWC R&E staff – although some increase in the number of locality representatives could be expected. What is expected is that over time that the NWC R&E program will be able to lever and coordinate more effective inputs from the Ministry of Agriculture and facilitate and assist exporters in their farmer outreach program.

3.5.7 Assessment of the business model for income generation and sustainability: the public private sector partnership into the future.

The review of the operations of NWC over the last 20-years has demonstrated that an effective R&E Program is a necessary requirement to maintain and expand Fiji's horticultural export industry. These R&E services required could in principle be delivered from a range of sources and more likely a combination of sources. These sources are:

- Ministry of Agriculture
- Exporters
- Stand-alone donor funded projects
- Private service providers
- Nature Way Cooperative as the sole service provider
- NWC in combination with other service providers.

These various options are discussed briefly below:

Ministry of Agriculture

Traditionally in Fiji, and other Pacific islands, the Ministry of Agriculture has been responsible for providing research and extension services. Ministries of Agriculture have been, by and large, ineffective in providing these services for horticultural export industries. This is due to a combination of factors:

- Staff tend to be generalists, who don't have relevant practical training in horticulture
- The high mobility of staff between locations
- Effectiveness and calibre of staff tends to be highly variable
- The Ministry has broad mandates and is expected to service a range of industries thus finds it difficult in identifying and focusing on priority needs of a particular industry.
- Civil service rules in terms of working hours, availability of fuel, and use of vehicles limit effective contact with farmers

However, it is important to have the support of the Ministry of Agriculture and to coordinate and focus the significant resources that the Ministry has at its disposal. The NWC R&E Program has had some success in leveraging and focussing the Research Division's resources at the Sigatoka Research Station. There is good scope to take this collaboration further and to extend it to Extension Service.

Exporters

Private exporters have played a critical role in developing Fiji's horticultural export industries. The existence of these exporters has given Fiji a significant advantage over other Pacific island countries in trying to develop a fresh produce export industry. However, these exporters are small businesses, a number of whom originally entered the industry as growers themselves. Most face significant cash flow challenges and do not have the financial or technical capability to operate field services themselves. This situation could change in the future if larger companies such as Fiji Water become significantly involved in papaya production. However, even if such cases emerge, these larger companies will require guidance and technical advice in taking on such a role. One of the key lessons learnt from the decade of NWC involvement in operating a field service is the need for the greater involvement and responsibility of the exporters in program. However, it is unlikely for the foreseeable future that most exporters, if any, will operate their own field service.



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Stand-alone donor funded projects

Over the years, Fiji has had a number of stand-alone donor funded project that have provided field services to farmer. Most notable in recent years for the horticultural industries have been:

- Taiwan Technical Mission (TTM) fruit and vegetable project in the Sigatoka Valley
- SPC/EU Key Services to Agriculture Fiji Project (IKSA)
- EU/ITC Improvement of Key Services to Agriculture and Livestock in Fiji

Some useful outputs can be identified from such projects. However these projects tend to be donor driven and lack coordination with overall industry developments and needs. Invariably their outcomes are not sustainable. A significant departure from this approach has been the ACIAR Fiji Papaya Project and ACIAR Pacific Breadfruit Project. These applied research projects were directly embedded in Nature's Way Cooperative which ensured the relevance and sustainability of the outputs achieved. NWC needs to continue to build on this approach seeking out donor agencies and organisations that will support projects and activities that are in line with industry identified research and extension needs.

Private service providers

It has been suggested that NWC could contract out the provision of research and extension services to a private company. This company would be contracted to provide a given set of services and to meet certain targets. This would release the Cooperative from having to deal with troublesome administrative arrangements such as the management of vehicles. Such an approach has been utilised with some success in PNG with larger commodity industries – namely coffee and oil palm¹⁵. Elements of both the Fiji Papaya Project and the Pacific Breadfruit Project were successfully delivered by a private sector service provider. However, it is highly doubtful if a whole horticultural industry research and extension program in Fiji could be delivered by a private company. This is doubtful for two main reasons:

- In the small Fiji market it is unlikely that there would be a competent company large enough or willing to take on a whole research and extension program. The use of a non-Fiji based company is seen as inappropriate, even if such a company was available and willing to take on such a contract.
- For the foreseeable future the research and extension program will still have to be donor funded. It is highly unlikely in the current donor environment that financial support could be obtained for research and extension program managed by a private company.

This is not to say that private service providers could not have an increasingly important role to play in delivering activities that were part of the overall research and extension program, and this needs to be actively encouraged by NWC.

Nature Way Cooperative as the sole service provider

If Fiji had a large horticultural export industry and NWC was the sole, or at least, a major exporter, then it would make sense for NWC to be the sole provider of extension services. Fiji has a small horticulture export industry, albeit with the potential for significant growth. However, even if NWC was able to consistently achieve its annual throughput target of 3,000 tonnes, it would not have sufficient resources to operate an entire R & E program, nor would it be efficient to do so. It is much more appropriate for NWC to play the lead role in coordinating and leveraging the resources of the other stakeholders in the sector – the exporter, the Ministry of Agriculture, the exports and various donor funded projects and activities. To do this effectively NWC needs its own small and efficient research and extension program.

NWC in combination with other service providers.

As discussed above the appropriate business model is for NWC to take the lead role in providing the necessary research and extension service. This should be small core service that coordinates and leverages the inputs from other stakeholders in the sector. Over the last decade NWC has made good progress in developing this business model built around the NWC Research and Extension Partnership (REP) Committee. This now needs to be taken somewhat further along the lines of the structure proposed in figure 19. The expectation is that this will always be a public private sector partnership. However, as the industry growers, it is envisioned that this core structure will be increasingly funded by the industry itself.

¹⁵Sitapai E.C (2012). A Critical Analysis of Agricultural Extension Service in Papua New Guinea: Past, Present and Future. CIMC National Agriculture Conference. NARI May 2012.



3.5.8 NWC as an input supplier

As discussed above, Natures Way Cooperative has played a very successful role as a supplier of critical specialised inputs that were previously not available, or not available at a reasonably competitive price. These inputs are: plastic crates; certified Fiji red papaya seed; and, protein bait spray used to meet the requirements of the bilateral quarantine agreements for eggplant and breadfruit. In the case of plastic crates a major input supply company is now involved. However, NWC continues to be involved because of the superior quality of the product supply and it remains a profitable enterprise for the business. The certified "Fiji red" seed is a critical key service that NWC provides for the industry. In principle, this service could be passed on to a private sector service provider but this is unlikely to happen for the foreseeable future. The supply of bait spray for quarantine purposes is a small business that is unlikely to attract a significant private sector investor. The exception could be if protein bait spray was combined with much larger market prospects of protein for animal feed.

It has been suggested that NWC could become involved with much wider range of input supplies. For example supply the wide range of inputs required by a farmer growing papaya for export. These inputs currently have to be sourced from a number of different suppliers. While there is some merit in NWC taking such a function on behalf of farmers, it needs to be approached with caution. The supply of inputs such as fertilizer and irrigation inputs could be seen as moving too far away from NWC's core business and not justifying the risks involved. It would be appropriate to encourage exporters to take on this role on behalf of their "contracted" farmers. NWC could play a useful facilitating role in encouraging enterprising input suppliers, such as Marco Polo, to take on the role of "one stop" input supplier for papaya farmers.



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