Australian Government

Australian Centre for International Agricultural Research

MEMORANDUM OF SUBSIDIARY ARRANGEMENT

PROJECT NO. HORT/2018/195

IMPROVING ROOT CROP RESILIENCE AND BIOSECURITY IN PACIFIC ISLAND COUNTRIES AND AUSTRALIA

SOLOMON ISLANDS

Partners in Agricultural Research

MEMORANDUM OF SUBSIDIARY ARRANGEMENT

RELATING TO THE ACIAR PROJECT NO HORT/2018/195

"IMPROVING ROOT CROP RESILIENCE AND BIOSECURITY IN PACIFIC ISLAND COUNTRIES AND AUSTRALIA"

IN SOLOMON ISLANDS

1. General

This Memorandum of Subsidiary Arrangement (the "Memorandum") expresses the understandings of the Government of Australia ("GOA") and the Government of the Solomon Islands ("GOSI") concerning the responsibilities and contributions of the two Governments in regard to the activity of technical cooperation for development for *HORT/2018/195 Improving root crop resilience and biosecurity in Pacific Island Countries and Australia* (the "Project").

The Project is intended to improve sweetpotato planting material (pathogen tested) and planting practices as part of a broader program for resilient root cropping systems, responsive to the challenges of pests and diseases and climate change. The Project is anticipated to be implemented over a period of three (3) years as further described and detailed in Attachment A to Annex I to this Memorandum.

This Memorandum is made pursuant to and is subject to the provisions of the *Memorandum of Understanding between the Government of Australia and the Government of the Solomon Islands on Development Cooperation* (the "MOU"), which came into effect on 14 April 1994.

Unless otherwise provided in this Memorandum, the provisions of the MOU apply to this Project.

2. Designated Coordinating Authorities

The Designated Coordinating Authorities for the Project will be:

For the GOA: The Australian Centre for International Agricultural Research ("ACIAR").

For the GOSI: Ministry of Agriculture and Livestock ("MAL").

3. Implementing Agencies

Under the terms of Article 4 of the MOU:

(a) ACIAR nominates nominates Queensland Department of Agriculture and Fisheries ("DAF") as the Implementing Agency to undertake the Project on its behalf.

(b) MAL will be an Implementing Agency to undertake individual Project activities.

(c) MAL nominates Solomon Islands National University ("SINU") as an Implementing Agency to undertake individual Project activities on its behalf.

The respective responsibilities and contributions of DAF, MAL and SINU regarding their participation in the Project as the Implementing Agencies are set out at Annex I to this Memorandum in the form of a Project Arrangement. The signatures by representatives of DAF, MAL and SINU of the Project Arrangement will constitute their acceptance of their respective responsibilities and contributions to the Project.

4. Project Details

The description, objectives and budget of the Project are further detailed in Attachment A to Annex I to this Memorandum.

5. Evaluation

The Designated Coordinating Authorities may undertake joint activity monitoring and evaluation in relation to progress of the individual activities of the Project in the Solomon Islands, to occur at times as mutually arranged between them. The purpose of such evaluations will be to assess the effectiveness of the activities of the Project overall, and separately in the Solomon Islands, and to identify lessons to be learnt in improving future activities.

6. Contributions

6.1 Financial contributions from the GOA to support GOSI inputs to the Project will be up to a maximum of **AUD$ 86,340**, as further described in the Project Budget at Attachment A to Annex I to this Memorandum. Disbursement of the financial contributions will be subject to the normal annual Australian Parliamentary approval of appropriations.

6.2 Contributions from the GOSI (through MAL and SINU as in-kind support) to the Project is estimated at **AUD $0** as further described in the Project Budget at Attachment A to Annex I to this Memorandum. The GOSI contributions to the Project will cover resources to enable MAL and SINU staff to participate fully in the Project related activities necessary for efficient implementation and monitoring.

7. Project Personnel

MAL and SINU, for the purpose of the Project, will facilitate the deployment of Australian Project personnel (including Australian contractors, where relevant) in accordance with Article 10, 11, 12 and 16 of the MOU.

8. Project Supplies

8.1 Article 12 of the MOU will apply to the importation of Project supplies.

8.2 Project supplies provided by the GOA for the Project will be available for the unrestricted use of the Project and will not be withdrawn from that use without the consent of GOA.

8.3 Project supplies that, at the completion of the Project, remain in the Solomon Islands will be identified as such by mutual arrangement between the Implementing Agencies. Those items identified for repatriation will not be subject to duties, taxes or levies upon export.

8.4 In the event that duties, levies or taxes are applicable these will be paid by the GOSI.

9. Intellectual Property Rights

In accordance with Article 13 of the MOU and the cooperative nature of the Project, any Intellectual Property Rights (as defined in the MOU) developed through Project activities will be equitably apportioned by the participants to this Memorandum.

(a) Where such Intellectual Property is likely to be of substantial commercial value, the Designated Coordinating Authorities, and Implementing Agencies, where applicable, will enter into further Arrangement(s) providing for the equitable apportionment of profits royalties or licence fees relating to such Intellectual Property.

(b) Such an apportionment will be made taking into account the following factors:

- The intellectual contributions of each country;
- The financial contributions of each country;
- The contribution of intellectual property, materials, research effort and preparatory work of each country;
- The facilities provided by each country; and
- Such other relevant considerations as the Designated Cooperating Authorities may mutually determine.

10. Security

In accordance with Article 16 of the MOU, the GOSI will arrange for protective services necessary to ensure the safety of:

(a) the person and property of Australian Project personnel and their dependants; and

(b) Australian Project supplies.

11. Settlement of Differences

This Memorandum is not intended to create binding legal relations under international law for either participant. Consequently, any dispute or difference which arises out of the interpretation or application of this Memorandum will not be subject to adjudication or arbitration, but instead will be dealt with through amicable consultations and negotiations in accordance with Article 18 of the MOU as the sole method of achieving the peaceful settlement of that dispute or difference.

In the event of claims arising under this Memorandum, such will be dealt with in accordance with Article 15 of the MOU.

12. Amendments

This Memorandum may be amended at any time by an exchange of letters between the Designated Coordinating Authorities.

13. Duration of Memorandum

This Memorandum will take effect from the date of the last signature and the individual activities of the Project in the Solomon Islands will be deemed to have commenced

from that date. The Australian contribution to the Project and all the undertakings given herein will cease on 31 December 2024 or on such date as may subsequently be arranged in writing between the Designated Coordinating Authorities.

Signed by duly authorised representatives of their respective Governments, in duplicate, in the English language

FOR THE GOVERNMENT OF THE SOLOMON INSLANDS	FOR THE GOVERNMENT OF AUSTRALIA
Signature Ms. Ethel Frances Permanent Secretary	Signature Professor Andrew Campbell Chief Executive Officer
Name and Designation	Name and Designation
Date	Date

Signed by duly authorised representatives of their respective Governments, in duplicate, in the English language

FOR THE GOVERNMENT OF THE SOLOMON INSLANDS	FOR THE GOVERNMENT OF AUSTRALIA
Signature	Signature
Ms. Ethel Frances Permanent Secretary	Professor Andrew Campbell Chief Executive Officer
Name and Designation	Name and Designation
Date	Date

ANNEX I

PROJECT ARRANGEMENT

between Ministry of Agriculture and Livestock ("MAL"), Solomon Islands National University ("SINU") and Queensland Department of Agriculture and Fisheries ("DAF")
for
"Improving root crop resilience and biosecurity in Pacific Island Countries and Australia"

1. GENERAL

Recognising the Memorandum of Subsidiary Arrangement between the Australian Centre for International Agricultural Research ("ACIAR") and Ministry of Agriculture and Livestock ("MAL") as the Designated Coordinating Authorities for the Project ("the Memorandum"), this Project Arrangement details the responsibilities and contributions of the Implementing Agencies for the Project and specifies the coordinating arrangements between the Implementing Agencies and Designated Coordinating Authorities.

2. COORDINATION AND EVALUATION OF PROJECT

A Project coordination meeting will be held early in each year of operation. The designated project leader from DAF and program coordinator from MAL and SINU will attend these meetings, together with other Project personnel as appropriate.

ACIAR may at any time undertake evaluation and review studies of the Project.

The Implementing Agencies will provide financial, technical and such other information as may be required by ACIAR and will cooperate fully with any such study.

3. FINANCIAL ARRANGEMENTS

Payments to MAL and SINU by DAF will be made at six-monthly intervals from the date of project commencement in accordance with the Project Budget detailed in Attachment A to Annex I (Project Document). MAL and SINU will be required to provide to DAF a certified financial statement acquitting the advance.

The financial statement in Australian dollars acquitting the previous advance will set out the expenditure totals actually incurred under the five headings:

- Personnel;
- Supplies and Services;
- Travel;
- Infrastructure Costs; and
- Capital Items.

These statements will be certified by an authorised officer of MAL and SINU.

All remittances from Australia will be transmitted direct to MAL and SINU.

Financial reports from MAL and SINU will be submitted to DAF six-monthly from the date of project commencement.

4. PROJECT REPORTING ARRANGEMENTS

Progress reports on Project activities are required to be submitted to ACIAR annually.

The Implementing Agencies will consult on the content of such reports which should be the result of joint input. Each research team will sign and assume equal responsibility for the preparation and submission of the reports.

5. OWNERSHIP OF INTELLECTUAL PROPERTY RIGHTS

(a) The Implementing Agencies will treat, and will ensure their respective personnel (including officers, employees, servants, agents, contractors, and advisers) will treat, all commercially valuable know-how provided to it by the other in confidence, or derived or arising solely from the performance of the Project, as confidential and will not disclose such know-how without the prior written consent of the other Implementing Agency to anyone other than such persons having a need to know who will be required to take appropriate measures to safeguard such know-how. The phrase "persons having a need to know" will include officers, employees, and servants of MAL and SINU in which some or all intellectual property rights relating to that know-how may vest by virtue of the Memorandum and officers, employees, and servants of ACIAR. In this paragraph and all other provisions of this Project Arrangement the term "know-how" includes Intellectual Property as defined in Article 3 of the *Memorandum of Understanding between the Government of Australia and the Government of the Solomon Islands on Development Cooperation* (the "MOU"), which came into effect on 14 April 1994.

(b) In accordance with Article 13 of the MOU, and subject to Paragraph 9 of the Memorandum, the Implementing Agencies undertake that where Intellectual Property is created, derived or arises solely from performance of the Project, whether in Australia or in the Solomon Islands, the rights to the Intellectual Property in Australia vest in DAF and the rights to the Intellectual Property in the Solomon Islands vest in MAL and SINU, unless MAL and SINU otherwise directs ACIAR in writing that such rights to the Intellectual Property in the Solomon Islands will vest in DAF, in which case such rights vest in DAF.

(c) The Implementing Agencies undertake that each will ensure that any arrangements or agreements it enters into with any other person or body relating to the Project delivery give legal effect to the above and is consistent with all other relevant provisions of this Project Arrangement and the Memorandum. The rights to use all such Intellectual Property in other countries derived or arising from the performance of the Project will be apportioned according to the equitable criteria defined in Paragraph 9 of the Memorandum, unless otherwise mutually determined in writing by the Implementing Agencies and the Designated Coordinating Authorities, and all costs relating to the application for, and maintenance of, such rights will be borne by the relevant owner. Such apportionment determinations will be the subject of a separate instrument(s) to this Project Arrangement.

(d) Notwithstanding the above paragraphs each of the participants will have the right without the requirements of consent of the other participant, to utilise all know-how derived or arising solely from the performance of the Project for their own in-house purposes within their respective countries and, unless Intellectual Property rights relating to that know-how are similar to that

provided in paragraph 5(b) above, where a Designated Coordinating Authority in the country of the participant owns or controls relevant Intellectual Property rights, that Authority will have the right to licence use of such know-how within the country provided an undertaking of confidence is imposed on the end-user of know-how similar to that provided in paragraph 5(a).

(e) The Implementing Agencies, with the concurrence, where relevant, of the Designated Coordinating Authorities, may, at any time mutually determine in writing to make public any commercially valuable know-how provided to it by the other, or derived or arising solely from the performance of this Project Arrangement or the Memorandum and which is subject to an undertaking of confidence. All other Intellectual Property which is derived or arises solely from the performance of the Project and is related to that know-how will in so far as it continues to subsist, be owned and apportioned in accordance with paragraph 9 of the Memorandum.

(f) Notwithstanding anything to the contrary above, the Designated Coordinating Authorities, and the Implementing Agencies will each have the right to inform third parties of the general nature of any discovery, patentable invention, industrial design or commercially valuable know-how which is derived or arises solely from the performance of the Project to enable a third party to decide whether to approach the owner of those rights for further know-how and/or appropriate licensing or other arrangements.

(g) The Designated Coordinating Authorities encourage the publication of articles or papers of an academic, scientific, or technical nature intended for learned journals. However, where any article or paper of an academic, scientific or technical nature is written relating to the Project, by any officers, employees, servants or agents of the Implementing Agencies, such publication should acknowledge the support provided by the Designated Coordinating Authorities to the Project. The Implementing Agencies acknowledge that each will be responsible in these circumstances, consistent with each other, for determining the extent to which such articles or papers may contain and reveal details of Intellectual Property including commercially valuable know-how derived or arising solely from the Project.

(h) The Implementing Agencies will inform each other in writing as soon as practicable and no later than immediately prior to the commencement of the Project activities under the Memorandum of all existing Intellectual Property rights owned by the third parties which are proposed to be utilised in the Project and any limitation on the use thereof which relates to any other obligation under this Project Arrangement or the Memorandum or to the utilisation of the results of the Project.

6. TERMINATION

It is understood that should circumstances beyond the control of either MAL, SINU or DAF render this Project Arrangement inoperative it will lapse three (3) months after written notice has been given by either MAL, SINU or DAF.

In the event the Project lapses in accordance with the last preceding paragraph, DAF will accept responsibility within the financial limitation of the Project, for work done, expenses incurred and commitments made to the date of the lapsing and will accept, as

part of the acquittance of funds provided, or a claim for reimbursements, the reasonable costs and expenses incurred by MAL and SINU arising from the termination.

7. CORRESPONDENCE

All formal correspondence relating to this Project Arrangement should be addressed as follows:

For ACIAR:

Chief Executive Officer
Australian Centre for International Agricultural Research
GPO Box 1571
Canberra ACT 2601
AUSTRALIA

For DAF:

Director General
Queensland Department of Agriculture and Fisheries
GPO Box 46
Brisbane QLD 4001
AUSTRALIA

For MAL:

Permanent Secretary
Ministry of Agriculture and Livestock
P.O BOX G13, Honiara
Solomon Islands

For SINU:

Vice Chancellor
Solomon Islands National University
Kukum Highway
Honiara
Solomon Islands

The undersigned being duly authorised, have signed this Project Arrangement.

FOR THE MINISTRY OF AGRICULTURE AND LIVESTOCK

Signature

Ms. Ethel Frances
Name

Permanent Secretary
Title

25/8/22
Date

FOR THE FOR THE QUEENSLAND DEPARTMENT OF AGRICULTURE AND FISHERIES

Signature

Bernadette Ditchfield
Name

Deputy Director-General
Title

Date

SOLOMON ISLANDS NATIONAL UNIVERSITY

Signature

Dr Jack Maebuta
Name

Acting Vice Chancellor
Title

Date

The undersigned being duly authorised, have signed this Project Arrangement.

FOR THE MINISTRY OF AGRICULTURE AND LIVESTOCK
Signature
Ms. Ethel Frances
Name
Permanent Secretary
Title
Date

FOR THE FOR THE QUEENSLAND DEPARTMENT OF AGRICULTURE AND FISHERIES
Bernadette Ditchfield Bernadette Ditchfield (Jun 17, 2022 10:00 GMT+10)
Signature
Bernadette Ditchfield
Name
Deputy Director-General
Title
Jun 17, 2022
Date

SOLOMON ISLANDS NATIONAL UNIVERSITY
Signature
Dr Jack Maebuta
Name
Acting Vice Chancellor
Title
Date

The undersigned being duly authorised, have signed this Project Arrangement.

FOR THE MINISTRY OF AGRICULTURE AND LIVESTOCK
Signature
Ms. Ethel Frances
Name
Permanent Secretary
Title
Date

FOR THE FOR THE QUEENSLAND DEPARTMENT OF AGRICULTURE AND FISHERIES
Signature
Bernadette Ditchfield
Name
Deputy Director-General
Title
Date

SOLOMON ISLANDS NATIONAL UNIVERSITY
Signature
Dr Jack Maebuta
Name
Acting Vice Chancellor
Title
08/07/2022
Date

SOLOMON ISLANDS NATIONAL UNIVERSITY
Office of the Vice Chancellor
SOLOMON ISLANDS

Attachment A to
Annex I

Project Document

Attachment A to Annex 1 – comprise the Full Project Proposal and the Project Budget (collectively Project Document).

Australian Government

Australian Centre for International Agricultural Research

Full Project Proposal

ACIAR Program(s) area	HORT
Project Title	Improving root crop resilience and biosecurity in Pacific Island Countries and Australia
Project Number	HORT/2018/195
prepared by	Julie O'Halloran
ACIAR Research Program Manager	Irene Kernot

Version – 23 July 2020

Privacy statement

ACIAR, as an Australian Government agency, is required to comply with the thirteen Australian Privacy Principles set out in Schedule 1 of the *Privacy Act 1988*.

The personal information provided in this project proposal is stored in electronic format by ACIAR. The information is reproduced internally for the purpose of meetings to consider project proposals and the names, contact details and curricula vitae (CVs) of all project members included in this proposal may be shared with external project reviewers as part of the project development cycle. It also forms part of the contract documentation exchanged with the Commissioned Organisation, collaborating organisation(s) and partner-country government(s).

The names and contact details of Project Leaders may be listed with project details on the ACIAR website, provided to other databases and media in the context of briefings and publicity on the ACIAR project portfolio, and used for mail-outs of ACIAR corporate publications.

ACIAR endeavors to keep this information as up-to-date as possible, with the assistance of the individuals whose details are recorded.

ACIAR does not divulge any other personal information to third parties for any other purpose.

Summary Information

Version # and date of this document	*Version 9 – 22 December 2021*
Project number	*HORT/2018/195*
Full project title	*Improving root crop resilience and biosecurity in Pacific Island Countries and Australia*
Budget ($)	*$2,050,000*
Commissioned Organisation	*Queensland Department of Agriculture and Fisheries*
Project Leader	*Dr Julie O'Halloran*
Country 1 Coordinator	*Dr Amit Sukal*
Proposed start date	*01 January 2022*
Proposed end date	*31 December 2024*

ASPG	Australian Sweetpotato Growers Inc.
AusAID	Australian Government overseas aid program
CGIAR	Consultative Group of International Agricultural Research
CIP	International Potato Centre
DAF	Department of Agriculture and Fisheries, Queensland
FAO	Food and Agricultural Organization of the United Nations
ICCON	In-Country Communication Officer Network
KGA	Kastom Gaden Association
LAMP	Loop-mediated isothermal amplification
LSU	Louisiana State University
MAF	Ministry of Agriculture and Fisheries (Samoa)
MAFF	Ministry of Agriculture, Food and Forests (Tonga)
MAL	Ministry of Agriculture and Livestock (Solomon Islands)
MoA	Ministry of Agriculture (Fiji)
NAQS	Northern Australia quarantine strategy
NGO	Non-government organisation
PCR	Polymerase Chain Reaction
PIC	Pacific Island Countries
PIFON	Pacific Islands Farmer Organisation Network
PNG	Papua New Guinea
PRA	Participatory rural appraisal
PT	Pathogen-tested
qPCR	Quantitative polymerase chain reaction (real-time PCR)
R&D	Research and development
SINU	Solomon Islands National University

SPC	The Pacific Community
SPC-CePaCT	The Pacific Community - Centre for Pacific Crops and Trees
SROS	Scientific Research Organisation of Samoa
UQ	University of Queensland

Contents

1. Project Justification

1.1 Project Aim

The project will improve sweetpotato planting material (pathogen tested) and planting practices as part of a broader program for resilient root cropping systems outlined in Table 1, responsive to the challenges of pests and diseases and climate change.

1.2 Development Issue and Research Opportunity

The development issue

Agriculture provides livelihoods for 67% of the Pacific region population. Root crops are key staples in PICs with annual consumption exceeding 225 kg per capita (Chandra 2015). The development of resilient food systems is a key priority for the Pacific region (ACIAR, 2019) to address specific challenges and opportunities:

- *Extreme weather:* With a prevalence for extreme weather events and natural disasters, agriculture is important for PIC food and nutritional security (Balakrishnan 2005). The characteristics of sweetpotatoes make them an important crop in disaster preparation strategies (McNamara and Prasad 2014, Campbell 2015).
- *Malnutrition:* Raw and dehydrated sweetpotato has a low glycemic index (Allen et al. 2012), an excellent source of beta-carotene, vitamin C, dietary fibre and essential minerals. With vitamin A deficiency, endemic malnutrition and non-communicable nutrition related diseases and disorders (diabetes, obesity, hypertension and heart disease) throughout PICs, sweetpotato is promoted as a crop of high nutritional value (UNICEF 2008, Barker et al. 2009, Lyons et al. 2014, Ministry of Health and Medical Services, 2014, Martyn et al. 2017).
- *Food security:* Sweetpotatoes have greater tolerance to changing weather extremes, more resilient in drier conditions and under wetter conditions if well drained, than other vegetables (Hahn 1977, Iese et al. 2018). With traditional crops (taro and yam) under threat due to pest and disease, sweetpotato has the potential to increase substantially, underpinning taro and rivalling cassava as a dominant staple in PICs.

Widely grown in PNG, Solomon Islands and Vanuatu, sweetpotato is increasing in popularity in other Pacific countries. Between 2009 and 2014, FAO noted a 61% increase in production in Fiji, 7% in Solomon Islands and 5% in Tonga (FAO, 2014, FAOSTAT, 2019). Sweetpotato is identified by all PICs as necessary in food nutritional security and disaster reduction strategies (Iese et al. 2018). Rapid production of planting material (new vines every three weeks), ease of planting, early maturity relative to other root crops (3-4 months) and high nutritious yields make it an ideal option in disaster recovery.

However, current PIC sweetpotato yields are low compared to developed countries and have been declining in recent years. Farmers do not have access to ‘clean’ (pathogen-free) planting material, so rely on re-using the same material for decades (Furlong et al. 2019) with accumulating pathogen loads. Worse, when planting material is required in large

amounts following natural disasters under government assistance schemes to help farmers back into food production, quality cuttings are not available.

The research opportunity

Furlong et al. (2019) highlighted that unclean planting material and poor propagation practices were impacting on yields by at least 50%. The provision of pathogen tested material and improved propagation and planting practices such as 'seed bed' technologies as used in the Australian sweetpotato industry were recommendations in this report. While agronomic practices in sweetpotato production are sub-optimal, addressing these is unlikely to realise significant benefits to production systems unless the quality of planting material (i.e. pathogen tested) and planting practices are improved. Seedbed technologies is a system to optimize propagation for multiplication and so would be relevant for any developing PT scheme. Additionally, sufficient tip material (preferred planting material) is generally not available in PICs as traditionally farmers rely on back-cuttings for planting material and will try to utilise all plant material even that of poorer vigour. Seedbed technologies could ensure supplies of tip material for planting (Furlong et al 2019) and when in an area with good drainage are also resilient post natural disasters.

None of the project partner countries have established pathogen-tested (PT) schemes, which have shown up to 30 t/ha increases in yield in Australia and 25-70% in PNG, with additional benefits of earlier maturity and improved root shape (pers. comm. Eric Coleman, ASPG, 2019, Hughes et al. 2020). Samoa currently has some PT material that has been distributed to sweetpotato farmers but the protocol for PT, process for resupply and information on reinfection rates is not clear. Developing PT material for key varieties in each PIC as well as varieties of importance for emerging markets e.g. processing and value adding is the first step towards a PT scheme for sweetpotato farmers to access clean planting material. This project will build capacity for PT systems by developing PT material. It will also build on the survey and trial work reported by Furlong et. al 2019 on improving planting practices and methods as well as previous investment in PNG which also focused on planting practices including selection of planting material, length of cutting, depth of planting.

This project is based on the experiences in PNG which commenced with development of PT material and building awareness through field trials and farmer awareness. This project will also outline options for multiplication and distribution systems for PT material (based on Fiji as a model country) based on an understanding of sweetpotato marketing and supply chains in PICs. However, the implementation of these distribution systems in each PIC will require further investment. This system will need to be responsive to rapidly deploy new planting material following natural disasters to ensure food security and the concept models developed through this project will provide options to achieve this. Sweetpotato has already been recognised as a food security and disaster reduction crop in the PIC's (Iese et al. 2018). Since 2003 there have been 13 Category 5 and 14 Category 4 cyclones affecting PIC's. Increased yields and faster maturity (up to two weeks) with PT material will be critical when other food crops have been damaged or destroyed.

Henderson and Dennien (2018) assessed a range of Australian sweetpotato planting practices including bedding root specifications (size, age, and storage), plant bed height, depth of soil coverage, sprout harvesting, collectively referred to as seedbed technology. Aimed at multiplication of planting material, with optimized practices, sprout multiplication

could be improved by 25% in Australian systems. Use of seedbed technologies to improve sprout multiplication in any PT scheme would also require research and development to adapt for PICs. This seed bed technology system will be introduced through demonstration at SPC-CePaCT in later years of the project as a system for multiplication to supply field trials and future multiplication/distribution systems.

Accurate detection of virus presence in sweetpotato plants is complicated by a range of factors. Although sweetpotato viruses affect root development leading to economic losses, above ground, there can be little visual evidence of infection. If present, symptoms of virus infection can be difficult to distinguish from those caused by environmental and abiotic stresses. Symptom expression can vary depending on cultivar, virus strain and virus co-infections. Viruses can be present in sweetpotato plants at very low levels, but titres can change depending on external influences and host plant - virus interactions. Previous research in the USA, and at the CIP, identified low levels of accuracy when sweetpotato plant tissue was used in serological and conventional PCR assays. Some viruses are thought to be integrated into the large sweetpotato genome.

For these reasons, the USA (Clark NCPN), CIP (Love 1987), Australia (Dennien *et al* 2013) and more recently PNG, PT seed schemes rely on a range of diagnostic techniques for accurate plant health determination. This includes the use of herbaceous indicator plants, as a basis for downstream serology and molecular testing. Indicator plants are extremely sensitive to sweetpotato viruses and provide an ideal environment for rapid virus titre increases and readily express foliar virus symptoms. This facilitates increased levels of accuracy in determining plant health status via downstream diagnostics and provides a platform for confirmatory visual detection. Hence viruses present at low levels in sweetpotato plants, those involved in synergistic reactions, co-infections, host plant interactions, changing titres, and those not producing foliar symptoms on sweetpotato plants are all able to be detected via the use of indicator plants.

In 2014 in an attempt to speed up the PT process, the Australian sweetpotato PT scheme based at DAF Gatton Research Facility in Qld included routine qPCR testing to complement the use of herbaceous indicator plants. qPCR is more sensitive and thus more accurate than conventional PCR in detecting viruses present in low titres (Clark *et al 2012*). To date, correlation of results from known positive plants against the standard testing regime has shown high levels of accuracy (Dennien 2018) for some DNA viruses such as SPLCV. qPCR provided confirmatory results for the PT scheme and increased efficiencies in relation to grower enquires on seedbed health status with results provided within 24 hours without the need for lengthy indicator plant assays.

However, this was not the case for some RNA viruses such as the globally distributed SPFMV, where qPCR results displayed considerably lower levels of accuracy. Pan, (1996) suggests that SPFMV virus particle distribution varies within plants. This may also be further influenced by virus co-infections. Further investigation by DAF revealed that molecular tests qPCR and LAMP, using tissue from known SPFMV infected sweetpotato plants produced positive results from leaves with visual symptoms and negative results from symptomless leaves situated 80mm away on the same vine (pers. comm. S. Dennien, DAF 2021). Multiple sweetpotato tissue samples from the same plant sent to NSW laboratories for ELISA testing in 2017, resulted in both positive and negative results depending on the where on the plant the sample originated. Experiments conducted at GRF to evaluate the efficacy and accuracy

of LAMP and qPCR compared to traditional virus diagnostic procedures also indicates varying levels of accuracy in molecular SPFMV assays based on sweetpotato plant tissue.

Table 1. Broader resilient root crop system framework for the Pacific Islands

Resilient Root Crop systems in the Pacific Islands

Phase 1 – 3 years	Phase 2*	Long term outcomes
Clean planting material development Clean material of farmer varieties accessible for all PICs Trials and demonstrations of PT material and improved planting practices Extension program to promote PT and improved planting practices Value proposition of PT and improved planting practices Concept/model multiplication/distribution systems including upscaling for post disaster recovery	Establishment of pilot multiplication/distribution system for root crop planting material in PICs (including PT sweetpotato and taro, yam pest/disease resistant material) Agronomic management for multiplication systems e.g., seedbed technologies, screenhouse management. Ongoing PT/planting practice extension program Disaster recovery concepts tested Virus reinfection in field assessed in PT field trials established in Phase 1 Commercial/community root crop planting material multiplication/distribution systems (including PT sweetpotato and taro, yam pest/disease resistant material) Agronomic management of sweetpotato farming systems including soils, pests, diseases, water and rotations trials and extension program Assess impact of PT system, planting practices and agronomic management improvements	Multiplication and distribution systems for root crop plant material facilitating farmer access in all PICs. Post disaster recovery upscaling and distribution of sweetpotato planting material contributes to improved food security in PICs Benefits of PT sweetpotato and resistant yam and taro planting material and improve root crop agronomic management realised through improved livelihoods for PIC farmers **More resilient root crop systems**
Foundational activities		
Survey based on semi structured interviews with sweetpotato farmers Scoping study of PIC infrastructure and supply chains to inform multiplication/distribution system	Family Farms teams and gender strategy to underpin project activities, specifically improved agronomic practices and business management	

* Indicates potential activities for a next phase of investment as part of a broader resilient root crop system. Timeframes and activities to be determined by outcomes from the proposed Phase 1 and stakeholder support.

1.3 Partner country and Australian research and development priorities

Within the Pacific region, food and nutritional security are priorities for all countries. A prevalence of natural disasters and the need to mitigate climate change impacts has necessitated a focus on food systems resilience. Additionally, livelihood security is an increasing priority for economic development within the region (ACIAR 2020).

Consultation with project partners in each PIC has identified sweetpotato as a priority crop and this is reflected in their participation in the project. Root crops are a source of export earnings (Fiji 2015 –AUD$12.8M; Samoa 2016 –AUD$1.9M). Increased sweetpotato production and quality from PT material and more suitable varieties would provide opportunities in this sector. PIC government's strategic plans emphasise the necessity for food and nutritional security and enhanced R&D capacity, (Fiji's 5-year Development Plan (2017-2021), Agricultural Sector Plans 2016-2020 (Samoa and Tonga) and Solomon Island agricultural goals to 'improve food security' and 'improve rural livelihoods'). The most efficient way to increase production and commercialisation of staples is the adoption of superior varieties and production systems, a key goal for the region (Bourke et al 2006, Saber 2020).

The differences in status of sweetpotato production in each PIC has meant that activities in each country will have a slightly different focus, reflecting varying issues and priorities. Based on discussions with PIC project partners, the following summarises priorities for sweetpotato production in each country. These priorities will be considered in selection of varieties for PT development but will also be used in the development of the broader resilient root crop systems program. In all cases both subsistence and commercial/semi-commercial farmers are key stakeholders to target for demonstration trials and communication events. Targeting commercial farmers was successful in PNG, however, the scale of what is considered 'commercial' operations is not necessarily the same between PNG and the PIC's. Improving livelihoods of subsistence farmers is a key priority for ACIAR so this demographic must also be a focus for field trials, particularly in regions where commercial operations may be limited.

- *Samoa* – Sweetpotato is not historically a key crop in Samoa, however, current production does not meet market demand, so Samoa is focused on increasing the production of sweetpotato through more farmers, more area of production and improved yield. It is possible that the survey process will also identify barriers to why more farmers are not currently growing sweetpotato. Samoa has some PT varieties and requires a focus on both subsistence and developing semi-commercial sweetpotato farmers. Multiple PT varieties will also be needed to reflect fit for purpose for fresh and developing processing/value adding sectors.
- *Tonga* – Sweetpotato is the third most important root crop after cassava and Xanthosoma, commonly marketed locally and also overseas. Ministry of Agriculture, Forestry, Food and Fisheries is keen to diversify production from fresh sales into processed products and has researched noodle manufacture in recent years. Review of varieties for PT will consider processing varieties.
- *Fiji* – Some key varieties have already been identified but PT of these is still required. There has also been a focus on developing commercial sweetpotato production with

some community groups for processing and value adding by the Ministry of Agriculture. In using Fiji as a model for a clean seed system, greater understanding of how sweetpotato is currently marketed and the supply chain will be required and obtained through the survey process. This will be combined with scoping of in country resources and infrastructure to develop concept multiplication and distribution systems.

- *Solomon Islands* – Sweetpotato is a very significant crop in the country and unlike other root crops, people rely on continuity of supply of sweetpotato for food security. The Ministry has been working to develop commercial sweetpotato and cassava production with farmers on Guadalcanal so both subsistence and commercial sweetpotato growers are a priority for the Ministry of Agriculture and Livestock through this project. Increasing rainfall in Solomon Islands has highlighted that with heavy rainfall sweetpotato can be tuberless. This is a significant risk for food security given the reliance on sweetpotato in Solomon Islands and this project will also consider varieties that may be more tolerant of wet conditions and still maintain productivity. Understanding these farming systems further through the survey could also inform future work through the broader resilient root crop systems program, e.g. drainage systems.

As we increasingly move towards molecular techniques and commercial entities request more rapid, cost effective virus testing processes as part of PT schemes, refined sampling methods could ensure the accuracy of molecular techniques to detect sweetpotato viruses directly from sweetpotato plants. DAF will conduct replicated glasshouse trials to determine if the sampling protocol for SPFMV can be improved. Decreased timeframe to provide accurate SPFMV results will enhance PT scheme efficiencies including in PNG and PICs. A large range of virus-infected plants are held at Gatton Research Station as positive controls for the sweet potato pathogen testing program. Knowledge of the viral sequence of these Australian isolates enhances development of molecular diagnostic assays and confidence in their use.

Sweetpotato is a significant industry in Australia currently valued at $100 million. The success of the Australian sweetpotato scheme is dependent on capacity to continue to identify viral incursions. Field surveys of Australian sweetpotato crops will monitor for any new viral incursions. This field surveillance will target gaps in the existing field surveillance conducted by NAQS. As viral infections of sweetpotato are often without visible symptoms, this monitoring through field surveys is the only way of detecting new incursions. Novel viruses have been identified in Australian sweetpotato through this process in previous projects (Henderson and Dennien 2018). The field survey work will also include monitoring for high priority pests of sweetpotato (as per the Sweetpotato biosecurity plan) as well as pests of high priority which can be hosted by sweetpotato to link with Biosecurity Queensland's surveillance program and high priority pests identified by Plant Health Australia.

Identification of virus through PT of sweetpotato material from PICs is also beneficial to highlight potential biosecurity threats (for both PICs and Australia) and inform protocols to minimise incursions or manage breaches and develop standardised diagnostic protocols for the Pacific region.

This project will also continue to improve viral diagnostics skills both in Australia and the PICs. The project will combine herbaceous indexing with *Ipomoea setosa* and molecular

techniques for viral diagnostics as used by agencies throughout the world. Reciprocal workshops in these techniques, to be conducted through the project, will ensure consistency in protocols across the Pacific region and with new staff employed through the project at SPC-CePaCT will build capacity for project activities. This is particularly important as there are limited training opportunities for viral diagnostic techniques within the Pacific Islands (pers. comm. Dr Amit Sukal, 2021).

1.4 Relationship to other ACIAR investments and other donor activities

Numerous projects that complement this proposed project have been completed or are still ongoing. Previous investments (SMCN2004/071, PC2010/026, PC2005/134, PC2006/106, PC2011/053, HORT2010/65*)* have focused on pest and disease reduction in sweetpotato and specifically PT development and adoption in PNG. This project has considered learnings from these projects in developing project activities for Fiji, Solomon Islands, Samoa and Tonga. Details of how this proposed work relates to and complements these other programs is summarised below.

Table 2. Linkages to ongoing and past R&D investment

Project	***Key focus***	***Linkage with proposed project***
SLAM/2020/139 Pacific Soil Portal, CROP/2020/186 Conservation Agriculture in the Pacific	Projects still in development in PICs on sustainable intensification and soil health	Identify opportunities for sharing of information and co-location of field sites as well as shared communication products.
HORT2016/185 ACIAR	Ongoing project in PICs on emerging pests and diseases	Linkage through the projects existing advisory group and possibly through joint events and project updates as coordinated by project leaders. This project also involves an online pest and disease platform which the proposed project will be able to contribute to in respect to photos of pest/disease from surveys and communication products.
HORT2014/097 ACIAR	Ongoing project in PNG to develop market-oriented value chains and increase capacity for production and distribution of planting material. Use of LAMP viral diagnostics and optimisation of seedbed performance for clean	The proposed project will increase SPC-CePaCT capacity in this methodology through provision of LAMP equipment. Learnings in developing production and distribution of PT material could be applied to partner PICs in future development of a distribution system through commercial growers.

	planting material is also a focus.	Guidelines /standards for the PNG clean material scheme can be adapted to other PICs as their multiplication and distribution sites develop.
PT17001 Hort Innovation	Ongoing project to extend existing knowledge and develop new knowledge on soil health and nematode management in sweetpotatoes with a focus on agronomic and farming system aspects.	This project could adapt key findings from PT17001 to PIC sweetpotato production and share communication material.
HORT2010/65 ACIAR	This project has reported survey data on key varieties in each PIC and potential pest and disease impacts on production. The combination of low-quality planting material and poor planting practices likely significantly contributes to yield reductions (at least 50%) in PICs. A recommendation from this project was that 'seed bed' technologies as used in Australia could be a management option to improve the current planting practices.	The proposed project will consider these survey results in PIC variety selection for PT and those sweetpotato practices captured through the survey. Field trials established in each PIC through the proposed project will also include planting practices as well as PT material.
VG13004 Hort Innovation	This project continued development of 'seed bed' production systems in Australian sweetpotato production systems.	Knowledge from this project will be used to establish a demonstration of 'seed bed' propagation systems at SPC-CePaCT.
PC2011/053 ACIAR	The advantages from PT material were increasingly recognised throughout this project in PNG and a PT scheme recommended to be initiated in PNG. The project also recommended an AWM strategy as the most suitable option for weevils in sweetpotato.	The proposed project will build on this work with PT material development in Fiji, Tonga, Samoa and Solomon Islands. Weevil management recommendations could also be used within PICs as part of the communication materials packaged up for each PIC.

PC2010/026 ACIAR	PT material out-yielded non-PT material by 52% and 66%. Virus reinfection immediate but does not translate immediately into yield decline. Build on this work with PT material development in Fiji, Tonga, Samoa and Solomon Islands.	Build on this work with PT material development in Fiji, Tonga, Samoa and Solomon Islands.
PC2005/134 ACIAR	This project developed PT material for the most popular commercial/subsistence varieties at this time. PT material developed for varieties from SI and PNG (cleaned varieties were sent back to SI (2 varieties) and the remaining 12 or so were sent to Fiji but not yet cleaned).	As part of this project the status of these PT and non-PT varieties will be reviewed and cleaned through this project if still the most popular varieties.
SMCN2004/071 ACIAR	This project developed PT material in PNG and Australia including the discovery of new viruses. The project also identified tools for weevil IPM programs.	Learnings from PT scheme development will be built on in developing the Fiji model and learnings from weevil IPM considered for individual PICs in any communication products.
PC2006/106 ACIAR	This project assessed local varieties in Solomon Islands and PNG for b-carotene, in particular orange-flesh sweetpotato for improved vitamin A nutrition.	High b-carotene containing varieties will be considered when selecting varieties for PT.

2. Project Outcomes

2.1 Expected project outcomes

This project continues to build on existing research, by addressing recommendations to investigate yield penalties from poor planting material and planting practices reported by Furlong et al. (2019). The primary outcomes of this project are to develop pathogen tested clean sweetpotato material and increase awareness and adoption of PT planting material

and practices such as selection, planting and propagation. Field trials of PT material and planting practices will be targeted at smallholder and semi/commercial sweetpotato farmers. With access to, and adoption of PT planting material, this will contribute immediately to smallholder and commercial farmers. This could be through more product surplus to household requirements and increased income or alternatively a reduction in the area of sweetpotato grown to achieve the same quantity with opportunities for other crop rotations. The project will build pathogen diagnostic capability for both the Australian sweetpotato industry and SPC-CePaCT through trials to refine sweetpotato sampling protocols, reciprocal workshops and continued collaborative efforts to build the relationship between DAF and SPC-CePaCT. Potential biosecurity threats identified for both Australia's and PICs sweetpotato industries will also be reported to relative biosecurity agencies.

2.1.1 Scientific Achievements

The project will achieve the following scientific achievements.

- Improved knowledge of sweetpotato viruses in Samoa, Tonga, Solomon Islands and Fiji (through the PT process) to inform potential biosecurity threats (to both Australia and PICs). This will include development of assays for novel virus detections so that they can be made available for quarantine agencies.
- Improved viral diagnostic techniques (sampling protocols, phytosanitary procedures for germplasm transfers, primer development and molecular diagnostics) that will contribute to standardised protocols across the Pacific region (Australia and PICs) e.g., development of LAMP primers for SPFMV based on analysis of sequence data from positive controls from DAF sweetpotato collections and the Pacific.
- PT material developed for key varieties from each PIC with quantification of benefits in yield, quality, and maturity to be used as the basis of an industry development and extension strategy.
- Options for a PT scheme in the Pacific (Fiji) so that a PT multiplication and distribution system can be responsive for post disaster access to PT material, informed through understanding of the sweetpotato supply chain and its participants. A Fiji model PT sweetpotato seed scheme has the potential for further adaptation and/or modification as options for other PICs.
- Quantitative comparison of standard planting practices with optimised planting practices combined with understanding of socio-cultural, gender and non-economic values will inform communication material and promotion of these practices more broadly to sweetpotato farmers through an extension strategy. The value proposition for clean sweetpotato planting material and improved planting practices will provide decision support for risk management and return on labour unit investment in sweetpotato farming.
- Knowledge of gender roles in sweetpotato production and marketing, social and cultural insights into sweetpotato markets and supply chains and clarification of drivers and barriers to sweetpotato production in PICs enabling development of strategies to address them.

2.1.2 Capacity Built

The following outlines areas of enhanced capacity developed through the project.

Individuals

- *Sweetpotato farmers:* Smallholders and semi/commercial sweetpotato growers engaged through the project will have capacity to implement better sweetpotato planting practices including selection of planting material, length, depth of placement. These stakeholders will be engaged through the project survey process, as co-operators for field trial or demonstration sites, attendees at farmer updates and communication events and through distribution of communication products/case studies. It is likely that this capacity building will be at the individual, village and/or farmer network level depending on project partner networks and the range of communication activities implemented through the project. PIC growers participating in the Australian sweetpotato farm tour will be able to transfer and implement relevant elements within their farms through a farmer to farmer learning process.
- *DAF and SPC-CePaCT staff:* Technical skills workshops will contribute to standardising diagnostic protocols and professional development for both DAF and SPC-CePaCT staff in molecular and herbaceous indexing techniques, respectively. The capacity for LAMP diagnostics at SPC-CePaCT will be achieved through the purchase of LAMP equipment. This technique can then be used in the viral diagnostic and removal work involved in developing PT sweetpotato material. This process was successful in previous projects in PNG for identifying gaps and inconsistencies in protocol methodologies between Australia and PNG and also developing project staff networks.
- *PIC field staff:* Ministry and NGO field officer staff will have developed capacity in improved sweetpotato planting practices. They can then further extend this knowledge to other sweetpotato farmers through future interactions and events beyond the project.

Organisations

- *SPC-CePaCT:* Further developing SPC-CePaCT's viral diagnostic capability will allow for continued provision of PT clean sweetpotato material based on standardised protocols. These skills could also be applied to other root crops to provide clean planting material. CePaCT will also have capacity for multiplication of PT sweetpotato material through screenhouse infrastructure at SPC-CePaCT in Fiji. This could be used beyond the project as a source of PT material for further multiplication and distribution in PICs.
- *Ministry's and NGO's:* Organisations in the PICs (Ministry's, NGO's Universities) recognise the value of PT sweetpotato material. PICs are also working to develop semi-commercial and commercial sweetpotato farming as well as processing and value adding opportunities. With further development of these sectors and different varietal characteristics for processing and value adding, key varieties will continue to evolve and the capacity to develop PT material as this happens will be beneficial. Consultation with project partners in the development of this project has also highlighted recognition that planting practices for PIC sweetpotato could also be improved. The communication resources and staff training in these practices through

the project will confer capacity for these organisations to continue to develop farmer skills in these areas beyond the project.
The capacity and infrastructure to produce clean sweetpotato material will initially rely on screenhouse infrastructure at SPC-CePaCT and seedbed technologies to supply initial field trials and demonstration sites. The project will propose a concept clean sweetpotato seed scheme for Fiji based on existing and developing value chain participants. This will include options for rapid upscaling following natural disasters. The Fiji model could then be assessed for feasibility in other PICs and modified or adapted according to the operational environment in these countries. The establishment of the multiplication and distribution system in countries will form the next step in the broader resilient root crop system program to also incorporate other root crop planting material such as resistant taro, yam and cassava planting material. Greater knowledge and understanding of existing pest and disease complexes in the PIC's will inform biosecurity threat risk management strategies and enable pre-emptive action to minimise border breaches or containment/eradication for both Australia and PIC's i.e., development of assays any novel viruses.

Networks

- The project will build on existing collaborative relationships with SPC-CePaCT and further develop those with PIC Ministry's and NGO's. Closer networks and relationships with these organisations (Ministry's, NGO's and University) will facilitate sharing of germplasm, research information and future collaborations as well as capitalising on the in-country networks these organisations have with sweetpotato farmers and farmer networks.
- Linking with existing farmer networks as a means for farmers to learn of improved planting practices also highlights the value of the network to the individuals within it. This also highlights the value of collaborating with PIC project partners that routinely work with these organisations.
- The farmer tour of Australian sweetpotato farms will also forge networks between PIC and Australian sweetpotato farmers.

2.1.3 Innovation Enabled

Immediate innovations enabled through the project include:

- Adoption of clean sweetpotato planting material and improved planting practices (length of vine, depth of planting, selection of planting material) should result in a greater product surplus for cash sales after domestic consumption has been met and therefore increased income of farmers with improved return on labour inputs. PT sweetpotato planting material has increased yields by 25-70% in PNG and 30t/ha in Australia. Initial field trials through HORT2010/65 indicated that yield could be reduced by more than 50% with poor planting and propagation practices. Improving income is likely to have flow on benefits through investment of additional income in other agricultural production areas e.g., livestock or through greater disposable income extending these benefits to other areas of the community.
- With an appropriate multiplication and distribution system then farmer access to sweetpotato PT material would also be improved facilitating increased adoption of PT material and more regular updating of planting material. A costed 'model' clean seed system for Fiji could also be modified and adapted for other PICs. The

establishment of these systems could then incorporate a process for rapid scaling up following natural disasters to provide a responsive supply of planting material.

- Refined protocols for virus detections in Australia and PICs and identification of novel virus records. This will contribute to standardised protocols across the Pacific region and work towards agreed national/international standards as well as more accurate diagnostics to support biosecurity responses.
- With improved quality of planting material and planting practices in sweetpotato farming in PICs then further work on agronomic practices would be beneficial. While planting material and planting practices are significantly limiting yield any focus on agronomic practices is unlikely to achieve significant benefits to farmers.

2.2 Impacts beyond the life of the project

This project is one component in a program of work aimed at developing resilient root crop systems in the Pacific region (Table 1). This project will establish baseline knowledge of sweetpotato farming systems and supply chains in the PICs (from surveys) and an economic rationale for PT planting material and associated multiplication and distribution systems. Other project activities will focus on facilitating widespread awareness and stakeholder acceptance of PT planting material and improved planting practices.

Project activities and outputs detailed in Section 3 will facilitate a range of project outcomes associated with changes in awareness, knowledge and ultimately practices. Achieving these outcomes will be dependent on adoption of the planting practices and PT technology demonstrated through this project as well as support and development of PT seed systems from individual PICs. The theory of change for this project is depicted in Figure 2.

Table 3. Theory of change

		Description	Key assumptions
	Long term goals	Food security post natural disaster Resilience to climate change Improved livelihoods of sweetpotato farmers	• Multiplication/distribution system in each PIC established • Access to PT material is supported and maintained beyond the project at both SPC-CePaCT level (supply) and individual PIC level (multiplication and distribution) • Scaling up options post natural disaster responsive in the supply of planting material • Sweetpotato farmers able to find a market for any increased sweetpotato productivity/quality/maturity and/or able to benefit from other farming system changes.
Proposed project	Outcomes	• Adoption of PT material and optimised planting practices by sweetpotato farmers • Sweetpotato farmer (both genders) livelihoods improved through improved values on sweetpotato production • Standardised Pacific region sampling and viral diagnostic protocols and increased preparedness for biosecurity agencies	• Sufficient farmers adopt PT and optimised planting practices to support an ongoing multiplication and distribution system • Benefits of PT and optimised planting practices valued
	Intermediate outcomes	• Sweetpotato farmers have greater awareness and knowledge of PT and improved planting practices • Increased stakeholder capacity in PT and optimised planting practices • Sweetpotato PT planting material available to farmers to trial in PICs • Benefits of PT planting material and optimised planting practices quantified and recognised by sweetpotato farmers • More accurate sweetpotato virus diagnostics	• PT planting material is accessible for sweetpotato farmers i.e., distributed out of Fiji • Communication, farmer engagement and training activities will lead to increased awareness, knowledge and adoption of PT and optimised planting practices • Adoption of PT and optimised planting practices not limited by other factors
	Activities	• Survey of sweetpotato farmers via a semi structured interview and focus group discussion tools and infrastructure and supply chain scoping study provide foundational information to guide project activities • PT (virus free) sweetpotato planting material developed • Engagement of stakeholders and sweetpotato farmers • Training, communication and extension of PT planting material and optimised planting practices based on farmer to farmer learning and participatory trials • Quantification of benefits of PT material and optimised planting practices • Optimised sweetpotato viral diagnostic protocols and capacity	• Famers willing to cooperate in on farm trials of PT and planting practices • Farmer to farmer learning and communication activities increase awareness and willingness to trial/adopt PT and planting practices • PT plant material and optimised planting practices have quantifiable benefits in terms of yield or other farming system benefits • Partner organisations have capacity to deliver project activities
	Stakeholders	Project partner research and farmer organisations, PIC and Australian sweetpotato industries	

The following also outlines how some areas of the project could be extended beyond the life of the project.

Barriers in sweetpotato farming

In the development of this project, PICs have indicated that there are barriers in sweetpotato farming that have limited yield and production. It is anticipated that the survey process as a first step in this project would assist in identifying what some of these barriers are. Strategies to address these could then be developed and implemented over time. Longer term this could increase sweetpotato production in PICs.

PT capacity

The capability of SPC-CePaCT to produce PT clean planting material will continue to be deployed in the future for varieties with characteristics for other end purposes. Identifying varieties that can support sustainable farming systems to supply root products, fresh or processed with value added attributes (e.g. colour, taste and increased nutritional value) could bring new opportunities for root crop production in the Pacific and benefit farming communities and consumers, as well as other value chain participants. New product lines can expand business opportunities in domestic and export markets.

SPC-CePaCT's capability in PT clean planting material development could also be used to develop PT systems for other root crops.

Scaling up PT systems

The next steps after this project are scaling up PT seed systems. SPC-CePaCT will need to annually produce sufficient stock of each PICs preferred varieties. This will require sufficient infrastructure and management capacity from PICs to maintain multiplication and distribution over time to provide farmers with access to clean planting material outside of cyclone season and be responsive in providing material following cyclones or other natural disasters. The initial infrastructure established at SPC-CePaCT in Fiji could be further expanded based on the multiplication and distribution system concept developed through this project. With the implementation of the multiplication and distribution system for PT sweetpotato in Fiji this could then be scaled out to other PICs. These systems would provide ongoing accessibility of PT sweetpotato material by farmers.

Continued extension of project learnings

Continued communication and extension of PT sweetpotato and optimal planting practices within PICs will be necessary to achieve further adoption and the accrued benefits of increased yields and income for smallholder and commercial farmers. The digital resources developed through this project such as training videos on optimal planting practices will continue to be available to address turnover of PIC organisation field staff and continued capacity building within PICs. With increased production of sweetpotato and more consistent supply, development of the processing and value adding sectors would also be more feasible with support from individual PICs and some market development.

3. Implementation

3.1 Research questions

The following outlines the project objectives and associated research questions:

Objective 1. Characterise sweetpotato farming systems in Pacific Island countries and the role and values of sweetpotato in broader farming systems

What are the characteristics (varieties, agronomic management, rotation crops, gender roles,) of sweetpotato farming systems in Fiji/Tonga/Samoa/Solomon Islands?

Why do farmers choose to grow sweetpotato (soci-cultural and values of sweetpotato)? How do sweetpotato systems fit within broader farming systems and what is the role of sweetpotato in these systems?

This is a foundational activity to inform subsequent project activities under Objective 2. Broader in scope than previous surveys, the results from this will build on previous surveys and inform varietal selection for PT development, the value proposition for improved sweetpotato planting material and practices, multiplication/distribution concept models and field demonstration trials and extension and communication activities. Information collected through this survey on agronomic practices and gender roles could also underpin work in these areas in future resilient root crop system projects.

Objective 2. Develop improved quality sweetpotato planting material and support optimised planting practices in PIC's

What adaptations to the PNG PT model are required for it to work in Fiji and other PIC's?

Development of PT system concept models based on the information collected through the characterisation of sweetpotato farming systems in PICs will be developed using Fiji as a model country. This will be based on the PNG experience but consider the infrastructure, resources, production systems and supply chains within Fiji and the PIC's. This will include options for rapid scaling up post natural disaster.

What yield benefits can improved planting material and practices achieve for PIC sweetpotato farming systems?

Planting practices (selection of planting material, vine length, depth and seedbed technologies) and clean planting material are key issues that impact significantly on sweetpotato production systems in the Pacific Islands. The project will establish a series of demonstration sites for optimal planting practices and yield comparison of PT and non-PT sweetpotato. These will also form the basis for farmer updates and communication products to increase awareness of PT sweetpotato planting material.

What is the value proposition for improved planting material (pathogen tested) and improved planting practices in in sweetpotato production systems (commercial and smallholder and both genders)?

Cost benefit analyses developed by the DAF Agricultural Economist will highlight potential economic impacts of PT and improved planting systems based on both commercial and smallholder production systems. Virus reinfection risks will only be evident with longer term continuous field demonstrations that monitor yield with increasing time in the field and exposure to viral vectors. The survey and ongoing communication process with farmer co-operators demonstrating PT sweetpotato and improved planting practices will identify non-economic values associated with these changed practices to contribute to an overall value proposition for improved sweetpotato planting material and planting practices.

Objective 3. Develop improved diagnostic protocols for key sweetpotato viruses, enhance diagnostic capacity and identify sweetpotato viruses currently present in PICs and Australia

What viruses are present in PIC sweetpotato planting material and how can virus diagnostics be optimised for more sensitive and efficient detections of sweetpotato virus?

The PT process in PICs and the Australian field survey will provide an understanding of sweetpotato virus distribution in Australia and PICs. This will identify potential biosecurity threats to both PICs and Australia and allow for assays to detect these to be made available for Plant Entry Quarantine surveillance. The Australian component will focus on refining protocols for improved accuracy and confidence in molecular diagnostics.

3.2 Research activities, approaches and outputs

The project will target smallholder and commercial sweetpotato farmers in Fiji, Solomon Islands, Samoa and Tonga. While subsistence farmers will be a key focus of this work to improve sweetpotato yield and income and livelihoods of smallholders, it is a priority for individual PICs to continue to develop semi-commercial and commercial farmers for processing, value adding and export opportunities. Both commercial and subsistence farmers will be engaged as cooperators for field trials and demonstrations. All PICs are working to develop commercial sweetpotato farming as well as processing and value adding capabilities. It is expected that commercial or semi-commercial farmers are likely to more readily recognise the potential value of PT material and improved planting practices to production.

Over the longer term this work will contribute to broader development issues such as food security following natural disasters (due to the rapid propagation and growth of sweetpotato) and nutrition related health disorders e.g. vitamin A deficiencies which orange flesh sweetpotato can be a source.

An initial survey, developed, tested and used in each country (Fiji, Solomon Islands, Tonga and Samoa) to characterise sweetpotato farming systems, will:

- inform which varieties are key varieties, pests, diseases, agronomic management and gender roles in the farming system.
- be targeted in-country to key sweetpotato production areas and include commercial and subsistence farmers
- include markets/retailers to identify utilisation, varietal, and quality characteristic preferences (including health characteristics i.e., vitamin A) at the retail level as well as gender roles in this sector.

- Identify barriers to production/markets/variety access indicated as specific to individual PICs.
- Identify opportunities for improved farming practices in sweetpotato in PICs.

Information from the survey will inform subsequent project activities such as key varieties for PT development (based on key varieties grown, agronomic characteristics, consumer preferences, end use specifications). For example, in Solomon Islands sweetpotato production under wet conditions is an issue so varieties which demonstrate improved productivity under these conditions could be included in PT development and field demonstrations. The survey will also form baseline data for evaluating any changes in practice.

The project has been developed based on key elements to facilitate adoption of sweetpotato PT material and optimised planting practices.

- *New knowledge and technology:* The development of PT sweetpotato material and knowledge of optimal planting practices (selection, vine length, planting depth based on identification as yield limiting with current practices through HORT2010/65) will underpin an extension strategy to increase awareness and facilitate adoption in Pacific Island (Fiji, Solomon Islands, Samoa and Tonga) sweetpotato farming. The project will develop SPC-CePaCT capacity as a regional centre for PT to supply future multiplication and distribution sites in each PIC with clean planting material. The project will develop a representation of an optimised clean seed system based on Fiji's sweetpotato farming and supply chain.
- *Collaborative program:* The project is a collaborative program in the PICs. Engagement with PICs will be through collaboration with in-country organisations including Ministry's, Universities and NGOs with a range of activities delivered in each PIC while PT material is being developed. These include completion of a scoping study and surveys, attendance at project updates, packaging of communication products for individual PICs and field trials and demonstration sites in each PIC. Details of collaboration in each PIC are outlined in section 5.2 of this proposal. Engaging with the private sector (NGO's, farmer organisations, semi commercial/commercial growers) is a critical component as both stakeholders in the sweetpotato supply chain and extension mechanisms for future PT adoption.
  The project will formally link with HORT2016/185's project advisory group to minimise the need for duplication of project governance and project updates. At present, during the COVID pandemic, it holds weekly meetings for extension and research personnel of all four project countries as well as NARI and the University of Goroka in Papua New Guinea.
- *Field trials for participatory research:* The focus of field trials in PICs will include improved propagation and planting practices and PT material as it becomes available. These will be adjusted slightly for each PIC to ensure that they are contributing to individual PIC priorities.
- *Farmer updates and farmer to farmer learning opportunities:* Project partners in each PIC will organise farmer training and farmer updates on the project. This will include farmer to farmer learning as farmers hosting field sites share their experience with PT and planting practices. One farmer tour per PIC to visit field sites for non-local growers organised by PIFON. A tour of SPC-CePaCT facilities where PT material is being developed, will also be conducted in the final year of the project. Based on a

highly successful PNG farmer tour of the Australian sweetpotato farms a PIC farmer tours of Australian sweetpotato systems will be coordinated through the Australian Sweetpotato Growers Association to facilitate farmer to farmer knowledge exchange, learning and accelerated adoption of PT and seedbed technologies.

- *Relevant and applicable communication products:* Communication products developed through other project work (HORT 2014/097 SMCN2004/071, PC2010/026, PC2011/053) that are relevant to issues and practices within the partner PICs will be repackaged for each PIC and distributed through each Ministry and field or grower update events.
- *Value proposition:* The project includes an in-kind contribution for a Queensland DAF Agricultural Economist to undertake cost benefit analysis on sweetpotato farming system models. Combined with social science expertise from a UQ Social Scientist this value proposition will reflect sweetpotato production practices, the family farming system, sweetpotatoes role in the system, markets and the economic and non-economic value of PT and improved planting practices. A minimum of two case studies (ideally commercial and smallholder) will be developed and packaged for each individual PIC. The value proposition will be a valuable decision-making tool for sweetpotato farmers and inclusive of both economic returns as well as non-economic values.

The Australian research component will focus on laboratory and glasshouse trials to further refine virus diagnostic protocols using molecular techniques (PCR, qPCR, LAMP) for increased accuracy and efficiency of diagnostics. These will include assessment of different spatial sampling techniques and sample material, specifically for SPFMV which has previously been found to produce variable results with molecular tests. High throughput (next generation) sequencing for known Australian sweetpotato viruses, specifically sweet potato feathery mottle virus (SPFMV), sweet potato chlorotic fleck virus (SPCFV) as well as any novel virus detections will be completed. All viral sequence will be deposited to GenBank®. Previously, high throughput (next generation) sequencing has conducted for sweet potato virus isolates from the Australian collection, however assembly of these genomes has previously been ad hoc and dependent on industry funding. Further analysis of existing sequencing data (in collaboration with the original researcher Dr Amit Sukal, SPC-CePaCT, Fiji) with current high-end computing resources and bioinformatics analysis software may overcome these difficulties. Alternatively, sequencing of genomes from partial purified virus preparations (which enriches for viral sequences and reduces host contamination) will be conducted. Limited field surveys will be conducted across Australian sweetpotato growing regions to monitor for any incursions.

Partnering with SPC-CePaCT to develop the PT material will continue to build on the existing relationship between Australian sweetpotato researchers and CePaCT. The project will contribute the development of comprehensive technical skills in all aspects of viral diagnostics through mutual training/mentoring to address skill needs. This will also ensure standardisation of viral diagnostic protocols across the Pacific region.

The subsequent table of activities is based on the following project objectives:

Objective 1. Characterise the sweetpotato farming systems in Pacific Island countries and the role and values of sweetpotato in broader farming systems.

Objective 2. Develop improve quality sweetpotato planting material and support optimised planting practices in PICs.

Objective 3. Develop improved diagnostic protocols for key sweetpotato viruses, enhance diagnostic capacity and identify sweetpotato viruses currently present in PICs and Australia.

Table 4. Project implementation plan

No.	Activity	Output(s)	Milestone date of output(s)
Objective 1. Characterise sweetpotato farming systems in Pacific Island countries and the role and values of sweetpotato in broader farming systems			
1.1	Establish in country teams	Partner contracts completed Initial project meetings completed Workplans and engagement plan developed	February 2022
	Approach	Develop collaborator agreements in liaison with individual country partners. Initial project team meetings held, one large group and smaller per country meetings.	
	Risks/Assumptions	The verbal and written discussions of project activities prior to the contracting of the project are upheld when developing formal collaborator agreements.	
	Application of outputs	Clear roles and responsibilities in collaboration with multiple partners to deliver project activities in PICs. Progress is based on milestones linked to project payments.	
1.2	Scoping study for multiplication/replication systems in each PIC	Contacts/stakeholders for scoping study identified Scoping study structure agreed upon by project team Multiplication/replication system concepts developed Scoping study completed	June 2024
	Approach	This scoping study will identify key stakeholders and relevant existing infrastructure and resources in each PIC for the future development of multiplication/distribution systems for root crop planting material. This includes government ministries, farming organisations, private businesses and information collated from the project survey. It will include a lit review component to provide background information on root crop systems R&D in the PICs. It will also include information on the sweetpotato production systems and supply chains captured through the project survey. In country project partners will be responsible for collating information on existing resources and infrastructure within each PIC. This study will also include multiplication and distribution system concepts including individual, tailored approaches for each PIC (particularly given variation in the relative importance of sweetpotato in each PIC) and options for rapid scaling up post natural disaster. The overall compilation of this study will be done by the Australian project team in liaison with PIC project partners. The study will include root crops other than sweetpotato as a range of existing plant material exists for other root crops however, access at the farmer level has been limited so any multiplication and distribution system could be used to benefit a range of root crop systems.	
	Risks/Assumptions	The assumption is that there are existing resources and infrastructure that could be used in future multiplication and distribution systems and that key stakeholders are willing to contribute information to this study.	
	Application of outputs	The scoping study will inform future establishment of PIC root crop multiplication and distribution systems.	
1.3	Develop and deliver sweetpotato farmer/market semi structured interviews to characterise sweetpotato farming systems as well as understand the role of sweetpotato within the farming system Proposed target survey minimum numbers are: • Solomon Islands, Fiji and Tonga - 80 farmers each country • Samoa – 50 farmers These numbers reflect the relative importance of sweetpotato in individual countries and will include subsets of commercial and smallholder, male and female farmers.	Questions and tools developed and submitted for ethics approval through UQ collaboration. Tools implemented with growers and supply chain stakeholders identified by partner organisations in PICs. Survey reports finalised. Field sampling completed as part of survey process. Varieties sampled and selected for pathogen testing. Samples for pathogen testing sent to SPC-CePaCT if not already in existing collection.	June 2022

	Approach	The project team has incorporated social science expertise into the project to specifically assist with this activity. The survey tools will be assessed through UQ's ethics approval process through this collaboration. Survey a subset of sweetpotato farmers from each PIC including both commercial and subsistence farmers using **semi-structured interviews and focus group discussions**- socio-cultural, symbolic and ritual role and values of sweet potato, gender associated reasons for why growing sweet potatoes. In addition to this a **farming systems survey** – to cover varieties selected for PT and also farmer updates on planting practices and cropping systems including links to poultry and livestock production. This survey is broader in scope than previous ACIAR project surveys e.g. HORT 2010 065. While there will be an emphasis on this methodology as initial project activities and outputs, there will be an ongoing communication with farmer demonstrators to capture any changes in values associated with trialling PT and improved planting practices.		
	Risks/Assumptions	Growing and marketing information is shared with project staff. Wariness in having people form urban areas visiting rural areas due to coronavirus.		
	Application of outputs	The breadth of information collected through this survey will inform subsequent project activities such as developing field site activities relevant to each country, identifying key varieties for each country, understanding how smallholder and commercial sweetpotato production systems differ in practices and values, consumer preferences, markets and decision making for economic and non-economic values and production system models and strategies to address any barriers to adoption of new practices. Farming system and market information will also identify entry points to improve agronomy as part of the broader resilient root crop system program or link to SLAM/2020/139 Pacific Soil Portal, CROP/2020/186 Conservation Agriculture in the Pacific. The survey will also capture supply chain information to include in the scoping study for PIC planting material multiplication and distribution systems.		
1.4	Develop value proposition for PT and improved planting practices in sweetpotato		Farming practice, drivers/priorities and market data collected including cost data Farming system economic and non-economic values developed **Minimum of 1** case study on value proposition of PT/improved planting practices per PIC, where possible include commercial and subsistence farmer case studies, developed.	December 2023
	Approach	Results of activities 1.3, 2.8 & 2.9 will inform the development of a value proposition for PT and improved planting practices. This will include input by a Queensland DAF Agricultural Economist and UQ's Social Science Researcher. This value proposition will reflect the economic (cost benefit analysis of PT sweetpotato and improved planting practices) and non-economic values for sweetpotato in the farming system (from activity 1.3). Semi-structured interviews with stakeholders to identify quality related issues, including tangible, intangible and credence attributes of sweet potato. This would allow to identify the causes for the problems experienced from a marketing/commercial perspective.		
	Risks/Assumptions	Growing and marketing information including some costs is made available to project staff.		
	Application of outputs	The value proposition will be a decision-making tool for sweetpotato farmers, particularly in risk management. This information will also be used in communicating benefits of PT material and optimised planting practices to other farmers as well as considerations for their farming systems in changing these practices.		
Objective 2. Develop improved quality sweetpotato planting material and support optimised planting practices in PICs.				

2.1	Review existing varietal collections at SPC-CePaCT and other sweetpotato germplasm collections		List of varieties held in collections for pathogen testing including storage location Compare with survey data for each PIC on varieties grown Selection of varieties for PT through this project based on varietal characteristics, agronomic performance, market acceptance and consumer preference Selection of existing PT material for early field trials in PICs	February 2022
	Approach	Initial surveying of PIC sweetpotato farmers will identify key varieties in each region which can then be cross referenced with existing varietal collections of sweetpotato PT material. This includes collections held by DAF, SPC-CePaCT, CIP and individual PIC countries e.g., SROS. Cross matching key varieties from each PIC with existing collections will accelerate the release of clean varieties and the establishment of PT field trials. Previous investment in PNG where demonstration sites included PT material that did not reflect key varieties resulted in mixed reactions from farmers. This highlighted the importance of getting PT varietal selection right in this project prior to establishing field trials. Transfer of plant material will occur according to PIC biosecurity protocols and any agreements between SPC-CePaCT and individual PIC's. In the event that plant material cannot be transferred then tissue culture will be used.		
	Risks/Assumptions	Reliant on co-operation from holders of germplasm. The assumption is that some varieties in the collection may match key varieties identified through PIC survey.		
	Application of outputs	Identifying key PIC sweetpotato varieties already held by SPC-CePaCT, will remove the need for transferring from PICs and if already pathogen tested accelerate field trials of PT material.		
2.2	Training of PIC project partners in PT material and planting practices		Training events (either face to face or virtual) Training video	July 2022
	Approach	Training in PT material (What it is, benefits) and optimised planting practices (planting material selection, vine length, depth) will be conducted early in the project either face to face or virtually depending on travel restrictions and/or timing of project meetings. This is so project staff in PICs can demonstrate these practices to farmers and at field trial sites. Video will also be able to be used to train new staff in the event of staff turnover during the project.		
	Risks/Assumptions	Project partner field staff in PICs including Ministry and NGO will have consistent training in PT and planting practices.		
	Application of outputs	This knowledge will be able to be shared by field staff (Ministry and NGO) with farmers hosting field sites and at farmer updates or one on one communication with farmers.		
2.3	Develop digital training/communication product on PT planting material and planting practices and seed bed technologies		Planting practice and seed bed technology training product aimed at farmers audience	June 2024
	Approach	YouTube style videos will be developed aimed at farmers as part of an extension program to increase awareness and knowledge of both optimised planting practices and PT material. This will include demonstration of planting practices, possibly by Australian sweetpotato growers and also interviews with PIC farmers using these practices in demonstration sites. This will also be available through the HORT2016/185 online pest and disease platform. This would also be available through farmer networks as a tool for farmer group capacity building.		
	Risks/Assumptions	Sweetpotato farmers will have access or know someone with access to a mobile device to view the video.		
	Application of outputs	Shared with sweetpotato farmers to increase awareness and how-to knowledge on planting practices and PT material.		
2.4	Selection of sweetpotato varieties to be pathogen tested		Review survey data and PIC priorities for sweetpotato Key varieties selected and transferred to SPC-CePaCT for pathogen testing	June 2022

	Approach	Key varieties selected for each PIC will be based on survey results including popularity and yield of individual varieties, quality characteristics and consumer preferences and agronomic characteristics. Selection will also consider the potential nutritional benefits of sweetpotato varieties and potential new market opportunities. Varieties for PT from individual PICs will be selected in consultation and consensus with in-country project partners. A **minimum of 3** varieties will be selected from each PIC for developing PT material.		
	Risks/Assumptions	All project partners can agree on varieties to be pathogen tested. Permits and transfer process is completed without issue.		
	Application of outputs	Varieties selected will undergo pathogen testing to produce clean planting material.		
2.5	Develop pathogen tested sweetpotato material		PT material for key varieties from each PIC	May 2024
	Approach	Key varieties from each PIC will be screened for any pests and diseases. Clean planting material will then be developed for each variety. Techniques used will include a combination of molecular, tissue culture and herbaceous indexing. Rather than attempting to develop PT capacity in individual PIC's placing further strains on limited budgets and manpower, CePaCT will take on the regional role of producing mother stocks of PT planting materials.		
	Risks/Assumptions	PT material is developed within the timeframe of the project. Harder to clean viruses could also be present. Permits and transfer process is completed without issue and varietal material from PICs is able to be sent to and from Fiji.		
	Application of outputs	Provision of PT material is the first step in improving productivity of sweetpotato. PT material developed through the project will be used in field trials in PICs once material has been 'cleaned'. PT mother stock material will also be maintained for rapid upscaling when required.		
2.6	Establish infrastructure (Fiji only) to maintain pathogen free material as a source of material for multiplication		Infrastructure established	December 2022
	Approach	A quarantine screenhouse (x1) will be established in Fiji to maintain the virus free status of PT material. Quarantine mesh will be sent from Australia as per the current PNG project as this has particular specifications. The screenhouse will be erected and staffed by SPC-CePaCT. This site will be used to maintain supplies of clean sweetpotato material.		
	Risks/Assumptions	PT material can be developed within the timeframe of the project for multiplication.		
	Application of outputs	Multiplication sites in-country will be necessary for distribution and as access points for farmers to refresh planting material. This site will be used to supply initial field trials of PT material. This will also contribute material for future multiplication and distribution systems as well as seed bed technologies and will be used to inform the model Fiji PT multiplication and distribution system.		
2.7	Develop and distribute communications products on PT planting material, optimised planting practices		Review communication material from previous sweetpotato investment e.g., in PNG and identify relevant content in liaison with PIC partners Repackage material based on relevance to individual PICs	December 2022
	Approach	Communication material from previous sweetpotato investment e.g., in PNG will be reviewed. Material relevant to PIC sweetpotato systems/issues will be repackaged. This can then be distributed at field walks and farmer updates. Where possible the project will link in with existing farmer networks/associations.		
	Risks/Assumptions	Material will be relevant to PICs.		
	Application of outputs	Repackaged material will be available for PIC stakeholders e.g., Government Ministry's, NGOs to distribute to sweetpotato farmers and used at extension events.		
2.8	Link with other concurrent PIC farming system projects SLAM/2020/139 Pacific Soil Portal, CROP/2020/186 Conservation Agriculture in the Pacific, Samoa and Tonga		Co-location of field sites Annual cross project meeting Shared communication products.	December 2023
	Approach	Link with project teams from SLAM/2020/139, CROP/2020/186 through an annual cross project meeting and ongoing communication. Provide PT sweetpotato material for field sites.		
	Risks/Assumptions	Confusion and lack of separation between projects with project partners.		

	Application of outputs	Optimised sweetpotato farming systems demonstrations/field trials.		
2.9	Field trials sites in each PIC		Field trial site locations identified Field trial established Monitoring of field trial site and data reported to Agricultural Economist. Extension events based on demonstration sites Case studies developed	Ongoing throughout project July 2024
	Approach	Field trial sites (**minimum of 1 per PIC**) will be established to highlight improved planting practices i.e., selection, length, depth and where PT material if available early enough in the project. Field trial sites in each PIC will be established and managed by project partners in each country as outlined in section 5.2.		
	Risks/Assumptions	PT material developed for each PIC within the timeframe of the project. Field trial sites can be established in each country and successfully followed through a sweetpotato crop. Sufficient resources in PICs to ensure that field trials are conducted with scientific rigour.		
	Application of outputs	Field trial sites will be used to quantify benefits of PT material and planting practices for cost benefit analyses, will be used for extension events and may be developed as a case study.		
2.10	Demonstration sites in each PIC		Demonstration site co-operators identified Demonstration sites established Extension events based on demonstration sites Case studies developed	Ongoing throughout project July 2024
	Approach	Additional small demonstration sites will be established in each PIC (**minimum of 2 per PIC**). These will be established and managed by project partners in each PIC. The exact nature of the demonstration site will be tailored individually for each site to enable specific issues for each PIC to be demonstrated but will be related to improved planting material or practices.		
	Risks/Assumptions	Co-operators can be found to host demonstration sites. Demonstration sites can be established in each country and successfully followed through a sweetpotato crop.		
	Application of outputs	Demonstration sites will be used for extension events and may be developed as a case study.		
2.11	Farmer communication events		Farmer updates to include inspection of crops and farmer training 1 x farmer tour to field sites per PIC 1 x farmer tour to SPC-CePaCT	Ongoing throughout project July 2024
	Approach	Project partners in each PIC will organise farmer training and farmer updates on the project. This will include farmer to farmer learning as farmers hosting field sites share their experience with PT and planting practices. One farmer tour per PIC to visit field sites for non-local growers organised by PIFON. A farmer tour of SPC-CePaCT facilities where PT material is being developed, will also be conducted in the final year of the project.		
	Risks/Assumptions	That PT material is available during the project. Assumes sites can be located for field trial and demonstrations and that other farmers will want to attend these events.		
	Application of outputs	Farmer feedback at these events would be collated and used in evaluating the project and farmer attitudes to PT and optimised planting practices.		
2.12	Australian sweetpotato farms tour by PIC farmers		Selection process for interested PIC farmers Australian sweetpotato farm tour program developed Travel coordinated Tour completed	December 2024
	Approach	Experiences in PNG have indicated that adoption of improved planting systems has been accelerated by farmer tours to Australian sweetpotato production systems. PIC farmers will be selected for travel and touring of Australian sweetpotato farms (aiming for 6-8 PIC farmers), minimum of 1 from each PIC. The Australian Sweetpotato Growers Association will coordinate the growers to be visited by PIC farmers as part of this tour. This will be held in Year 3.		

	Risks/Assumptions	Travel restrictions eased by the final year of the project and that PIC farmers are interested in a tour of Australian sweetpotato production systems.		
	Application of outputs	Growers who have participated in the Australian tour would then be encouraged to share their experiences at farmer updates and through farmer organisations and networks.		
Objective 3. Develop improved diagnostic protocols for key sweetpotato viruses, enhance diagnostic capacity and identify sweetpotato viruses currently present in PICs and Australia				
3.1	Reciprocal technical workshops in molecular diagnostic techniques (qPCR, LAMP) and herbaceous indexing		Workshops coordinated and delivered Standardised protocols for the Pacific region in sweetpotato virus diagnostics	September 2022
	Approach	Reciprocal workshops will be carried out between Queensland DAF and SPC-CePaCT. DAF project staff will lead workshop on herbaceous indexing techniques. This workshop will be carried out at DAF facilities in Gatton with established facilities for herbaceous indexing. This workshop will also be linked to sweetpotato farm visits and discussions with stakeholders. SPC-CePaCT project staff will lead a workshop in molecular techniques (qPCR, LAMP). This workshop will be carried out at SPC-CePaCT facilities in Fiji.		
	Risks/Assumptions	Travel restrictions lifted permitting travel for these workshops.		
	Application of outputs	The techniques developed through these workshops will be applied directly as part of the project activities. These activities will contribute to ensure that viral diagnostic protocols are standardised within the Pacific region.		
3.2	Potential biosecurity threats to PICs and Australia identified		Samples collected during the PIC in-country surveys and screened for viruses at SPC-CePaCT Sequencing of novel viruses and assay development for biosecurity screening.	Ongoing throughout project December 2024
	Approach	Conducted concurrently with the farmer survey. Samples will be screened for viruses. FAO and individual PIC protocols for international movement of sweetpotato germplasm will be followed. Tissue culture will be considered if vegetative material will be problematic. Any novel viruses will be sequenced and assays developed to assist biosecurity screening by PICs and Australia.		
	Risks/Assumptions	Field samples can be collected during the survey process and contain virus. Assays can be developed to detect these viruses.		
	Application of outputs	Screening viruses through pathogen testing process will highlight potential biosecurity threats to PICs and the $100M Australian sweetpotato industry. Sequencing will provide positive identification on any potential new viruses and enable assay development which is important for biosecurity activities in PICs and Australia to screen for biosecurity threats.		
3.3	Australian plant spatial sampling laboratory trials to refine sampling protocols for virus diagnostics		Refined virus diagnostic protocols for increased accuracy for sweetpotato virus detection, specifically SPFMV.	Ongoing throughout project December 2024
	Approach	A minimum of 2 replicated glasshouse experiments will be conducted by DAF project staff to evaluate sections of vine and root tissue and pooled tissue samples for the presence of SPFMV. This trial will include both traditional graft inoculated indicator plants as controls and sweetpotato plants. This will include plants from a single cultivar from the nuclear Australian sweetpotato germplasm collection and the live positive control collection at GRF, specifically a non-PT SPFMV positive plant, a PT virus negative plant and a non-PT dual infected positive plant (for SPFMV and SPLCV).		
	Risks/Assumptions	That SPFMV particles are unevenly distributed within sweetpotato plants. Current protocols can be further refined for improved accuracy and efficiency of diagnostics.		
	Application of outputs	Experimental results will determine if refined sampling methods can produce equal levels of accuracy to traditional methods for the detection of SPFMV. If successful and budgets allow other viruses could be added. Decreased timeframe to provide accurate SPFMV results will enhance PT scheme efficiencies. Rapid results provided to growers will enable timely on farm decision making in relation to seedbed (planting material) changeovers.		

3.4	Australian sweetpotato virus transmission study		Identification of virus vectors for SPCFV	Ongoing throughout project December 2024
	Approach	Insect cultures of a minimum of 1 common sweetpotato insect pest species (Aphids (Family: Aphididae), Silverleaf whitefly (Family: Aleyrodidae, species: Bemisia tabaci), Mites (Family: Sarcoptidae), Scale insects (Superfamily: Coccoidea), Mealy bugs (Family: Pseudococcidae)) will be developed from wild caught individuals and bred through several life cycles on plants other than sweetpotato or PT sweetpotato plants. Cuttings of sweetpotato infected with SPCFV or SPCV will be obtained from the GRF virus positive germplasm collection and grown in the glasshouse for several weeks. A plant will be placed into an insect proof cage with a clean PT tested sweetpotato plant and one species of insect will be introduced to the cage. A transmission time is yet to be determined however it is anticipated that multiple days will be required. Four to six replicates will be used depending on availability of insects. This method will be repeated for each insect species studied.		
	Risks/Assumptions	Common sweetpotato pest species are vectors for these viruses		
	Application of outputs	Knowing which insect vector/s are involved in viral transmission is important for minimising viral spread through control of the vector through both chemical and cultural control options. This information would be transferrable to PICs.		
3.5	Next generation sequencing of sweetpotato virus isolates to support project activities		Sequence for SPFMV, SPCFV and other novel discoveries.	Ongoing throughout project December 2024
	Approach	Genomic sequencing of DAF mother stock isolates of sweet potato feathery mottle virus (SPFMV), sweet potato chlorotic fleck virus (SPCFV) via high throughput next generation) sequencing as well as any novel viral detections will be conducted by the DAF virology group. This will also include genomic sequence analysis and alignment of previously sequenced isolates completed through VG13004.		
	Risks/Assumptions	LAMP primers can be developed from sequence data.		
	Application of outputs	Sequence data will be added to GenBank® database. Sequence information will be used to develop specific LAMP primers for diagnostics of key viruses in both Australia (SPFMV, SPCLV, SPCV) and PICs. LAMP primers can then be used in proof of transmission studies to confirm that transmission has occurred. This information will also be valuable to the laboratory trials in 3.3 to determine viral strains in germplasm lines as differing strains may influence virus titres and in-plant movement of virus particles. Genomic sequence analysis of previously sequenced Australian isolates will provide information on virus strains present in Australian positive control plants and facilitate optimised assay development.		
3.6	Field survey of Australian sweetpotato crops		Field survey results on virus detections in Australian sweetpotato crops	Ongoing throughout project December 2024
	Approach	Field samples from Australian sweetpotato crops across key Australian production regions (Atherton Tablelands, Bundaberg, south-east Queensland and Cudgen) will be collected and screened for virus incursions. Northern Australian Quarantine Strategy (NAQS) does not currently have the resources to do this across all sweetpotato regions. DAF project staff will collaborate with NAQS staff to develop a coordinated program to address gaps in NAQS existing surveillance program. Results will be reported to BQ surveillance program based on high priority pests of sweetpotato (from Sweetpotato Industry Biosecurity Plan) and high priority pests hosted by sweetpotato (from Plant Health Australia).		
	Risks/Assumptions	Field surveys will detect viral infections in sweetpotato.		
	Application of outputs	Any novel virus detections will be immediately reported to the relevant biosecurity state agencies as legislated. Results of the field survey program will be reported in project updates to ASPG, NAQS and Biosecurity QLD. Any detections will also link to the Sweetpotato Industry Biosecurity Plan, specifically actions to be taken on farms with detections.		

3.3 Users

The key focus of this project is to develop PT sweetpotato material and demonstrate optimised planting practices and PT material to sweetpotato farmers in PIC's.

While partner organisations are also part of the project team, they are also end users in that the project is capacity building so that those organisations are better placed to develop sweetpotato systems and work with the farming communities. Training of partner organisation staff in PT and planting practices (Ministry and NGO staff), will ensure that PICs have capabilities to support the project activities both within the project and beyond the life of the project. The project will also ensure young scientists employed at partner institutions are part of a process that facilitates knowledge transfer to a new generation of scientists.

The main beneficiaries of project outputs will be men and women smallholder farmers and commercial/semi-commercial sweetpotato farmers. Benefits to commercial growers are likely to be improved yields, quality and maturity of sweetpotato production with PT planting material and improved planting practices. The benefits of this R&D are typically visible to farmers and adoption is not limited by aversion to risking food supply in trying new varieties as might be the case with subsistence farmers. Smaller scale demonstration sites with smallholder farmers will also demonstrate the potential yield benefits from PT material and/or improved planting practices. However, there may also be opportunistic benefits i.e., same yield from less area so labour is freed up and able to grow higher value options, longer fallows, less intensive rotations, better shaped produce which sells faster so less time spent at markets.

Communication products developed through the project will be available to PIC project partners and stakeholders for distribution to sweetpotato farmers either through project related extension activities and farmer updates or through one-on-one visits with farmers.

In-country communication of project activities and PIC sweetpotato farmer tours to Australian sweetpotato production systems will increase farmer knowledge of the benefits of PT material and improved planting practices. Adoption of clean planting material and improved planting practices has the potential to significantly improve sweetpotato yields and facilitate livelihood impacts. Improved sweetpotato production through PT material and better planting and propagation practices will provide opportunities for increase supply for family consumption with surplus sold for increased income.

In addition to SPC-CePaCT, any scaled up PT scheme would also undoubtedly require more active involvement of a range of stakeholders in each partner country. Specific stakeholders would vary with each PIC but support by the relevant government would be essential. Other stakeholders could include NGO's, village/community groups, farmer organisation networks.

3.4 Gender strategy

It is estimated that 70% of women in Fiji and Solomon Islands, and 60% in Tonga and Samoa are involved in agricultural production (UNFPA 2014). In Solomon Islands, women garden three times longer than men (Anderson et al. 2013). Additionally, women still have the primary responsibility of family food preparation. Urbanised employment of men is increasing, leaving women in the village to be sole food producers and care providers for children and the elderly. In other countries temporary migration acts in a similar fashion.

Commercialisation of sweetpotato production is increasing. In Fiji, Furlong et al (2019) observed commercial production as almost entirely the concern of men. However, in Fijian town markets and roadside stands, women are a higher proportion in conducting sales.

This highlights the significance of women's roles in PIC farming systems. As countries differ, clarification of women's roles in sweetpotato production is imperative. To ensure gender equity in the research then the following processes will be incorporated into the project.

- Initial project surveys will provide an understanding of women's roles. The survey process will incorporate female team members who will conduct interviews with women involved in the growing, marketing and consumption of sweetpotatoes. The survey will interview comparable numbers of male and female farmers. Survey data will be separated based on gender to highlight where gender differences in responses exist and where there is agreement. There is also an opportunity to partner with women's groups to undertake the surveys and the collaboration with a range of project partners will facilitate access to these groups.
- Where it is possible to collect the required information, then the value proposition will consider the implications for gender roles and how economic and non-economic values might impact on the livelihoods of each gender.
- Understanding the market linkages between genders and how other gender responsibilities impact on this and pilot strategies to support any challenges.
- In the selection of farmer co-operators an inclusive approach will be followed so that both genders have an equal opportunity to be involved in the project.
- Focused on developing PT material, it is unlikely this project will achieve more than an understanding of gender roles and the potential impacts of improved sweetpotato planting material and practices for each gender. However, an understanding on how and where men and women congregate within the community will assist in targeting communication and farmer updates to ensure that both genders are equally able to access the project results. Linking with HORT2016/185 plant health clinics will deliver extension messages at rural markets where both men and women assemble. Communities in the Pacific Islands do congregate in different places within the community based on gender or exhibit modified behaviour in some spaces based on gender. Communication and farmer updates must consider these gender factors in planning the location of events. In some cases, separate events for men and women may be needed to cater for these differences.

The project will also consider what opportunities and consequences there could be for gender with a PT scheme.

The project itself has greater women involvement. Most of the staff that will be involved in the PT scheme from SPC-CePaCT are women and youths.

3.5 Communicating project outputs and outcomes

The project builds on existing stakeholder relationships with SPC-CePaCT developed through previous R&D investment (PC2005/134, HORT2012/065, PC2010/026, PC2011/053). The project team will continue to build on communication and engagement with project partners in PICs (MOA, MAL, MAF, MAFFF, SINU, SROS, Kastom Gaden and PIFON, UQ) established in project development. This will be via initial project team planning meetings and through smaller meetings with partners for each individual PIC. Regular

project update and progress meetings will be held with in-country project teams. How much of this communication is online will be determined by future COVID-19 restrictions around travel.

Overall project management communications will be through the project team leader to maintain a single point of contact. For individual activities within the project then the appropriate project team members will be responsible for communication with the relevant project partner. PT sweetpotato material development will be led by SPC-CePaCT and in particular Dr Amit Sukal (SPC-CePaCT). DAF will coordinate the technical workshops and PIC farmer tour of Australian sweetpotato farms and the Australian focused component of the work program.

The DAF project team will also seek advice from the ACIAR In-Country Communication Officer Network (ICCON) in how it can assist in highlighting and increasing the visibility of the project within PICs.

Face to face interviews with survey participants will be conducted early in the project by both PIC and DAF team members (travel permitting). Communication products will be developed based on previous sweetpotato R&D and guided by PIC relevant issues. This material will be packaged i.e., designed for each PIC so that it can be made available to increase awareness of the project and provide informative products directly related to each PIC. Examples of the types of information this could include are: what is PT sweetpotato and why is it needed, planting/propagation techniques for sweetpotato, sweetpotato pest and disease factsheets (virus, phytoplasma and weevil). Each PIC will be able to distribute this material at other farmer updates and events they run as well as communication events through this project.

Initial consultation with PIC project partners has also identified where there might be existing farmer networks that the project could access and link within terms of targeting communication products and activities and identifying co-operators for field sites. PIC partners will establish and coordinate field trial and demonstration sites with both smallholder and commercial/semi-commercial in each PIC. Farmer updates, tours and communication events will also be held in conjunction with these sites.

The proposed sweetpotato project will link to the existing advisory group for HORT2016/185. This group already includes many of the proposed project partners and would significantly reduce duplication of attendance at multiple project updates. The online pest and disease platform operated through HORT2016/185 would also be a tool to communicate through such as photos of pest/disease from surveys, updates on pathogen testing progress.

3.6 Intellectual property and other regulatory compliance

Regulatory compliance with protocols for the transfer of plant material between PIC's will be adhered to. In 2010, the regional Heads of Agriculture and Forest Services endorsed the policy that the Pacific Community (SPC) would act as an agent for the contracting parties in the region to address their needs vis-à-vis the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The SPC is responsible for ensuring its 22 Pacific island countries and territories are food and nutrition secure. Thus, access to resilient gene pools of plant genetic resources for food and agriculture (PGRFA) available in the multilateral system on access and benefit-sharing (MLS) of the ITPGRFA is vital. The SPC hosts a crop and tree genetic resources collection in the Centre of Pacific Crops and Trees

(CePaCT). The SPC signed an agreement with the governing body of the ITPGRFA placing the CePaCT crop collections under the ITPGRFA framework. It receives financial support from the Global Crop Diversity Trust (GCDT) to maintain taro and yam collections in particular. For trees and other species not included in Annex 1 of the ITPGRFA, the SPC continues to use the SPC material transfer agreement (MTA), which was in use before the SPC's agreement with the governing body of the ITPGRFA. The SPC has distributed over 60,000 plantlets under a combination of both the SMTA and the SPC MTA. Thus, while it is an international organization, the SPC operates under the access and benefit-sharing (ABS) frameworks of both the Convention on Biological Diversity (CBD) and the ITPGRFA, depending on the materials involved and the purposes for which they are being acquired or provided.

There are a range of additional protocols that are likely to be applicable to this project. These include:

- In the event that the transfer of plant material from Australian sweetpotato germplasms collections is necessary this will be conducted in accordance with the relevant customs protocols for Australia and Fiji. This germplasm will be based on material from previous PT projects such as PC2005/134 in the event that cleaned varieties from this are no longer available in SPC collections. This will be determined from the review of existing PT material in SPC collections.
- Additional protocols related to this project will involve screenhouse production of sweetpotato plant material to maintain virus free status. These guidelines will be adapted from those used in PNG.
- The protocols for a clean seed system will also be included in the concept clean seed system options developed for Fiji. This information will be adapted from Australia and PNG experiences to individual PIC's.

4. Monitoring, Evaluation and Learning

4.1 Monitoring progress and adapting as required

Project progress will be monitored against milestones negotiated with ACIAR and collaborating partners. These will be linked to project payments allocated throughout the life of the project. Annual workplans will be developed from the final project proposal at yearly project update and planning meetings in Fiji (Sigatoka or Suva). Field visits to conduct surveys, coordinated field sites and deliver farmer events will be require participation by PIC project partners.

Any issues arising that could impact on the delivery of project milestones will be reported to the ACIAR project manager in a timely manner as well as any solutions the team has considered. Any changes deemed necessary to the project activities will be developed in conjunction with the relevant project partner and ACIAR. Reporting and communication (virtually and face to face) with project partners will be critical in identifying any risks that may impact progress and developing corrective measures. Six monthly travel (if not restricted) by Australian project team members will be the minimum to maintain in-country momentum.

4.2 Generating evidence of achievement

The project will be assessed against a series of evaluation questions and associated performance indicators.

Table 5. Project evaluation questions and performance indicators

Evaluation questions	How will the outcomes be monitored and evaluated?
What were the key learnings from the PIC sweetpotato farming system interviews in terms of characterising sweetpotato farming systems and motivations/drivers for sweetpotato farmers?	*Results of sweetpotato farmer/supply chain interviews*
How has the project progressed towards a PT sweetpotato seed scheme in the PIC's?	*Evaluation would include:* *The number and details of varieties for which PT options have been generated* *Development of a concept multiplication and distribution system based on Fiji supply chain* *Screenhouse infrastructure established at SPC-CePaCT* *Pathogen free material maintained and some multiplication occurring at SPC-CePaCT screenhouse.* *Training of partner organisation staff in PT material and its benefits* *Farmer awareness of PT sweetpotato material through field trials and communication and extension events*

How has the project improved the capacity of PIC organisations and farmers to implement PT and improved planting practices?	*Evaluation would include:* *Number of PIC project staff trained in PT and planting practices* *Number of field trial and demonstration sites* *Number of communication and farmer update events and feedback/evaluation of these events* *SPC-CePaCT staff have increased capacity to undertake PT of sweetpotato material* *Feedback following PT and planting practice training from PIC project partner field staff*
What has been the impact of PT material and improved planting practices on sweetpotato production?	*Evaluation would include:* *Field trial and demonstration site results i.e., is there a yield/quality benefit?* *Project linkages with other soils and agronomy related projects* *Value proposition and case studies quantifying benefits to sweetpotato farmers* *Farmer testimonials*
To what extent did the project optimise viral diagnostic protocols?	*Development of standardised diagnostic protocols* *Results of replicated Australian laboratory trials* *Pacific region viral diagnostic protocols* *Accuracy gains in replicated Australian laboratory trials*
What improved knowledge of sweetpotato viruses in Australian and the PICs did the project contribute?	*Results of field surveys, PT development, vector transmission studies and gene sequencing* *Improved assays based on virus identification, gene sequencing.* *Knowledge of vector transmission for key sweetpotato virus*

The following evaluation questions have been formulated to identify key learnings from the project. In undertaking this monitoring and evaluation a key focus will be on identifying learnings that will contribute to related projects and future activities.

4.3 Contributing to impact evaluation

The project survey results and report will be used as a baseline for adoption of PT sweetpotato material and improved sweetpotato planting practices both during and beyond the project. Cost benefit analyses will provide a comparison of returns on existing sweetpotato systems (with some inferences on livelihoods) and the potential system under PT and improved planting practices.

The market and supply chain information captured through the survey process could also be used to assess whether there have been any shifts such as varieties grown, consumer preferences, market opportunities, etc.

As a key goal in this work is to ultimately improve the livelihood of sweetpotato farmers, then baseline data could be compared with future information on production and marketing

data to quantify any changes in the amount of product sold for income versus domestic consumption as well as any changes in livelihoods.

4.4 Avoiding harm

Responsible conduct of research according to the Australian Code for the Responsible Conduct of Research (2018) will ensure the integrity of research results and the resulting production system recommendations. No negative environmental or socio-economic outcomes are expected from the research. All farming system recommendations will comply with Good Agricultural Practice guidelines. Recommendations will consider the need to ensure equitable access to affordable clean seed for normal farming operations as well as to support community and farming system resilience pre and post disasters where access to planting material may impact of caloric or nutritional sufficiency. While new pests and diseases may negatively affect market access, the project team will comply with biosecurity reporting standards for each country and international standards for diagnostics.

A component of avoiding harm will include consideration of the risks in transferring potentially contaminated germplasm between countries. This will be carried out with the necessary permits and according to the entry requirements for individual countries. Tissue culture will be used if transfer of vegetative material between PICs will be problematic.

Viral diagnostics involves laboratory based molecular procedures requiring numerous chemical reagents. Maintaining PT material vine stocks requires screenhouse work. Both laboratory and screenhouse work will be conducted according to protocols including workplace health and safety procedures.

The project team also understands that soil fertility is an issue in PICs, and this will be a risk, particularly where practices are aiming to improve current yields and therefore exacerbate soil fertility issues. While there is undoubtedly a need for work on agronomic practices including soil fertility, until the potential in planting material and practices is improved then any soil fertility work is also likely to see limited benefits. The project will highlight in communication products and events that with improved planting systems and potential yield increases then crop inputs to make increased yields sustainable will also be critical.

While DAF doesn't have an ethics approval process to guide the potential impacts of collecting survey data from farmers it does have a privacy policy around the use of data collected by DAF staff. The project team will make clear expectations around the use of this data with project partners.

COVID-19 contingency

With the current COVID-19 pandemic there is a significant risk that travel in the early stages of the project could still be restricted. In this event the project team will put in place strategies to initiate and manage project activities remotely. Some renegotiation with ACIAR may be required to reallocate travel funds to additional resources in the PICs. Strategies to address these limitations include:

- COVID-19 has forced a rapid transition to virtual communication technologies and initial project establishment and planning would require a higher level of remote meetings.

- Restricted travel in the first year of the project would also necessitate alternatives for face-to-face workshops in Year 1 of the project. This could be facilitated via webinar and/or virtual events.
- Similarly, training of PIC field staff in sweetpotato planting practices and use of PT material would be done through the development of training videos and virtual training events. These could also then be included on the HORT2016/185's digital platform.
- The project would work with ACIAR resources in the PICs to support the project by conducting some field visits if DAF project staff were unable to travel. This will also include links with ACIAR alumni.
- The project would also work with Australian sweetpotato growers utilising Pacific Islander labour scheme workers to train these agricultural workers in sweetpotato PT material and planting practices (vine selection, vine length, depth of planting, seed bed technologies, PT planting material). DAF currently provides compliance assistance during quarantine of newly arrived workers so could identify potential workers through this program. This is unlikely to immediately impact on practices in PICs but in the longer term when they return to the Pacific Islands these labour resources would have skills relevant to sweetpotato farming. While this would happen to a certain extent through employment in Australian systems, specific workshops could be targeted based on PIC practices. Feedback from Australian based liaison with Solomon Island communities is that this would be welcome and beneficial. The demographic of labour tends to be a mix of both rural and city based in origins.
- Communication production development would be able to continue based on DAF content with packaging of this material individually for each country completed remotely.
- The project would be able link with weekly meetings through HORT2016/185's project advisory group.
- If/when travel is reinstated then DAF project team may require additional trips to ensure project activities are on track.
- DAF will notify ACIAR immediately of any issues as they become apparent to determine any variations necessary.

5. Resourcing

5.1 Project team

Table 6. Project team

Name	Gender	Organisation	Discipline	Roles and responsibilities in project	% Time on Project	ACIAR Funding of time input %
Julie O'Halloran	F	DAF	Senior Development Horticulturist	Project leader – Overall project management	50	0
Michael Hughes	M	DAF	Farming Systems Development Officer	Country co-ordination and screen house and field agronomic practice development	30	0
Sandra Dennien	F	DAF	Senior Technical Officer	Manager virology component. – Oversee PT component of the project. In collaboration with SPC development of improved virus diagnostics	30	0
Elio Jovicich	M	DAF	Senior Horticulturist	Advisor – shade house design, Qld crop evaluations	15	0
TBA		DAF	Research Agronomist	Virology and agronomy – Virus testing at Gatton Research Facility	33	33
Rachel Langenbaker	F	DAF	Research Experimentalist	Grower liaison for farm visits and farmer tour - Bundaberg Research Facility	17	17
Kathy Crew	F	DAF	Molecular virologist	Virology – assisting in molecular virology aspects	19	19
Bill Johnston	M	DAF	Senior Principal Agricultural Economist	Economist - analysis of project trials and outcomes	20	
Brett Day	M	DAF	Research Agronomist	Farmer tour - Bundaberg Research Facility	11	11
Mary Firrell	F	DAF	Senior Experimentalist	Technical assistance – vector transmission at Gatton Research Facility	29	29
Grahame Jackson	M	Consultant	Project Advisor	Collaboration with countries, linkages with other projects.	20	20
Peter Long	M	ASPG	Executive Officer	Liaison for Australian sweetpotato farmers to coordinate farmer tour	3	3
Gomathy Palaniappan	F	University of Queensland	Social Scientist	Provide social science expertise into survey and gender and extension impact. Coordinate ethics approval.	10	10

Name	Gender	Organisation	Discipline	Roles and responsibilities in project	% Time on Project	ACIAR Funding of time input %
Amit Sukal	M	CePaCT, SPC	Virologist	Oversee CePaCT, SPC component and new diagnostic technologies	50	27
To be appointed		CePaCT, SPC	Research Technician	Phytodiagnostics – Develop and manage herbaceous indexing and glasshouse/ screen house components for CePaCT	100	100
To be appointed		CePaCT, SPC	Senior Laboratory Technician	Undertake CePaCT virology component	100	100
Sangita Devi		MOA, Fiji	Coordinate project work with support employed through the budget.	Develop screenhouses and multiply PT planting material for distribution	30	30
Lavinia Kaumaitotoya	F	PIFON	Project coordinator but will also involve time commitment of Communications staff.	Coordinate farmer tours and video communication product	12	12
Seuseu Tauati		MAF, SROS, Samoa	CEO	Implement Samoa aspects – literature review, survey, field sites.	30	30
Maria Gharuka		MAL, Solomon Islands	Researcher/ technician	Implement Solomon Island aspects – literature review, survey, field sites.	0	0
Pita Tikai	M	Kastom Gaden		Co-ordinate field sites and farmer events.	15	15
Lawrence Atu	M	Solomon Islands National University	HOD Agriculture	Co-ordinate and monitor field sites.	13	13
Leody Vainikolo		MAFF, Tonga	Researcher/ technician	Assist with survey, farmer demonstrations, farmer extension and communication	20	20

Julie O'Halloran will be overall project lead. Julie and Michael Hughes will be responsible for communication and engagement within country partner organisations. DAF Senior Principal Agricultural Economist Bill Johnston will be responsible for developing cost benefit analyses for sweetpotato farming systems for commercial and smallholder farmers.

DAF Senior Technical Officer Sandra Dennien will coordinate and facilitate the Australian component of this work and oversee activities by the Research Agronomist (TBA) and Rachel Langenbaker. Sandra will also be the key person liaising with the SPC-CePaCT project team. As the key researchers working with the Australian industry and ASPG Sandra and Rachael have extensive experience in all aspects of sweetpotato production including PT, best practice agronomy, pest and disease management. Sandra managed the DAF pilot sweetpotato clean seed scheme I the early 2000s and Rachael facilitated the

Australian farm visits for previous PT trainings and the PNG sweetpotato farmers visit in 2019.

Dr Amit Sukal will oversee the SPC-CePaCT viral diagnostics and PT material development components of the project. These project activities require specialised viral diagnostic capabilities.

Grahame Jackson will advise and facilitate on in-country networks. Grahame has extensive networks in PICs, a history of conducting R&D in the Pacific region and was responsible for the implementation of research in Fiji under HORT2010/065.

Dr Gomathy Palaniappan, Senior Research Fellow at the School of Agriculture and Food Sciences, University of Queensland will oversee the social and gender components of the project. She will also contribute to developing the value proposition and extension related components of the project. She brings over 10 years of experience from her expertise in community development, gender inclusion and extension in ACIAR projects in PNG, Philippines, Pakistan, Laos and Cambodia.

The Australian project team has a gender split, however, it is unknown at this stage what this will be for the in-country project team.

Not all PIC project partner personnel have been determined yet as most organisations have provided details of officer who will coordinate the project work but have also indicated that they will require employment of additional support once the project commences using budget provided through the project.

Pita Tikai, Kastom Gaden will co-ordinate field trial and demonstration sites in Solomon Islands with Lawrence Atu of SINU.

PIFON will coordinate farmer tour activities and grower targeted video development and provide links with farmer organisations in Fiji and Samoa.

Contacts for project development discussions with project partners are:

- Shalendra Prasad - Head of Research – Ministry of Agriculture, Fiji
- Tanu Toomata and Tommy Tuuamalii – Ministry of Agriculture and Fisheries, Samoa
- Seuseu Tauati – General Manager – SROS
- Metuisela Falesiva and Villiami Toalei Manu – Ministry of Agriculture, Food and Forests, Tonga
- Maria Gharuka – Ministry of Agriculture and Livestock, Solomon Islands
- Pita Tikai – Kastom Gaden
- Lawrence Atu – SINU
- Lavinia Kaumaitotoya – PIFON
- Gomathy Palaniappan – UQ

5.2 Project partnerships

Department of Agriculture and Fisheries (DAF), Queensland

DAF leads sweetpotato research and development in Australia with extensive experience in all aspects of the complex sweetpotato farming system including agronomy, physiology, pest and disease management, cultivar selection, tissue culture propagation and clean planting material production. DAF initiated the successful Australian sweetpotato pathogen testing scheme and innovative new planting techniques including flat planting, best practise crop management, seedbed technology and is one of the world's leading organisations in phytodiagnostics. DAF maintains close ties with grower organisations ensuring the outcome of research is appropriate and applicable to the industry. In addition to Australian sweetpotato research, DAF has been involved in ACIAR sweetpotato projects in PNG and Solomon Islands and is currently collaborating with global sweetpotato experts from Louisiana State University. DAF also has a large vegetable agronomy research program and supports national and international RD&E in post-harvest and supply chains. DAF will be the commissioned organisation and lead the implementation of this project in close collaboration with the Pacific Community Centre for Pacific Crops and Trees.

University of Queensland (UQ)

UQ will provide social science expertise to the project. This will involve development of the survey tools (semi-structured interview questions and focus group questions) and co-ordination of the associated ethics approval process. The Social Science Researcher has also provided input into the gender strategy and will assist with implementing this strategy in project activities. The Social Science Researcher will have an ongoing role in supporting monitoring and evaluation of project extension and communication activities. The Social Science Researcher has been involved in multiple other ACIAR projects, contributing similar expertise and support.

The Pacific Community - Centre for Pacific Crops and Trees (SPC-CePaCT), Fiji

SPC-CePaCT is the key organisation assisting Pacific island countries conserve the region's genetic resources. They maintain collections of local selections of crops including taro, banana, cassava, yams and sweetpotato and have imported advanced varieties. They have virus diagnostic capacity and have conducted virus research on other root crop staples. Currently they maintain regional and imported improved varieties of sweetpotato germplasm *in vitro.* SPC-CePaCT has developed distribution systems for sending plant material throughout the PIC's. Importantly SPC-CePaCT acts as a secure location for maintenance of the regions sweetpotato germplasm. SPC-CePaCT will conduct the pathogen testing of sweetpotato varieties and maintain mother stocks of this material for rapid upscaling.

Ministry of Agriculture (MOA), Fiji

MOA's mandate in Fiji is to provide food and nutrition security, income and employment to support broad-based economic sector growth. MOA has Crop Research and Extension Divisions. The proposed work also contributes to the five key strategic priorities outlined in MOA 5 Year Strategic Development Plant 2019-2023 of food nutrition, sustainable livelihoods, climate resilience, commercial agriculture and strengthened service provision. MOA will carry out the project activities (farmer survey, field sites and farmer communication activities) in Fiji.

Ministry of Agriculture and Fisheries (MAF) and Scientific Research Organisation of Samoa (SROS), Samoa

MAF is the principal organisation providing technical advice, training and support for subsistence and commercial farmers to manage food security and generate opportunities for sustainable income generation. The Crops Division covers root crop research, development and extension. The work in Samoa will be undertaken co-operatively by MAF and the SROS. SROS's vision is through research and development to value add to goods and services for significant social benefits and improved national GDP. Project funds will be divulged to MAF as the lead for the project in Samoa. However, SROS will support MAF in implementing the research components and MAF will conduct the survey for both main islands of Upolu and Savaii.

Ministry of Agriculture, Food and Forests (MAFF), Tonga

MAFF's mission is to facilitate sustainable development of the agriculture sector. MAFF has both R&D and extension programs. Their extension program includes a Women and Youth Development in Agriculture Program which focuses on promotion of agriculture and multiplication of planting materials. MAFF will carry out the project activities (farmer survey, field sites and farmer communication activities) in Tonga and specifically in those regions that MORDI doesn't work in but also working to support MORDI in the regions that MORDI operates.

Ministry of Agriculture and Livestock (MAL), Solomon Islands

The Ministry of Agriculture and Livestock (MAL) is the Government agency responsible for agriculture development in Solomon Islands. In order to carry out its responsibilities, MAL maintains research, extension, livestock and biosecurity / quarantine services. MAL's central office is in Honiara, with representatives in all the major islands. MAL will conduct the initial project survey of sweetpotato farmers and be involved in farmer events, working with SINU and Kastom Gaden to carry out the work program on sweetpotato. MAL is providing Ministry staff as in-kind to work on this project.

Kastom Gaden Association, Solomon Islands

KGA is a national non-government organization (NGO) whose main focus is on family food security and rural livelihood development. KGA has a network of rural farmers who are members of the Planting Material Network (PMN) with a current total membership of 5,451 registered members throughout the country, with the PMN members being the target beneficiaries. They have been doing collections and bulking of sweetpotato under the past projects and the current one which will end this year. In conjunction with SINU and MAL, Kastom Gaden will undertake field trial and demonstration sites on sweetpotato farms. Kastom Gaden has the farmer networks in Solomon Islands as well as experience in training and working with farmers to implement field trials.

Solomon Islands National University (SINU)

SINU in addition to its role in teaching and education is also committed to applied research to provide relevant solutions for the Solomon Islands. SINU will be involved in the project through Lawrence Atu, Faculty of Agriculture. Lawrence will advise on field trial sites.

Pacific Island Farmers Organisation Network (PIFON)

The Pacific Island Farmers Organisation Network serves as an umbrella organisation for national farmer organisations in the Pacific region, to coordinate capacity building, share success stories and the lessons learnt and support regional exchanges of expertise between farmer organisations and their associated private sector partners. PIFON aims to provide a range of services to improve the viability and sustainability of Pacific Islands Farmer Organisations so that they can perform better as farmer organisations. PIFON has an extensive network of farmer organisations throughout the Pacific Islands including those countries that this project is working with. Additionally, PIFON also has a focus on women in agriculture.

PIFON will coordinate a farmer tour in each PIC to look at PT and planting practice field and demonstration sites. PIFON will also coordinate the production of a communication video on PT and planting practices with testimonials from field and demonstration site farmers.

5.3 Other resourcing requirements

Other critical inputs include:

- Procedures, permits and protocols for the transfer of plant material between countries will need to be reviewed. Both DAF and in-country project partners will be responsible for these inputs.
- The project has budgeted for necessary equipment and infrastructure such as a LAMP viral diagnostic machine and screenhouses for Fiji. This has been allocated to the SPC-CePaCT budget and purchasing will be the responsibility of SPC-CePaCT.

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Pers comm. Eric Coleman Australian Sweetpotato Seed, calculated from ACIAR project PC 2011/053 Appendix 6

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UNFPA (2014) Population and development profiles: Pacific island countries. Prepared by United National Populations Fund, Pacific Sub-Regional Office. Suva, Fiji.

UNICEF (2008) Situation reporting: Food price increases/nutrition security in Pacific islands UNICEF.

Appendix A: Intellectual property register

Inquiries concerning completion of this form should be directed to <contracts@aciar.gov.au>.

Administrative details

Project ID	HORT2018 195
Project title	Resilient root crop systems in the Pacific Islands: developing pathogen tested sweetpotato
Assessment provider	Julie O'Halloran
If not Australian project leader, provide title	
Date of assessment	22 December 2021

Categories of intellectual property and brief description

Plant or animal germplasm exchange

Does the project involve:	**Yes**	**No**
provision of germplasm by Australia to a partner country?	✓	
provision of germplasm from a partner country to Australia?		✓
provision of germplasm from or to an IARC or another organisation and a project participant?	✓	
use of germplasm from a third party		✓
material subject to plant breeders/variety rights in Australia or another country?		✓

If "yes" to any of the above, for each applicable country provide brief details of the material to be exchanged:

If the germplasm exchange can be finalised before the project commencement, provide a Materials Transfer Agreement.

If the specific germplasm to be exchanged cannot be identified until after project commencement, indicate the type of material likely to be exchanged.

Country	**Details of plant or animal germplasm exchange**
Australia - Fiji	Sweetpotato planting material from collections of clean varieties from previous R&D investments sent from Australia to Fiji
Fiji – Solomon Islands	Sweetpotato planting material for pathogen testing and virus removal and then return of clean varietal material under existing protocols for SPC working with these countries
Fiji – Samoa	Sweetpotato planting material for pathogen testing and virus removal and then return of clean varietal material under existing protocols for SPC working with these countries
Fiji - Tonga	Sweetpotato planting material for pathogen testing and virus removal and then return of clean varietal material under existing protocols for SPC working with these countries

Proprietary materials, techniques and information

Does the project involve provision (from one party to another) of:	**Yes**	**No**
research materials or reagents (e.g. enzymes, molecular markers, promoters)?		✓
proprietary techniques or procedures?		✓

data		✓
proprietary computer software?		✓

“Data” means all data produced, acquired or used by a Party for the purposes of conducting the Project including technical know-how and information reduced to material form by that Party.

If "yes" to any of the above, for each applicable country provide:

brief details of the materials or information, the organisation providing, and the organisation receiving the materials

a copy of any formal contract between the parties.

Country	Details of proprietary materials, techniques and information

Other agreements

Is any aspect of the project work subject to, or dependent upon:	Yes	No
other materials-transfer agreements entered into by any project participant?	✓	
confidentiality agreements entered into by any project participant?		✓

If "yes" to any of the above, for each applicable country provide:

brief details of the agreements and conditions

a copy of any such agreement before project commencement.

Country	Details of other agreements
Fiji	International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) standard material transfer agreement (SMTA). The SPC is responsible for ensuring its 22 Pacific island countries and territories are food and nutrition secure. Sweetpotato is included in Annex 1 of this agreement.

Project, background and third-party Intellectual Property

This includes but is not limited to patents held or applied for in Australia and/or in partner countries and/or in third countries. For example, Project IP includes any new germplasm, reagents (such as vectors, probes, antibodies, vaccines) or software that will be developed by the project and any data that is created under the Project that will be reduced to a material form.

Project IP (IP that is expected to be developed during the project)

The following material is to be developed as part of the Project:

Type of material	Description (name of document, subject or other identifying information)
Publications/ Reports	• Scoping study for multiplication/replication systems in each PIC • PIC Survey report • Review of existing variety collections • Farmer tour reports
Framework/Guidelines	• Rapid scaling up options for sweetpotato planting material to respond to natural disasters • Guidelines for PT sweetpotato planting material screen houses

Communication Materials	• Fact sheet on PT sweetpotato planting material • Case study on value proposition of PT/improved planting practices per PIC • Factsheet on improved sweetpotato planting material • Youtube style video communication/farmer testimonial on PT planting material/improved planting practices • Demonstration site case studies on PT material and/or improved planting practices
Training Materials	• Virtual survey training conducted by project Social Scientist with in-country project partners • Training (virtual or face-to-face on) of in-country project partners on PT material and improved planting practices
Strategies	• Strategies for the ongoing protection of…
Analysis	• Value proposition of PT sweetpotato and improved planting practices including cost benefit analysis and non-monetary value

Background IP (IP that is necessary for the success of the project but that has already been created and is owned by parties to the project)

Any agreements in place regarding Background IP including any data that is brought to a Project by a Party that will be used for the purposes of the Project and the creation of Project IP should be provided to ACIAR prior to project commencement.

	Yes	**No**
Is it their Background IP?		✓
If “yes”, are there any restrictions on the project's ability to use the Background IP?		
would there be any restriction on ACIAR or the overseas collaborator claiming their rights to IP for the project based on the Background IP (refer ACIAR Standard Conditions)?		

If "yes", for each applicable country provide brief details of: the source of the Background IP; whether the Commissioned Organisation and/or Australian collaborators and/or developing country collaborators own it; any conditions or restrictions on its use.

country	**Details of background IP**

Third Party IP (IP that is owned by or licensed from other parties)

Agreements governing the use of third-party IP can be related to research materials, research equipment or machinery, techniques or processes, software, information and databases.

	Yes	**No**
Is there any relevant Third Party IP that is essential to the project?		✓
If “yes”, would there be any restriction on ACIAR claiming its rights to IP for the project (refer ACIAR Standard Conditions)?		

If "yes", for each applicable country provide brief details of: the source of the Third Party IP; the applicable country/ies; the circumstances/agreement/arrangement under which the IP is to be obtained or used by the project partners (for example, material transfer agreement, germplasm acquisition agreement, confidentiality agreement, research agreement or other arrangements); any conditions or restrictions on its use.

Country	**Details of third party IP**

Other contracts, licences or legal arrangements

	Yes	No
Are there any other contracts, licences or other legal arrangements that relate to the project?		✓

If "yes", for each applicable country provide brief details.

Country	Details of other contracts, licences or legal arrangements

Appendix B: Project Variations

Variations to the project after commissioning should be documented in this section

Variation 1.

Variation Date	**Purpose**	
Example date	Brief explanation of purpose for variation	
Changes (omissions, substitutions, inclusions)	i.	Page 8, line 16-18. - **Omitted line**: "…*example*…" - **Substituted line**: "…example…"
	ii.	Page 9, line 12. - **Included line**: "…example…"
	iii.	
	iv.	
	v.	
	vi.	
	vii.	
	viii.	
	ix.	

Project Budget- Expenditure

HORT/2018/195 Improving root crop resilience and biosecurity in Pacific Island Countries and Australia

ORGANISATION	1/01/2022	1/07/2022	1/01/2023	1/07/2023	1/01/2024	1/07/2024	TOTAL (PER ORGANISATION)	TOTAL (IN-KIND)		
QDAF, Australia										
Personnel (Total)	$ 62,385	$ 63,881	$ 63,881	$ 65,423	$ 65,423	$ 67,010	$ 388,002	$ 625,006		
Research Operating (Total)	$ 40,000	$ 40,135	$ 50,000	$ 50,000	$ 42,500	$ 42,500	$ 265,135			
Travel (Total)	$ 22,500	$ 22,500	$ 30,000	$ 30,000	$ 29,500	$ 27,774	$ 162,274			
Infrastructure (enter/amend at end of row)	$ 16,235	$ 16,447	$ 18,705	$ 18,905	$ 17,865	$ 17,847	$ 106,003		Infrastructure %	13.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 141,120	$ 142,963	$ 162,586	$ 164,327	$ 155,287	$ 155,131	$ 921,414	$ 625,006		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
ASPG, Australia										
Personnel (Total)	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 5,999	$ -		
Research Operating (Total)							$ -			
Travel (Total)	$ 1,210	$ -	$ 1,210		$ 2,601		$ 5,021			
Infrastructure (enter/amend at end of row)	$ 110	$ 50	$ 110	$ 50	$ 180	$ 50	$ 551		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 2,320	$ 1,050	$ 2,320	$ 1,050	$ 3,781	$ 1,050	$ 11,570	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
UQ, Australia										
Personnel (Total)	$ 9,450	$ 9,450	$ 9,450	$ 9,450	$ 9,450	$ 9,450	$ 56,700	$ -		
Research Operating (Total)							$ -			
Travel (Total)							$ -			
Infrastructure (enter/amend at end of row)	$ 473	$ 473	$ 473	$ 473	$ 473	$ 473	$ 2,835		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 9,923	$ 9,923	$ 9,923	$ 9,923	$ 9,923	$ 9,923	$ 59,535	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
SPC, Fiji										
Personnel (Total)	$ 59,188	$ 59,188	$ 59,188	$ 59,188	$ 59,188	$ 59,188	$ 355,125	$ 77,625		
Research Operating (Total)	$ 25,720	$ 25,720	$ 18,333	$ 18,333	$ 17,004	$ 16,994	$ 122,104			
Travel (Total)	$ 8,333	$ 8,333	$ 2,940	$ 2,940			$ 22,546			
Infrastructure (enter/amend at end of row)	$ 13,986	$ 13,986	$ 12,069	$ 12,069	$ 11,429	$ 11,427	$ 74,966		Infrastructure %	15.00%
Capital	$ 40,000						$ 40,000			
SUB-TOTAL (ORGANISATION)	$ 147,227	$ 107,227	$ 92,530	$ 92,530	$ 87,620	$ 87,609	$ 614,741	$ 77,625		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
MOA, Fiji										
Personnel (Total)	$ 6,900	$ 6,900	$ 6,900	$ 6,900	$ 6,900	$ 6,900	$ 41,400	$ -		
Research Operating (Total)	$ 4,400	$ 4,400	$ 2,000	$ 2,000	$ 2,000	$ 2,050	$ 16,850			
Travel (Total)	$ 3,420	$ 3,420	$ 3,010	$ 3,010	$ 1,940	$ 1,940	$ 16,740			
Infrastructure (enter/amend at end of row)	$ 736	$ 736	$ 596	$ 596	$ 542	$ 545	$ 3,750		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 15,456	$ 15,456	$ 12,506	$ 12,506	$ 11,382	$ 11,435	$ 78,740	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
PIFON, Fiji										
Personnel (Total)	$ 3,150	$ 3,150	$ 3,150	$ 3,150	$ 3,150	$ 3,150	$ 18,900	$ -		
Research Operating (Total)	$ -	$ -	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 60,000			
Travel (Total)	$ 1,200	$ 1,200	$ 1,200	$ 1,200	$ 1,329	$ 1,200	$ 7,329			
Infrastructure (enter/amend at end of row)	$ 218	$ 218	$ 968	$ 968	$ 974	$ 968	$ 4,311		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 4,568	$ 4,568	$ 20,318	$ 20,318	$ 20,453	$ 20,318	$ 90,540	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
MAF, Samoa										
Personnel (Total)	$ 6,900	$ 6,900	$ 6,900	$ 6,900	$ 6,900	$ 6,900	$ 41,400	$ -		
Research Operating (Total)	$ 4,000	$ 4,000	$ 2,200	$ 2,200	$ 2,300	$ 2,299	$ 16,999			
Travel (Total)	$ 6,670	$ -	$ 6,136		$ 3,880		$ 16,686			
Infrastructure (enter/amend at end of row)	$ 879	$ 545	$ 762	$ 455	$ 654	$ 460	$ 3,754		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 18,449	$ 11,445	$ 15,998	$ 9,555	$ 13,734	$ 9,659	$ 78,839	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
MAL, Solomon Islands										
Personnel (Total)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Research Operating (Total)	$ 8,400	$ 8,400	$ 2,700	$ 2,700	$ 2,700	$ 2,870	$ 27,770			
Travel (Total)	$ 6,840	$ -	$ 6,120		$ 3,880		$ 16,840			
Infrastructure (enter/amend at end of row)	$ 762	$ 420	$ 441	$ 135	$ 329	$ 144	$ 2,231		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 16,002	$ 8,820	$ 9,261	$ 2,835	$ 6,909	$ 3,014	$ 46,841	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
KG, Solomon Islands										
Personnel (Total)	$ 3,450	$ 3,450	$ 3,450	$ 3,450	$ 3,450	$ 3,450	$ 20,700	$ -		
Research Operating (Total)			$ 2,400	$ 2,397	$ 1,960	$ 2,000	$ 8,757			
Travel (Total)	$ 1,700	$ 1,700	$ 1,700	$ 1,700	$ 1,700	$ 1,700	$ 10,200			
Infrastructure (enter/amend at end of row)	$ 258	$ 258	$ 378	$ 377	$ 356	$ 358	$ 1,983		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 5,408	$ 5,408	$ 7,928	$ 7,924	$ 7,466	$ 7,508	$ 41,640	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
SINU, Solomon Islands										
Personnel (Total)	$ 3,445	$ 3,445	$ 3,445	$ 3,445	$ 3,445	$ 3,445	$ 20,670	$ -		
Research Operating (Total)	$ 549	$ 550	$ 2,530	$ 2,520	$ 2,000	$ 2,000	$ 10,149			
Travel (Total)			$ 1,700	$ 1,700	$ 1,700	$ 1,700	$ 6,800			
Infrastructure (enter/amend at end of row)	$ 200	$ 200	$ 384	$ 383	$ 357	$ 357	$ 1,881		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 4,194	$ 4,195	$ 8,059	$ 8,048	$ 7,502	$ 7,502	$ 39,500	$ -		
ORGANISATION	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (PER ORGANISATION)**	**TOTAL (IN-KIND)**		
MAFF, Tonga										
Personnel (Total)	$ 4,600	$ 4,600	$ 4,600	$ 4,600	$ 4,600	$ 4,600	$ 27,600	$ -		
Research Operating (Total)	$ 4,570	$ 4,570	$ 2,530	$ 2,530	$ 2,500	$ 2,500	$ 19,200			
Travel (Total)	$ 6,640	$ -	$ 6,147		$ 3,880		$ 16,667			
Infrastructure (enter/amend at end of row)	$ 791	$ 459	$ 664	$ 357	$ 549	$ 355	$ 3,173		Infrastructure %	5.00%
Capital							$ -			
SUB-TOTAL (ORGANISATION)	$ 16,601	$ 9,629	$ 13,941	$ 7,487	$ 11,529	$ 7,455	$ 66,640	$ -		
TOTAL ORGANISATIONS	**1/01/2022**	**1/07/2022**	**1/01/2023**	**1/07/2023**	**1/01/2024**	**1/07/2024**	**TOTAL (ALL ORGANISATIONS)**	**TOTAL IN-KIND (ALL ORGANISATIONS)**		
Personnel (Total)	$ 160,467	$ 161,963	$ 161,963	$ 163,505	$ 163,505	$ 165,092	$ 976,496	$ 702,631		
Research Operating (Total)	$ 87,639	$ 87,775	$ 97,693	$ 97,680	$ 87,964	$ 88,213	$ 546,964			
Travel (Total)	$ 58,513	$ 37,153	$ 60,163	$ 40,550	$ 50,410	$ 34,314	$ 281,103			
Infrastructure	$ 34,646	$ 33,790	$ 35,548	$ 34,767	$ 33,707	$ 32,982	$ 205,439	$ -		
Capital	$ 40,000	$ -	$ -	$ -	$ -	$ -	$ 40,000			
TOTAL $AUD (PERIOD)	$ 381,265	$ 320,681	$ 355,367	$ 336,501	$ 335,586	$ 320,601	$ 2,050,001	$ 702,631		
TOTAL $AUD (YEAR)	$ 381,265	$	676,048	$	672,087	$ 320,601	$ 2,050,001			

Ministry of Agriculture and Livestock, Solomon Islands **Collaborator** **Personnel Expenditure Table** **HORT/2018/195** **Improving root crop resilience and biosecurity in Pacific Island Countries and Australia**

Name	Gender	Organisation	Position at Organisation	Discipline	Role and responsibilities in project	Email Address	Annual salary (AUD)	Annual salary uplift (%)	Project time input (%)	Funding Source (of time input) Note: column K will calculate based on Column I-Column J		ACIAR						In-Kind						Estimated weekdays working on project	Percentage of estimated days working on project spent in country
										ACIAR	In-Kind	Pay 1	Pay 2	Pay 3	Pay 4	Pay 5	Pay 6	Pay 1	Pay 2	Pay 3	Pay 4	Pay 5	Pay 6	Total Days	Percentage
												1/01/2022	1/07/2022	1/01/2023	1/07/2023	1/01/2024	1/07/2024	1/01/2022	1/07/2022	1/01/2023	1/07/2023	1/01/2024	1/07/2024		
Maria Gharuka		MAL						0%			0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	-	
Total Organisation employees												$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0	
Sub-contractor total												$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	-	
Total personnel (excluding on-costs)												$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**0**	
On-costs*	0.0%											$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		
Annual salary uplift*	0.0%																								
Total personnel (including on-costs)												$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		

*Not used for sub-contractors as these are variable and hence should be captured within daily rate/annual salary

Solomon Islands National University, Solomon Islands **Collaborator** **Personnel Expenditure Table** **HORT/2018/195** **Improving root crop resilience and biosecurity in Pacific Island Countries and Australia**

Name	Gender	Organisation	Position at Organisation	Discipline	Role and responsibilities in project	Email Address	Annual salary (AUD)	Annual salary uplift (%)	Project time input (%)	Funding Source (of time input) Note: column K will calculate based on Column I-Column J		ACIAR						In-Kind						Estimated weekdays working on project	Percentage of estimated days working on project spent in country
										ACIAR	In-Kind	Pay 1	Pay 2	Pay 3	Pay 4	Pay 5	Pay 6	Pay 1	Pay 2	Pay 3	Pay 4	Pay 5	Pay 6	Total Days	Percentage
												1/01/2022	1/07/2022	1/01/2023	1/07/2023	1/01/2024	1/07/2024	1/01/2022	1/07/2022	1/01/2023	1/07/2023	1/01/2024	1/07/2024		
Lawrence Atu		SINU					$53,000	0%	13%	13%	0%	$3,445	$3,445	$3,445	$3,445	$3,445	$3,445	$0	$0	$0	$0	$0	$0	96	0%
Total Organisation employees												$3,445	$3,445	$3,445	$3,445	$3,445	$3,445	$0	$0	$0	$0	$0	$0	96	0%
Sub-contractor total												$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	-	
Total personnel (excluding on-costs)												$3,445	$3,445	$3,445	$3,445	$3,445	$3,445	$0	$0	$0	$0	$0	$0	**96**	**0%**
On-costs*	0.0%											$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0		
Annual salary uplift*	0.0%																								
Total personnel (including on-costs)												$3,445	$3,445	$3,445	$3,445	$3,445	$3,445	$0	$0	$0	$0	$0	$0		

*Not used for sub-contractors as these are variable and hence should be captured within daily rate/annual salary