



Australian Government
Australian Centre for
International Agricultural Research

Background Information

HORT/2014/077

Enhanced fruit production and
postharvest handling systems
for Fiji, Samoa and Tonga

(CITRUS PROGRAM)

Citrus

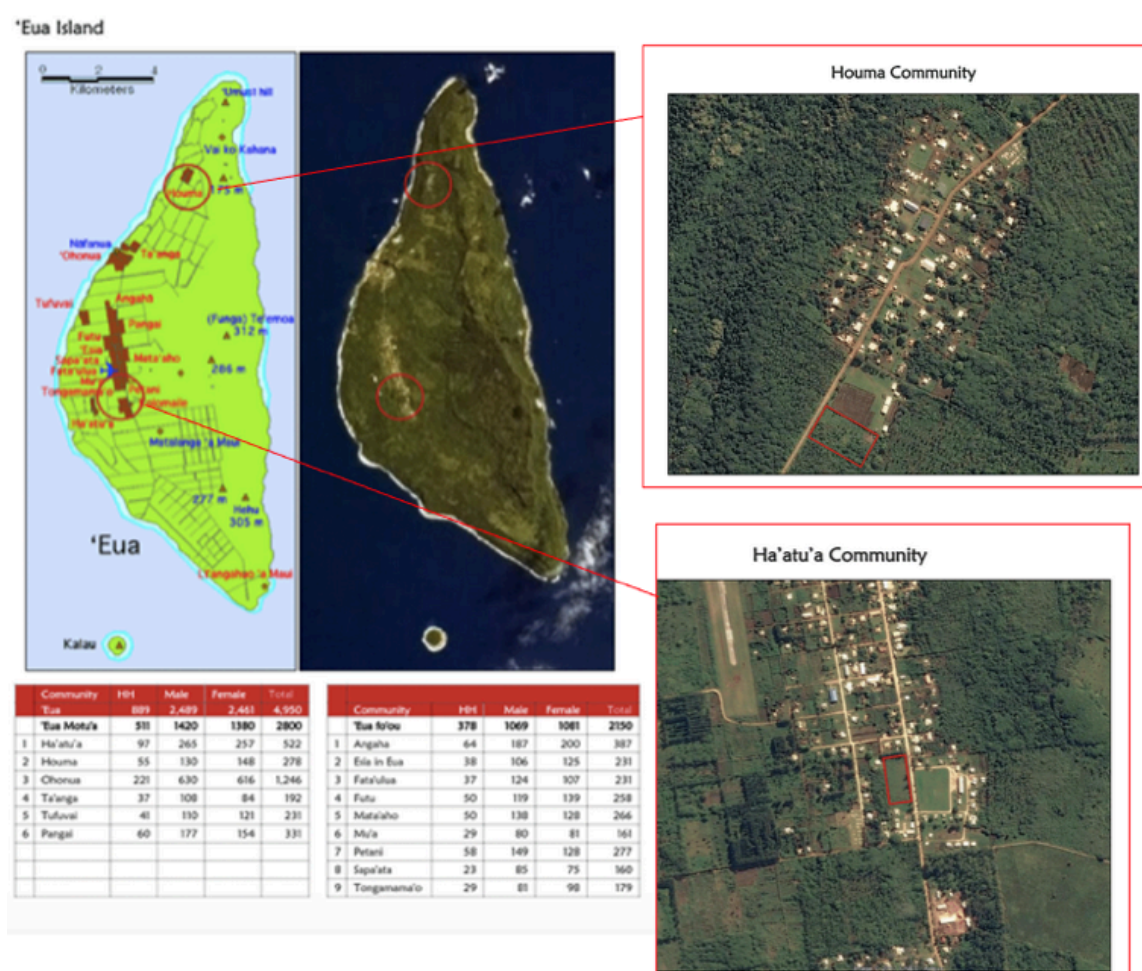
The citrus program in Hort 2014.077 (completed in 2021) focussed on increasing commercial citrus production in Tonga¹, specifically the main population centre of Tongatapu Island and the adjacent `Eua Island. There was preliminary community and farmer consultation in Fiji and preliminary postharvest capacity building in Samoa.

Most of Tonga's citrus historically comes from `Eua Island, however, production is primarily sourced from aging bush plantings that are predominantly seedling sourced, impeded by a lack of agronomic management, with associated declining product quality and production volumes. To increase local citrus production, new orchards needed to be established. We undertook multiple community-engagement fora² supported by MAFFF and MORDI to prioritise community and site selection. Three potential orchard locations on Eua Island were identified with sufficient area, good soil, availability of water for irrigation, and closeness to a community, with the Houma and Ha'tua communities on Eua Island finally selected in 2016. Negotiations with the Tonga Government was then undertaken to gain all approvals necessary, as the Ha'tua site was on Education Department Land and the Houma site was on King's land.

¹Activities in Samoa and Fiji were limited to farming community consultation and value chain assessments, and postharvest capacity building workshop. Future support for the citrus industry in Samoa has been integrated into HORT/ 2019/165.

² Building on extensive community consultation undertaken by ACIAR SRA/HORT/2016/108.

Local citrus trees in Tonga are bush-grown and often difficult to harvest due to their height and large thorns. Being seeded-type, the fruit quality of these local trees is declining with time. Eating qualities of the fruit (texture, sweetness, shape, size, colour) are inconsistent and difficult to market relative to the imported citrus. Given this, we needed to source and import new citrus grafting material into Tonga. Multiple consignments of grafted citrus trees were imported into Tonga between 2016 and 2019, with material sourced from commercial citrus nurseries located in NSW. Given little information on potential cultivar compatibility to local soils and consumer cultivar-preferences, we sourced a wide range of citrus cultivars.³ Varietal selection was restricted to those commercially available in Australia⁴. We were keen to plant a range of easy peel mandarins to give us the widest possible maturity window of up to six months. The earliest was *Imperial* followed by *Emperor* and then *Afourer*. They were selected based on proven performance in the sub-tropics/tropics with origins in sub-tropical China (Guandong Province). *Ellendale* (Tangor) is the latest selection planted. Further research has pointed to *Daisy* and *Fremont* due to their performance in the Northern Territory, which we plan to further import into Tonga via ACIAR HORT.2019.165. Similarly, we are looking for a wide season for oranges using a *Navel* and a late *Valencia* selection. These varieties are more challenging to grow because of their temperate Mediterranean origins. The *Tahitian Lime* and *Meyer lemon* were obvious selections because of their origins and well-known good performance in warm climates.



³ Citrus cultivars selected and imported into Tonga included *Imperial* mandarin, *Meyer* lemon, *Emperor* mandarin, *Afourer* mandarin, *Valencia* orange, *Washington* navel, *Tahitian* limes, *Meyer* lemon and *Cox Hybrid* rootstock.

⁴ New lines coming on stream over the last decade tend to be protected by PBR with consequent royalties.

Citrus trees were planted at the Houma community and at the Ha'atu'a community on 'Eua Island (Fig. 9), and at Nishi Trading, Utulau, on Tongatapu Island. Land preparation and planting was conducted in November 2016 (Nishi Trading orchard) and in April 2017 ('Eua Island orchards) (Fig. 10). The citrus orchards on Tongatapu have benefited from extensive in-kind⁵ contributions from Nishi Trading. Planting at the two 'Eua Island sites involving participation from the Houma and Ha'atu'a community, and support from MORDI, MAFF and the local District officers



Figure 10. Images of the project-established citrus orchards on 'Eua and Tongatapu (Nishi trading site) Islands, Tonga during planting phasing and in April 2021 (concurrent with project completion).

In early 2017, a workshop was undertaken at each orchard community to raise awareness and provide preliminary training in orchard and tree management. Given the need to carefully monitor the trees in the first 12 months after planting, and to overcome a few unforeseen soil nutrition challenges, we initially employed a part-time community member to provide regular maintenance and technical updates. In early 2018, we moved into an important partnership with MORDI (a local NGO specialising in community engagement and development), with

⁵ In kind support included extensive access to labour, equipment, land, chemical sourcing and application, tree monitoring, irrigation and pest and disease monitoring

MORDI now coordinating ongoing orchard management and leading the project local community engagement activities. Importantly, MORDI has provided extensive co-investment into the two Eua Island orchards, purchasing farm equipment, chemicals, and water irrigation systems.

In April 2019, more citrus trees were imported into Tonga, including: 220 *Tahitian limes*, 15 *Imperial mandarin*, 11 *Meyer lemon*, 5 *Emperor mandarin*, 5 *Afourer mandarin*, 3 *Valencia orange*, 3 *Washington navel* and 7 *Cox Hybrid* rootstock

The importation of *Tahitian limes* sought to capitalise on a pending export pathway for *limes* into New Zealand (B. Wiseman *pers com.* 2018) and was co-funded by PHAMA+. Imported citrus trees were hardened at the newly established MORDI plant nursery, with 100 *Tahitian limes* deployed to expand Nishi Trading citrus orchard, and 100 to establish a new citrus orchard at MORDI's Nuku'alofa complex (Fig. 11). Other citrus species were planted at the two Eua orchards and the Nishi Trading orchard to replace a few plants that failed to survive the initial orchard establishment phase, and to expand plantings based on available land (Suppl 8).

To support a future local scaling-out of plantings, we sourced and imported commercial citrus rootstock seed (i.e. *Cox mandarin* hybrid and *Troyer citrange*). Earlier attempts to import root stock seed into Tonga in December 2018 and February 2019, needed to be postponed due to limited seed availability and then potential poor seed viability. In late 2019, root stock seeds were successfully germinated, and a root-stock seedling plot established at the MORDI plant nursery, with a preliminary citrus plant propagation workshop on fruit tree grafting undertaken in July 2020. Tree maintenance and monitoring continued through to April 2021 coordinated by Prof John Chapman, MORDI, and Nishi Trading⁶ based on a project



WhatsApp group.

Fiji Citrus. In 2017, USC and MoA undertook two missions to Vanua Levu Island to scope possible Fijian citrus community collaborators, with the Naweni community on the Southern side of Vanua Levu identified as a possible future collaborator. Multiple community fora were undertaken to scope community engagement capacity and support priorities (Suppl 9). An opportunity to assist this community, based on collaboration with a concurrent ACIAR

⁶ From July 2021 through to Dec 2025, ACIAR-project (HORT/2019/165) will provide further technical support and additional capacity building to enable orchards to transition into sustainable enterprises.

agroforestry project FST/2014/067, was further identified during the mid-term review undertaken in late 2017. Researchers from both FST/2014/067 and HORT/2014/077 visited the community again in February 2018. While there was local stakeholder interest in expanding citrus production in Vanua Levu, to translate this interest into sustainable production systems would have necessitated sourcing and import new citrus genetic into Fiji, identifying and negotiating land access, land preparation, providing critical training support and overcome challenging inter-island postharvest transport logistic. Given limited available project resources and the project end date, we decided to alternatively focus on supporting and consolidating our newly established citrus orchards in Tonga.

Samoa Citrus. A series of preliminary community dialogues focussing on smallholder citrus farmers in the villages of Asau and Sataua⁷, on Savai'i Island, Samoa were undertaken by USC, SROS and MAF in 2017. A rapid postharvest review and local stakeholder surveys of Savai'i to Apia citrus market value chain were completed, highlighting a need to improve the transport coordination and limited citrus cultivars diversity. While postharvest capacity building workshops were subsequently held in February 2017 and May 2018 in partnership with FAO, research interventions have been integrated into the work plan of the pending new ACIAR project HORT/2019/165.

Research Ethics

This project had human research ethics approval from the University of the Sunshine Coast A16814, A16836, A16808, A201397 and S181253. MAFFF Tonga research permit was issued on 3/5/2016.

⁷ These villages (both located on north-western Savai'i Island) represent Samoa's main citrus production region.