



Pacific Horticultural and Agricultural Market Access Program (PHAMA)

Technical Report 36: Development of a Risk Management
Measure for Mites on Organic Bananas to New Zealand
(SAMOA06)

5 NOVEMBER 2012

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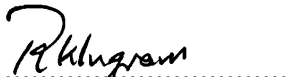

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Abbreviations

Abbreviation	Description
BBTV	Banana bunchy top virus
BORIC	Biosecurity Organisms Register for Imported Commodities
BSV	Banana streak virus
HTFA	High Temperature Forced Air
MAF	Ministry of Agriculture and Forestry
MAWG	Market Access Working Group
NMAC	National Market Access Coordinator
NZMPI	New Zealand Ministry for Primary Industries
PHAMA	Pacific Horticultural and Agricultural Market Access Program
PI-PLD	Pacific Islands Pest List Database
PLD	Pest List Database
SPC	Secretariat of the Pacific Community
SQS	Samoa Quarantine Service
STA	Short-term advisors
STEC	Samoa Trust Estate Corporation
URS	URS Australia Pty Ltd
WIBDI	Women in Business Development Inc.

Executive Summary and Recommendations

Exports of bananas to New Zealand have occurred sporadically from Samoa prior to 2009. In 2009, Women in Business Development Inc. (WIBDI) began trial shipments of organic misiluki bananas with a view to develop a commercial export pathway. Practical difficulties in sourcing adequate supply of fresh bananas, the variable and delicate nature of misiluki bananas, and interceptions of a range of mites and insects on-arrival have hindered the development of this export pathway since 2009.

This short term project was to investigate the quarantine status of pests found on Samoan banana exports to New Zealand and to determine what options were available to both manage them and retain the organic status of the product. The activity was also intended to build the capacity of Samoa Quarantine Service (SQS) to conduct export inspections of bananas to the same standard as those done on-arrival by the New Zealand Ministry for Primary Industries (NZMPI).

The primary pest of quarantine concern to NZMPI on misiluki bananas are mites. The mite life stages collected on misiluki bananas are adults, larva and eggs. None of the specimens collected as part of this study and as a result of interceptions at the New Zealand border could be identified to species level to enable determination of quarantine status. This was due to the highly specialised diagnostic requirements of these mite families and the inability to identify non-adult forms to species level. Despite the inability to identify the mites to species level, the broader categorisation of family was determined for some specimens. At least one of the families of mites collected were potentially pests of plants and therefore of quarantine concern to New Zealand. Some of the other mites collected were from families not considered to be plant pests and their quarantine status remains unclear.

Due to the uncertain identification of the mites associated with misiluki bananas, New Zealand will continue to consider them as quarantine pests until further detailed technical analysis is conducted. This work may be pursued as the next step in this activity, but it would require significant additional resources and expertise.

As a result of the quarantine difficulties encountered with exports of fresh misiluki bananas, a dried banana export pathway to New Zealand has also been developed by WIBDI. Feedback from WIBDI and New Zealand importers and retailers indicates that there is a strong commercial interest for the product and demand continues to grow. In addition, the quarantine, quality and supply issues that are associated with fresh organic misiluki are not an impediment to the dried misiluki export pathway.

In light of the strong demand for dried organic misiluki bananas by New Zealand importers and retailers and the difficulties with mite identifications, the following recommendations are made to the Samoa Market Access Working Group (MAWG).

Recommendations

- 1. Access for fresh organic misiluki bananas to New Zealand not be pursued at this stage due to difficulties in clarifying the quarantine status of mites associated with fresh bananas from Samoa.**
- 2. Investigations into the treatment of organic misiluki bananas for mites and other quarantine pests are not pursued due to the strong interest in dried organic bananas.**
- 3. Scientific investigations into the species of mites associated with bananas in Samoa may be pursued as a separate research activity if a suitable donor or organisation can be found to fund the research and if there is significant industry interest.**

- 4. Efforts to develop and use the expertise of SQS and other staff in pest diagnostics should continue.**
- 5. Effort and resources should be devoted to improve the production and export of dried organic bananas.**

1 Background

Trial shipments of organic misiluki bananas were exported from Samoa to New Zealand during 2009 and 2010 by WIBDI. Early indications in terms of market returns and viability were promising but export stopped following the interception of pests (mites) on arrival in New Zealand. The interception of pests required the shipments to be fumigated with hydrogen cyanide. Fumigation reduces the shelf life and removes the organic status of the product so reduces possible profitability. Interception of pests is also a major issue for bananas imported into New Zealand from other countries such as Ecuador and the Philippines.

Trials were conducted by the Ministry of Agriculture and Forestry (MAF) Crops Division and WIBDI in 2009 and 2010 to try and find ways to remove or kill the pests present on the fresh bananas. Trials were done using High Temperature Forced Air (HTFA), dipping in hot water and washing with high pressure water. The HTFA treatment could kill the pests but had unacceptable effects on fruit quality. Hot water dipping was found to be a promising option but required further work to develop a practical process and fully assess its ability to kill the pests and effects on fruit quality.

Limited information is known on the identity of the pests found on Samoan bananas and which ones are of quarantine concern to New Zealand. Historic records are available from surveys and research activities but limited information was available on the pests that may be found on banana fruit prepared for export.

The objectives of the activity were to investigate the quarantine status of pests found on Samoan banana exports to New Zealand and determine what options are available to both manage them and retain the organic status of the product. The activity was also intended to build the capacity of SQS to conduct export inspections of bananas to the same standard as those done on-arrival by NZMPI.

The deliverables for this activity were:

- Interim report to the Samoa MAWG documenting information collated on pests of bananas, possible management options and any required trials. *Prepared in July 2012 (see Appendix B).*
- Draft technical package for New Zealand MAF outlining the pests on bananas and the proposed management of quarantine risks. *Not prepared (see later sections).*
- Draft report to the Samoa MAWG outlining the information collated, activities conducted and the quarantine requirements and procedures to export organic bananas to New Zealand. *This report.*

2 Schedule of Activities Conducted

SAMOA06 was carried out between May and September 2012. Key components included:

Collation and analysis of existing information on pests of banana and exports to New Zealand

Ongoing throughout the activity by the short-term advisors (STA).

Collection and identification of pests on Samoan bananas

Pest samples were collected and processed by WIBDI and SQS staff during June–August. Assistance with the identifications was provided by NZMPI via remote diagnostics sessions. Video images from microscopes in the SQS wharf office were jointly viewed by scientists in the NZMPI lab in Auckland while being discussed by phone.

Visit to New Zealand 6–12 May 2012 by STA and SQS

Purpose of the visit was to improve the awareness within SQS of the requirements that bananas need to meet for import into New Zealand. The aim was to observe the import process for fresh produce including handling, document verification, sampling and visual inspection, pest identification and remedial activities. See Appendix A.

Visit to Samoa 12–24 June 2012 by STA

Purpose of the visit was to progress the issues identified in the May 2012 visit to New Zealand. In particular, to start sourcing existing technical information on banana pests and quarantine procedures, gain a better understanding of the current arrangements for production and processing of bananas, and begin the collection and identification of pests on bananas. See Appendix B.

Visit to Samoa 19–30 August 2012 by STA

Purpose of the visit was to progress the sampling and identification of pests on bananas, find historic records for exports of bananas, determine if it was sensible to arrange trial shipments, and investigate options for post-harvest washing, sorting, packing and certification.

3 Historical Exports of Bananas to New Zealand and Interceptions

3.1 Fresh Bananas

Information was collated and analysed to provide a clear picture of the exports of fresh Samoan bananas that have occurred in recent years (see Appendix C). Exports of Cavendish and misiluki bananas have occurred sporadically from Samoa over the last 10 years. Exports ceased around 2008 and started again in 2009 when WIBDI began trial shipments of organic misiluki bananas. Significant practical difficulties exist in sourcing adequate volumes of fruit and undertaking the post-harvest cleaning, sorting and packing required for the export market. Samoa's traditional export market for bananas was New Zealand but supply is now dominated by Ecuador and the Philippines.

Pests have not been detected on bananas during export inspection by SQS but they have been detected by NZMPI on-arrival in New Zealand. The pests intercepted on-arrival include: mites, ants, mealybugs, beetle and scales. Mites were the most frequently intercepted type of organism. The mite interceptions included adults, larva and eggs and none were able to be identified to species level.

Eight different types of mites were intercepted with three identified to genus level and the remaining five to family level. One of the families is known to include species that are pests of plants. All of the other intercepted families / genera do not include species that are considered to be pests of plants. For example, they include species that are predators of other arthropods or feed on organic matter.

With some care, it is possible to detect ants, mealybugs, beetles and scales without magnification (e.g. a hand lens or microscope). Due to their small size and ability to move it is difficult to detect mites without particular care and magnification. Even when mites are detected it can be difficult to accurately identify them, especially when immature life-stages are involved.

3.2 Dried Bananas

Production of dried bananas started as a by-product of WIBDI's efforts to export fresh bananas. Small shipments were sent to New Zealand throughout 2009 and 2010 while work was done to improve the process. The size of the consignments increased during 2011 and at least two commercial sized consignments have been exported so far in 2012. Work to improve the process and facilities is continuing including with a PHAMA Export Development Small Grant and a recently approved grant from the Increasing Agricultural Commodity Trade program.

The same company in New Zealand that imported fresh bananas from WIBDI has been strongly supportive of the dried banana product. They remain keenly interested in sourcing both dried organic banana and pineapple products from Samoa.

4 New and Existing Records of Banana Pests

4.1 Collection and Identification of Pests on Bananas

Insects and mites from misiluki bananas were collected and identified during June–August. The samples were collected and processed by WIBDI and SQS staff during and between the two visits by the STA. NZMPI assisted to identify the samples using remote diagnostics from their Plant Health and Environment Laboratory in Auckland. See Appendix D for details.

A total of 18 identifications done were: ant (x4), beetle (x2), earwig (x3), lepidoptera (x1), mealybug (x1), millipede (x2), mite (x4) and spider (x1). The ants, mites and mealybug are the likely organisms of quarantine concern.

Several mite samples were collected in June but were unable to be identified. Identification of mites collected in August was also limited by difficulties in adequately preparing the specimens (i.e. clearing and mounting on microscope slides).

Of the 18 identifications, 3 were to species level, 5 were to genus, 9 were to family and 1 was to order. The small number of identifications to species level illustrates how complex it is to both find and then accurately identify organisms on bananas or other fresh produce. The majority of the specimens were of relatively large organisms. The larger organisms are generally not associated with fresh produce that would have been cleaned and sorted for the export market.

Two of the mites were identified to genus level and the other two only to family level. One of the identified genera (*Tetranychus*) contains important plant pests. The other genus (*Pronematus*) does not contain plant pests. The two families of mites that were identified do not contain species that are plant pests. However, as for the mites that were intercepted in New Zealand, all of these mites would currently be considered to be regulated pests by NZMPI due to the identifications not being detailed enough.

4.2 Overall List of Pests and Other Organisms on Samoan Bananas

Records for pests and other organisms associated with bananas in Samoa were collated from existing records, interceptions and the samples that were collected in June–August 2012 (see Appendix E). The list includes insects (ants, aphids, beetles, earwigs, mealybugs, scab moth, scales, thrips, weevils and whiteflies), mites, fungi, nematodes and viruses.

5 Capacity to Conduct Export Inspections and Diagnostics

5.1 Export Inspections

The visit to New Zealand in May 2012 was very useful to allow the SQS representative to observe the import clearance process for fruit and vegetables and consider what improvements were needed to how inspections were done in Samoa (see Appendix A). SQS officers had done similar observational visits in ~2006 but no refresher visits or more structured training since.

Follow up discussions were held with SQS in June–August focussing on the status of the current policies, procedures and facilities.

General guidance for export clearance of fruit and vegetables is provided in the 2004 SQS Operations Manual but the focus is on import clearance and only the export of personal consignments. Updated guidance such as work instructions for approving facilities, conducting inspections, sampling and dealing with non-conforming consignments would be valuable.

Samoa's biosecurity legislation was under review at the time of this activity. The inclusion of export related activities in the new legislation will be a useful addition.

5.2 Pest Diagnostics

The pest diagnostics work done in this activity would not have been possible without the training program that was delivered by NZMPI for SQS and others in Samoa in recent years. The SQS and WIBDI staff involved in collecting and identifying the pests had all completed the basic +/- advanced components of the training. The resources provided through the training (microscopes, basic laboratory equipment, reference books) were also crucial. The building of new dedicated facilities for diagnostic work by PHAMA and MAF will make this work much more straightforward in the future.

The need to collect new information on the pests of bananas provided a good opportunity for SQS officers to practice and develop their diagnostics skills from the training program. This could be expanded in the future to cover the inspection of consignments in enough detail to find pests that might be present and basic pest identification skills for all officers.

6 Conclusions

Bananas are known to be affected by a range of common large and small insect pests in Samoa. The organisms recognised as being production pests (e.g. scab moth, mealybugs) are generally not the organisms that are intercepted on-arrival (e.g. mites). One of the mites intercepted on-arrival and one of the mites collected in June–August are potentially pests of plants. The other mites intercepted and collected are from groups that not considered to contain pests of plants.

Considerable effort was made during June–August to sample and identify mites on the bananas but no identifications to species level were achieved. Similarly, NZMPI did not determine the species names of any of the mites intercepted by Samoan bananas during 2003–2010.

Without more detailed identifications of the mites it is not feasible to prepare a technical package for NZMPI arguing that some or all of the mites found on the bananas should be considered non-regulated. In principle the argument is valid but there is still too much uncertainty on the identity of the mites and whether they are present in New Zealand or not. In particular, more investigation would be required due to two of the mites potentially being plant pests.

The amount of effort and expertise required to get detailed identifications of the range of mites that could be on the bananas is not considered worthwhile given the other practical challenges involved in exporting fresh organic bananas and the real potential for expanding exports of dried banana.

Similarly, it is not considered worthwhile to conduct further trials to try and develop procedures for removing or killing the range of types and life-stages of mites that could be present.

Trials to improve the post-harvest handling (e.g. washing, grading, general hygiene) may be worthwhile in the future if there was commercial interest in exporting fresh bananas that did not have to rely on organic status. Quality issues of having more uniform ripening and less external damage would also need to be addressed.

7 Limitations

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The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between May and September 2012 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

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Appendix A

Appendix A Trip Report: New Zealand May 2012

The purpose of the visit was to improve the awareness within SQS of the requirements that bananas need to meet for import into New Zealand. The aim was to observe the import process for fresh produce including handling, document verification, sampling and visual inspection, pest identification and remedial activities.

The STA (Bronwyn Wiseman) held discussions with NZMPI in Wellington and participated in the site visits and discussions in Auckland. The SQS representative (Seve Mautoatasi Ola, Senior Quarantine Officer) participated in the activities in Auckland.

Over the four days in Auckland, the process for containerised cargo and air cargo was thoroughly observed. The detailed schedule is provided below. This included observing and participating in inspections of bananas from Ecuador, oranges, lemons and strawberries from the USA, grapes from Chile, mangosteens from Thailand, taro, leaves and other vegetables from Fiji, and taro leaves, root vegetables and mats from Tonga. The logistics were observed at NZMPI facilities at Auckland airport, approved freight companies (Menzies, AirNZ) at Auckland airport, one of the major produce importers (Turners & Growers) and at a smaller produce importer (Mellow Foods). An overview of the set-up and procedures at the NZMPI diagnostics lab was also gained during a site visit.

The visit provided an excellent opportunity for Mr Ola to observe the import clearance process and gain greater awareness of the technical and operational challenges that need to be overcome for the successful export of products from Samoa. Over the visit it became clearer that in addition to the technical issues specific to bananas (e.g. pests, production methods) there are a range of more generic issues to address. These mainly relate to awareness and capacity for SQS and other participants to export produce to New Zealand.

Important issues related to improving banana (and other) exports that became clear during the visit included:

- Knowledge of the pests of bananas (identity and life-stage) and how to manage them.
- Access to adequate facilities and equipment for holding produce, conducting inspections, identifying interceptions and taking remedial action.
- Awareness of SQS staff and potential exporters of the import requirements for bananas (and other products) into New Zealand and how to meet them.
- Capacity of SQS staff to conduct export inspections and certification activities.
- Ensuring there is appropriate legislation and guidelines/procedures.

Appendix A

Date	Activity	Location
6 May	<ul style="list-style-type: none"> Travel (Wiseman Canberra-Wellington) 	
7 May	<ul style="list-style-type: none"> Meeting with NZMPI: Nacanieli Waqa (Senior Adviser, Pacific Market Access, Plant Imports & Exports Group) and Shiroma Sathyapala, Manager, Fresh Produce Imports). Travel (Wiseman WLG-AKL; Ola Apia-AKL overnight) 	Wellington, New Zealand
8 May	<ul style="list-style-type: none"> Introductory meeting with NZMPI (Nicole Cairns, Team Leader Auckland Metro) at Auckland Biosecurity Centre. Fresh produce (USA oranges and lemons) clearance and inspections at Turners & Growers (Mt Wellington). Fresh produce (Thai mangosteens, mixed vegetable consignment from Fiji) inspections at Menzies air-freight facility, overview of NZMPI air-cargo operations and discussions on current issues (Dunja Hassencamp, Team Leader). 	Auckland, New Zealand
9 May	<ul style="list-style-type: none"> Fresh produce (containerised bananas from Ecuador, grapes from Chile) clearance and inspections at Turners & Growers (Mt Wellington). Meeting with NZMPI on systems and approvals process for transitional / approved facilities (Tania Marinas, Team Manager, Airport Oaks office). Fresh produce (Fijian taro) clearance and inspections at Mellow Fresh (Otahuhu). Also observed handling of a consignment of frozen taro and cassava from Fiji. 	Auckland, New Zealand
10 May	<ul style="list-style-type: none"> Fresh produce (USA strawberries) clearance and inspection at NZMPI air-cargo. Visit to NZMPI Investigation & Diagnostic Centre (Plant Health and Environment Lab; Tamaki) to observe facilities and operations (receival and processing of border interceptions; containment lab; microscopy and imaging, library and insect collection). 	Auckland, New Zealand
11 May	<ul style="list-style-type: none"> Clearance and inspection of mixed consignments (including taro leaves, root crops and mats) from Tonga at AirNZ air-freight facility) and discussion with NZMPI inspectors. Exit meeting (by phone at Auckland Biosecurity Centre) with NZMPI (Nacanieli Waqa). 	Auckland, New Zealand
12 May	<ul style="list-style-type: none"> Travel (Wiseman Auckland-Canberra; Ola Auckland-Apia) 	

Appendix B

Appendix B Interim Report to Samoa MAWG July 2012

An extract is provided below from the 9 July 2012 interim report. Information that is presented or updated elsewhere in this report is not included (e.g. pest records and historical trade information).

Summary

This report provides an update on the progress and next steps to improve access for fresh organic bananas to New Zealand. It includes the objectives, status of tasks and a proposed action plan for July–September for inputs from MAF Quarantine and Crops, WIBDI and the PHAMA STA and National Market Access Coordinator (NMAC). It also includes the technical information that has been collated so far and what is still needed on:

- Export consignments of bananas from Samoa and interceptions
- Pest records for bananas in Samoa.

Production of dried bananas started as a by-product of WIBDI's efforts to export fresh bananas. Given the challenges of the fresh banana pathway and the opportunities of a dried product it is recommended that PHAMA consider assistance for both types of product.

Objectives and status of tasks

The objectives of the activity were to investigate the quarantine status of pests found on Samoan banana exports to New Zealand and determine what options are available to both manage them and retain the organic status of the product. The activity was also intended to build the capacity of Samoa MAF to conduct export inspections of bananas to the same standard as those done on-arrival by NZMPI.

May 2012 visit to New Zealand – Short Term Adviser & SQS

The purpose of the visit was to improve the awareness within SQS of the requirements that bananas need to meet for import into New Zealand. The aim was to observe the import process for fresh produce including handling, document verification, sampling and visual inspection, pest identification and remedial activities. The STA held discussions with NZMPI in Wellington and participated in the site visits and discussions in Auckland. The SQS (Seve Mautoatasi Ola, Senior Quarantine Officer) participated in the activities in Auckland. The visit provided an excellent opportunity for Mr Ola to observe the import clearance process and gain greater awareness of the technical and operational challenges that need to be overcome for the successful export of products from Samoa.

June 2012 visit to Samoa – Short Term Adviser

The purpose of the visit by the STA was to progress the issues identified in the May 2012 visit to New Zealand. In particular, to start sourcing existing technical information on banana pests and quarantine procedures, gain a better understanding of the current arrangements for production and processing of bananas, and begin the collection and identification of pests on bananas. The visit reinforced that a lot of information needs to be collected on the pests on bananas, what their quarantine status is and how consignments of bananas can be prepared that are free of those pests. Many practical challenges exist for the production, harvesting and post-harvest handling of bananas that are suitable for export. Significant challenges also exist for Quarantine to be able to regulate the export of bananas. For

Appendix B

example: availability of facilities, legislation and procedures for export inspection; capacity to conduct export inspections, identify pests and implement appropriate remedial actions. See schedule below.

Proposed action plan for SAMOA06 banana exports to New Zealand

July

- SQS to work with WIBDI and Crops to collect and identify pests on bananas.
 - Collect and ID samples during July–August; aim to do at least 5 more times 1–2 weeks apart.
 - Coordinate with NZMPI (Disna and Lalith) for RMD sessions, getting both microscopes working, supply of equipment (jars, vials, microscope slides and dissecting kits) and sending of samples for confirmation of identifications.
 - Coordinate with NMAC if additional equipment or advice is needed.
 - MAF Crops to decide which officer will be involved in this work.
 - WIBDI to consider setting up dedicated space in their office for the diagnostics work.
- SQS to provide details of the consignments of fresh bananas that have been exported to New Zealand. e.g. date, phytosanitary certificate number, size, air freight or sea freight, any records from the export inspection, feedback from New Zealand on interceptions.
- SQS to provide available records of pests of bananas (including records from the recent Secretariat of the Pacific Community (SPC) survey when the report is available).
- Quarantine to provide a copy of the current operational manual.
- Quarantine to indicate what parts most need updating.
- SQS to provide an electronic or hardcopy of Part 4 (ready reckoner).
- PHAMA STA to continue preliminary review of operational manual, awareness of New Zealand import requirements for bananas and need for training in inspection (as identified May 2012).

August / September

- Continue collecting and identifying pests on bananas.
- PHAMA STAs visit Samoa including to:
 - Conduct training sessions on doing export inspections of bananas
 - Investigate options for post-harvest washing, sorting, packing and certification
 - Prepare report with available information and feasibility of exporting
- Decide if it is sensible to arrange for trial shipments and apply for PHAMA support.

September / October

- Possible trial shipment(s) of fresh bananas in collaboration with NZMPI and All Good Organics
 - PHAMA STA +/- Samoan representative to potentially participate in import inspection.

Appendix B

Date	Activity
12 June	<ul style="list-style-type: none">• Travel (Wiseman Canberra-Apia)
13 June	<ul style="list-style-type: none">• Preparation
14 June	<ul style="list-style-type: none">• Preparation; meetings with SQS and WIBDI
15 June	<ul style="list-style-type: none">• Preparation; meeting with SQS
16 June	<ul style="list-style-type: none">• Field visit with WIBDI sourcing bananas and processing arrangements
17 June	<ul style="list-style-type: none">• Preparation
18 June	<ul style="list-style-type: none">• Field visit (WIBDI ripening facility and STEC); meeting with Crops Division
19 June	<ul style="list-style-type: none">• Meetings with SQS and WIBDI
20 June	<ul style="list-style-type: none">• Banana diagnostics work (collecting samples from STEC & Afega and processing at MAF Atele station and SQS wharf office)
21 June	<ul style="list-style-type: none">• Banana diagnostic work (processing samples at SQS wharf office)
22 June	<ul style="list-style-type: none">• Banana diagnostic work (identifications include remote diagnostics session with NZMPI); meeting with WIBDI
23 June	<ul style="list-style-type: none">• Report/preparation
24 June	<ul style="list-style-type: none">• Travel (Wiseman Apia-Canberra)

Appendix C

Appendix C Historical Exports of Bananas to New Zealand and Interceptions

Sources of data

Information was sourced from reports previously provided to SQS by NZMPI, SQS records, WIBDI files, and discussions with government and commercial representatives in Samoa and New Zealand.

NZMPI generally provide quarterly reports to SQS (and other countries) of plant commodities that are exported to New Zealand, whether they conformed with the import requirements and any pests that were intercepted. SQS provided the available data from NZMPI to the STA during the August visit. The data covered 2003–2008 and from 2011 onwards as NZMPI had stopped sending the reports between 2008 and 2010. The available reports were analysed (see below) and the required additional information identified (October 2008 – December 2010). NZMPI had not provided the additional data at the time of preparing this report.

The SQS SQUID database is used to issue and record phytosanitary and other certificates (date, certificate number, volume, pre-export treatment etc), vessel clearances etc. Searching this database was relatively time consuming as it cannot be searched by commodity. It was decided not to complete the search for phytosanitary certificates issued at the airport as over 12,000 records would have had to be individually checked. The focus was shifted to the phytosanitary certificates issued by the SQS wharf office as this would cover the consignments exported by WIBDI. Since ~2006 different prefixes have been used for phytosanitary certificates issued at either the wharf office (APW-) or airport (FAL-).

Exports of bananas from Samoa

Between March 2003 and February 2008 there were 69 consignments of fresh bananas recorded as arriving in New Zealand from Samoa. Four consignments were private/non-commercial and the rest were commercial. The commercial consignments were mainly exported via air freight (x61) rather than sea freight (x4). The consignments were not even over the 5 year period: 34 in 2003, 2 in 2004, 17 in 2005, 13 in 2006, none in 2007 and 2 in early 2008. It is understood that no treatments were done pre-export other than washing and grading.

There were 27 consignments of fresh bananas exported between November 2008 and November 2010. One of these consignments was private/non-commercial (November 2008) and the rest were commercial (January 2009 onwards). All of the commercial consignments were exported airfreight by WIBDI. Nine of the commercial consignments were in 2009 and 17 in 2010. The first 4 consignments in 2009 did not have a pre-export treatment and the remaining 5 were treated with HTFA. All but one of the consignments in 2010 was treated pre-export with HTFA. The one untreated consignment in 2010 was a single carton that was exported at the same time as the final treated consignment.

There were no consignments of fresh bananas exported from Samoa after November 2010.

Feedback on WIBDI exports

A “proof of concept” project was done by WIBDI during 2010 to investigate options for improving the supply and export pathway for fresh and dried bananas. Various trials and observations were made on all aspects of sourcing bananas, post-harvest handling and ripening, attempts to remove pests pre-export, packaging and freight options, quality on-arrival and economic viability. Many practical

Appendix C

challenges were identified and one of the recommendations was to put more effort into the dried pathway.

Feedback was provided on several consignments by the importer. The comments illustrate the practical difficulties in exporting the relatively delicate and variable misiluki banana (compared to the more predictable and sturdy Cavendish banana). e.g. variable size, variation in ripeness within and between bunches, a lot of black marking on skin, bruising, sour taste (HTFA consignment).

Interceptions on Samoan bananas on-arrival in New Zealand

The organisms intercepted on Samoan bananas on-arrival in New Zealand were: mites, ants, mealybugs, beetle and scale (see table below).

Between 2003 and 2008, 6 of the 69 consignments of bananas were infested, 1 was destroyed, 1 was held (and presumably destroyed) and the remaining 61 conformed. All six infested consignments were fumigated and released. They were all commercial consignments with two arriving by air freight and 4 by sea freight. Five of the infested consignments arrived in 2003 and 1 in 2005.

Twelve different organisms were intercepted on the 6 consignments: mites (x6), ants (x2), mealybugs (x2), beetle (x1) and scale (x1). Both ants were intercepted on a single consignment and three of the types of mites were intercepted on a single consignment.

At the time of preparing this report, the only available interception data for the consignments exported by WIBDI in 2009 and 2010 were copies of three NZMPI laboratory reports. The interceptions were all of mites.

Appendix C

Available information on organisms intercepted on Samoan bananas 2003–2010

Type	Order / Family	Scientific name	New Zealand quarantine status	Consignment number#	Comments
mite	Acari	<i>Calvolia</i> sp	regulated*	C2009/119712	Limited published information but does not include plant pests.
mite	Acari	Cheyletidae indet	regulated*	C2003/31338	Species include parasites of birds and mammals, and predators in soil, forest litter, under tree bark and on foliage etc
mite	Acari	Tenuipalpidae indet	regulated*	C2003/31338	Includes plant pests (e.g. <i>Raoiella</i> , <i>Brevipalpus</i>)
mite	Acari	Tydeidae indet	regulated*	C2009/119712	Contains mites that are predatory on other arthropods or feed on fungal or other dead organic material.
mite	Acari: Oribatida	Microremidae indet	regulated*	C2003/31338	Contains mites that feed on living and dead plant, fungal and other organic material, and some predatory species
mite	Acari: Oribatida	Oribatida indet	regulated*	C2003/25100; C2010/337249 & C2010/321272 (eggs and larvae)	Contains mites that feed on living and dead plant, fungal and other organic material, and some predatory species
mite	Acari: Phytoseiidae	<i>Amblyseius</i> sp	regulated*	C2005/309423 & C2010/321272	Large genus of predatory mites; several species are popular as biological control agents.
mite	Acari: Winterschmidtidae	<i>Oulenzia</i> sp	regulated*	C2005/309423	Family includes predatory and parasitic mites.
beetle	Coleoptera:Coccinellidae	<i>Sticholotis</i> sp	regulated*	C2003/25100	
scale	Hemiptera	<i>Hemiberlesia palmae</i>	regulated	C2003/23474	
mealybug	Hemiptera: Pseudococcidae	Pseudococcidae	regulated*	C2005/309423	
mealybug	Hemiptera: Pseudococcidae	<i>Pseudococcus orchidicola</i>	regulated	C2003/9552	
ant	Hymenoptera: Formicidae	<i>Monomorium pharaonis</i>	non-regulated	C2003/59887	
ant	Hymenoptera: Formicidae	<i>Paratrechina vaga</i>	regulated	C2003/59887	Current name is <i>Nylanderia vaga</i>

*regulated: these interceptions would be considered regulated due to the incomplete identification (i.e. not to species level)

#Consignment number is the unique number assigned by NZMPI to all imported consignments

Appendix D

Appendix D Pest Diagnostics Completed June–August 2012

Samples of misiluki bananas were collected during June–August from growers in several villages that were registered as organic by WIBDI: Afega (north east Upolu), Faleula (north east Upolu), Fusi Safate (south east Upolu), Toamua (northern Upolu) and Aopo (north west Savai'i). Samples were also collected from a newly established plantation on STEC land near the Faleolo airport on Upolu. The samples were collected and processed during the two visits by the STA and also by WIBDI/SQS in July/August.

Arthropods were collected from the banana samples and preliminary identifications done using the skills and materials (e.g. diagnostic keys, photos) from the diagnostics training program run by NZMPI. Remote diagnostics sessions were held with NZMPI (Auckland laboratory) on 22 June and 29 August to confirm the identifications.

See table below for details.

Appendix D

Identifications of organisms sampled from Samoan bananas June–August 2012

Common name	Order / Family	Comments
Ant	Hymenoptera: Formicidae <ul style="list-style-type: none"> • <i>Anoplolepis gracilipes</i> • <i>Nylanderia</i> sp. • <i>Pheidole</i> sp. • <i>Tapinoma melanocephalum</i> 	Both species are definitely regulated pests for New Zealand. The two genera are also likely to be regulated pests for New Zealand.
Beetle	Coleoptera: <ul style="list-style-type: none"> • Nitidulidae: <i>Eपुरaea</i> sp. • Unidentified family 	<i>Eपुरaea</i> is a genus of beetle that includes species that feed on plant sap.
earwig	Dermaptera: <ul style="list-style-type: none"> • Chelisochilidae: <i>Chelisoches morio</i> • Chelisochildae (unidentified genus) • Lapiduridae (unidentified genus) 	Large sized organisms that are not generally an issue for consignments prepared for export.
lepidoptera	Lepidoptera: Pyralidae (unidentified genus)	Likely to have been banana scab moth pupae which is common in Samoa.
mealybug	Hemiptera: Pseudococcidae (unidentified genus)	May be one of the 3 mealybugs known on bananas that are quarantine pests for New Zealand.
millipede	Diplopoda <ul style="list-style-type: none"> • Labidoridae • Unidentified family 	Large sized organisms that are not generally an issue for consignments prepared for export.
mite	Acari: Oribatida: Schlerobatidae (unidentified genus) <ul style="list-style-type: none"> • Prostigmata: <i>Tetranychus</i> sp. • Prostigmata: Tydeidae: <i>Pronematus</i> • Prostigmata: Bdellidae 	Oribatida (suborder) includes mites that feed on living / dead plant, fungal and organic material, and some predatory species. Schlerobatidae (family) includes mites that feed on organic material. Prostigmata (suborder) includes many plant parasitic mites and others that are predatory or parasitic on arthropods. <i>Tetranychus</i> (genus) that contains economically important plant pests. Tydeidae (family) includes predatory, fungivorous and scavenging mites. Bdellidae (family) are predatory mites.
spider	Aranae: Pholcidae (unidentified genus)	Pholcidae (family) includes spiders commonly known as cellar spiders including daddy long legs.

Appendix E

Appendix E Pest and Other Organisms on Samoan Bananas

Records for pests and other organisms associated with bananas in Samoa were collated from existing information and new samples that were collected in June–August 2012. The main organisms of interest were the insects and mites found on banana fruit. A new list was prepared based on:

- Pacific Islands Pest List Database (SPC website: <http://pld.spc.int/pld/>)
- Interception records from NZMPI
- Data collected during HTFA and hot water trials done for bananas in 2009 and 2010
- Samples collected and identified by SQS and WIBDI
- Any other records held by SQS, Crops Division or SPC

General pest surveillance done by SPC in Samoa in May 2012 but identifications were not available at the time of preparing this report.

Records are combined for all *Musa* sp./bananas & plantains. There was one record specifically for *Musa acuminata*/dwarf banana (*Cordana musae*, leaf spot) but all others were for *Musa* sp.

Quarantine status for New Zealand was determined based on an online search of the NZMPI "Biosecurity Organisms Register for Imported Commodities" (BORIC) database 21 August 2012. <http://www.mpi.govt.nz/biosecurity-animal-welfare/pests-diseases/boric.aspx> The full species name is needed to determine if the organism is regulated or not using BORIC. Identifications only to genus or above would all likely be considered regulated. When organisms are "regulated" it is likely that action would be taken if they were intercepted (e.g. treatment, destruction or re-export).

The Pest List Database (PLD) was searched by the STA in June 2012. A report from the PLD list for *Musa*/Samoa was also provided to WIBDI by SPC when they were in-country for a survey in early August. No additional pests were included in the August list. SPC also conducted in-country training on the PLD with SQS in early August and highlighted that the entries for Samoa needed to be updated. SQS are aware of the need to update the PLD and aim to do this when resources allow.

No additional information could be located on the basic identifications that were done in 2009 and 2010 for the HTFA and hot water trials. The basic identifications were: ants, aphids, beetles, centipedes, earwigs, mealybugs, scale, slugs, snails, spiders, thrips, wasps and weevils. Interestingly, no mites were identified during these trials. This is likely due to the method of inspection not being detailed enough to locate very small arthropods such as mites.

No other records were available from the records of SQS or Crops Division. SPC provided a list of commonly found banana pests in Samoa which was added to the new list.

Pests were only included on the list if they were known to occur on bananas in Samoa. A range of species are known to be pests of bananas in other countries and occur in Samoa but there are not specific host/pest records for Samoa. For example *Aonidiella aurantii* (California red scale), *Aphis gossypii* (melon aphid), *Dysmicoccus brevipes* (pineapple mealybug) and *Thrips hawaiiensis* (Hawaiian flower thrips).

The list includes pests that are known to potentially cause harm to banana plants plus other organisms that are known to be associated with bananas but not necessarily cause any harm.

Appendix E

Records of pests and other organisms found on banana plants and fruit in Samoa

Type	Order / Family	Scientific name	Common name	New Zealand quarantine status	Source
a	Acari	<i>Calvolia sp</i>	mite	regulated (incomplete ID)	MPI interception
a	Acari	Cheyletidae indet	mite	regulated (incomplete ID)	MPI interception
a	Acari	Tenuipalpidae indet	mite	regulated (incomplete ID)	MPI interception
a	Acari	Tydeidae indet	mite	regulated (incomplete ID)	MPI interception
a	Acari: Oribatida	Microremidae indet	mite	regulated (incomplete ID)	MPI interception
a	Acari: Oribatida	Oribatida indet	mite	regulated (incomplete ID)	MPI interceptions
a	Acari: Oribatida	Schlerobatidae	mite	regulated (incomplete ID)	WIBDI, 22 June 2012
a	Acari: Phytoseiidae	<i>Amblyseius sp</i>	mite	regulated (incomplete ID)	MPI interceptions
a	Acari: Prostigmata	Bdellidae indet.	mite	regulated (incomplete ID)	WIBDI, 29 August 2012
a	Acari: Prostigmata	<i>Tetranychus sp.</i>	mite	regulated (incomplete ID)	WIBDI, 22 June 2012; SPC, 2012
a	Acari: Prostigmata: Tydeidae	<i>Pronematus sp.</i>	mite	regulated (incomplete ID)	WIBDI, 29 August 2012
a	Acari: Winterschmidtidae	<i>Oulenzia sp</i>	mite	regulated (incomplete ID)	MPI interception;
a	Aranae	Pholcidae indet.	spider	regulated (incomplete ID)	WIBDI, August 2012
a	Coleoptera: Nitidulidae	<i>Eपुरaea sp.</i>	beetle	regulated (incomplete ID)	WIBDI, 22 June 2012
a	Coleoptera: Scarabaeidae	<i>Adoretus sinicus</i>	Chinese rose beetle	regulated	SPC, 2012
a	Coleoptera: Coccinellidae	<i>Sticholotis sp</i>	beetle	regulated (incomplete ID)	MPI interception
a	Curculionidae	<i>Cosmopolites sordidus</i>	Banana weevil borer, banana root borer	regulated	SPC, 2012
a	Dermoptera: Chelisochilidae	<i>Chelisoches morio</i>	earwig	non-regulated	WIBDI, 22 June 2012
a	Hemiptera	<i>Abgrallaspis cyanophylli</i>	cyanophyllum scale	unknown	SPC, 2012; PI-PLD
a	Hemiptera	<i>Dysmicoccus neobrevipes</i>	mealybug	regulated	SPC, 2012; PI-PLD
a	Hemiptera	<i>Hemiberlesia palmae</i>	scale	regulated	MPI interception
a	Hemiptera	<i>Icerya seychellarum</i>	Seychelles scale	regulated	SPC, 2012; PI-PLD

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Type	Order / Family	Scientific name	Common name	New Zealand quarantine status	Source
a	Hemiptera	<i>Nipaecoccus nipae</i>	Coconut mealybug	regulated	SPC, 2012
a	Hemiptera	<i>Pentalonia nigronervosa</i>	Banana aphid	regulated	SPC, 2012
a	Hemiptera	<i>Pinnaspis aspidistrae</i>	fern scale	non-regulated	SPC, 2012; PI-PLD
a	Hemiptera	<i>Pseudococcus citriculus</i>	longtailed citrus mealybug	regulated	SPC, 2012; PI-PLD
a	Hemiptera: Pseudococcidae	Pseudococcidae	mealybug	regulated (incomplete ID)	MPI interception
a	Hemiptera: Pseudococcidae	<i>Pseudococcus orchidicola</i>	mealybug	regulated	MPI interception
a	Homoptera: Aleyrodidae	<i>Aleurodicus dispersus</i>	Spiraling whitefly	regulated	SPC, 2012
a	Homoptera: Diaspididae	<i>Aspidiotus destructor</i>	Coconut scale insect	regulated	SPC, 2012
a	Hymenoptera: Formicidae	<i>Anoplolepis gracilipes</i>	yellow crazy ant	regulated	WIBDI, August 2012; SPC, 2012
a	Hymenoptera: Formicidae	<i>Monomorium pharaonis</i>	ant	non-regulated	MPI interception
a	Hymenoptera: Formicidae	<i>Nylanderia</i> sp.	ant	regulated (incomplete ID)	WIBDI, 22 June 2012
a	Hymenoptera: Formicidae	<i>Paratrechina vaga</i>	ant	regulated	MPI interception
a	Hymenoptera: Formicidae	<i>Pheidole</i> sp.	ant	regulated (incomplete ID)	WIBDI, 22 June 2012
a	Hymenoptera: Formicidae	<i>Tapinoma melanocephalum</i>	ghost ant	regulated	WIBDI, 29 August 2012
a	Lepidoptera	<i>Nacoleia octasema</i>	Scab moth	regulated	SPC, 2012
a	Thysanoptera: Thripidae	<i>Chaetanaphothrips signipennis</i>	Rust thrips	regulated	SPC, 2012
f	Dothideales	<i>Guignardia musae</i>	freckle disease of banana		PI-PLD
f	Dothideales	<i>Lasiodiplodia theobromae</i>			PI-PLD
f	Mycosphaerellales	<i>Cladosporium musae</i>	leaf speckle		PI-PLD
f	Mycosphaerellales	<i>Mycosphaerella fijiensis</i>	Black leaf streak		PI-PLD
f	Mycosphaerellales	<i>Mycosphaerella musicola</i>	yellow sigatoka		PI-PLD
f	Phyllachorales	<i>Colletotrichum musae</i>	banana crown rot		PI-PLD
f	Phyllachorales	<i>Phyllachora musicola</i>	black cross disease		PI-PLD
f	Uredinales	<i>Uredo musae</i>	banana leaf rust		PI-PLD

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Type	Order / Family	Scientific name	Common name	New Zealand quarantine status	Source
f	Uredinales	<i>Uromyces musae</i>	leaf rust		PI-PLD
f	Xylariales	<i>Monographella stoveri</i>			PI-PLD
f		<i>Cordana johnstonii</i>	cordana leaf spot		PI-PLD
f		<i>Cordana musae</i>	cordana leaf spot		PI-PLD
f		<i>Deighтониella torulosa</i>	fruit spot, fruit speckle		PI-PLD
f		<i>Dothidella musae</i>			PI-PLD
f		<i>Haplobasidion musae</i>	Malayan leaf spot		PI-PLD
f		<i>Ramichloridium musae</i>			PI-PLD
f		<i>Sphaeronema</i> sp.			PI-PLD
g		<i>Achatina fulica</i>	Giant African Snail		SPC, 2012
n	Dorylaimina	<i>Xiphinema ensiculiferum</i>	dagger nematode		PI-PLD
n	Tylenchida	<i>Achlysiella williamsi</i>			PI-PLD
n	Tylenchida	<i>Aphelenchoides</i> sp.			PI-PLD
n	Tylenchina	<i>Discocriconemella limitanea</i>			PI-PLD
n	Tylenchina	<i>Ditylenchus</i> sp.	stem nematode		PI-PLD
n	Tylenchina	<i>Helicotylenchus dihystra</i>	spiral nematode		PI-PLD
n	Tylenchina	<i>Helicotylenchus microcephalus</i>	spiral nematode		PI-PLD
n	Tylenchina	<i>Helicotylenchus mucronatus</i>	spiral nematode		PI-PLD
n	Tylenchina	<i>Helicotylenchus multicinctus</i>	banana spiral nematode		PI-PLD
n	Tylenchina	<i>Helicotylenchus</i> sp.	spiral nematode		PI-PLD
n	Tylenchina	<i>Hemicycliophora vitiensis</i>			PI-PLD
n	Tylenchina	<i>Pratylenchus coffeae</i>	banana root nematode		PI-PLD
n	Tylenchina	<i>Radopholus similis</i>	burrowing nematode		PI-PLD
n	Tylenchina	<i>Rotylenchulus reniformis</i>	reniform nematode		PI-PLD

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Type	Order / Family	Scientific name	Common name	New Zealand quarantine status	Source
v	Badnavirus	Banana streak virus	BSV		PI-PLD
v	Nanovirus	Banana bunchy top virus	BBTV		PI-PLD

Pest Group: a = arthropods; b = bacteria; f = fungi; g = gastropods; n = nematodes; v = viruses.

References

MPI interception = records provided by NZMPI on pests intercepted during import inspection.

PI-PLD = Pacific Islands Pest List Database. As searched 27 June 2012; available on SPC website: <http://pld.spc.int/pld/> (extract was also provided to WIBDI by SPC in August 2012)

SPC (2012). Pest list provided by SPC to WIBDI, August 2012.

WIBDI, 22 June & 29 August 2012 – samples collected and tentatively identified by WIBDI/SQS and further identified via remote diagnostics session with NZMPI on 22 June & 29 August 2012.

WIBDI, August 2012 – samples collected and tentatively identified by WIBDI/SQS in July/August 2012.

Appendix F

Appendix F Photos



Collecting banana samples (Afega)



Collecting banana samples (STEC)



Collecting pests (Atele research station)



Identifying pests (SQS wharf office)



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