Pacific Horticultural and Agricultural Market Access Program (PHAMA)

Report to the Vanuatu Market Access Working Group (VMAWG)

Investigation of the Viability of the High Temperature Forced Air (HTFA) Facility as a Treatment Option for the Export of Fruit Fly Host Commodities to New Zealand

15 MAY 2011

Prepared for

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Abbreviations

Abbreviation	Description
BQA	Bilateral Quarantine Arrangement
HTFA	High Temperature Forced Air
IHS	Import Health Standard
NZMAF	New Zealand Ministry of Agriculture and Forestry
NPPO	National Plant Protection Organisation
NZ$	New Zealand dollar
PHAMA	Pacific Horticultural and Agricultural Market Access Program
QTI	Quarantine Technologies International
RG1	Risk Group 1
RG2	Risk Group 2
RG3	Risk Group 3
URS	URS Australia Pty Ltd
US	United States (of America)
VMAWG	Vanuatu Market Access Working Group
VUV	Vanuatu vatu

Executive Summary

This short term personnel project investigated the viability of re-establishing the High Temperature Forced Air (HTFA) treatment pathway in Vanuatu to facilitate trade in a number of fruits with New Zealand. The HTFA unit has not been used for a number of years and it is estimated that it would cost between 643,000 and 1,484,142 Vatu to get the unit to a state of repair where it could meet New Zealand's heat treatment specifications. A further estimated 157,485 Vatu may be needed to cover the costs of a New Zealand officer to travel to Vanuatu and audit the HTFA treatment pathway to allow trade to commence.

The costs associated with transporting, treating and exporting fruit to New Zealand from Vanuatu are relatively expensive, although they are not at present considered to be too prohibitive to prevent exports of higher value products such as limes and eggplant. There are, however, a number of risks associated with this export pathway which at this time outweigh any potential benefits of its re-establishment.

Limes and eggplant are the two commodities that would, at present, achieve the greatest returns in the New Zealand market. However, re-establishment of the HTFA treatment pathway to facilitate exports of these commodities cannot be justified at this time. Limes are currently exported to New Zealand via another treatment pathway and a shift in eggplant variety produced in Vanuatu would probably be needed to realise the potential of the New Zealand market.

There is a possibility that the Australian market may become available to Vanuatu papaya in the short- to mid-term future. This could result in a significant increase in opportunity for exports via the HTFA treatment pathway. There is not, at this time, enough information available to factor this potential market into the current viability study however.

Based on this study it is recommended that the re-establishment of the HTFA treatment pathway should not be pursued at the current time. It is further recommended that the Vanuatu Market Access Working Group (VMAWG) considers investigating the feasibility of processing fresh products to secure potential niche markets where competition may be minimal.

Recommendations

Based on this viability study it is recommended to the VMAWG that:

- Re-establishment of the heat treatment pathway for exporting fruit fly host commodities to New Zealand should not be pursued at the present time.
- A watching brief should be maintained on the situation in relation to Vanuatu's market access request for papaya into Australia, and if this pathway seems likely to open, the potential viability of the HTFA treatment pathway could be reconsidered based on market research and this report.
- If trade in limes with New Zealand continues to be strong, and an alternative treatment to methyl bromide fumigation is desirable, a systems approach could be investigated.
- In future deliberations on trade opportunities due consideration should be given to the market potential for processed commodities.

Background

1.1 The New Zealand Import Health Standard Framework

Risk goods, including plants and their products, cannot be imported into New Zealand unless an Import Health Standard (IHS) has been issued providing for imports of the risk goods concerned. An IHS essentially specifies the requirements that must be met to effectively manage those risks potentially associated with the risk goods. The Biosecurity Act (1993) is the principal legislation concerning the importation of risk goods into New Zealand, and import health standards are issued pursuant to Section 22 of that Act.

In the context of fresh produce, fruit and vegetables are generally considered to be risk goods, the risks associated with these are those arthropod pests, vectors and disease causing agents that may enter New Zealand on or within the fruit and vegetables or associated packing material.

1.1.1 Permitted Fruit and Vegetables from Vanuatu

A total of twenty four import health standards have been issued that allow the importation of fruit and vegetables into New Zealand from Vanuatu. A summary of these fruits and vegetables, and the date of issue for their respective IHS', is included in Table 1-1. The terms RG1, RG2 and RG3 used as headings in Table 1-1 refer to the older New Zealand pest classification system whereby pests were "ranked" into risk groups (RGs) in accordance with their potential impacts. The column headed RG3 refers to fruit flies of economic significance.

Table 1-1 Summary of commodities permitted to be exported to New Zealand from Vanuatu [Extracted from Biosecurity New Zealand Standard 152.02]

Scientific name	Common name	RG1	RG2	RG3	IHS date
Ananas comosus	Pineapple	*		*	16/6/1999
Carica papaya	Papaya	*		*	30/5/2006
Citrus aurantiifolia	Lime	*	*	*	17/3/2006
Citrus latifolia	Tahitian lime	*	*	*	17/3/2006
Citrus grandis	Pomelo/Pummello	*	*	*	17/3/2006
Citrus limon	Lemon	*	*	*	17/3/2006
Citrus paradisi	Grapefruit	*	*	*	17/3/2006
Citrus reticulata	Mandarin/tangarine	*	*	*	17/3/2006
Citrus paradisi x reticulata	Tangelo	*	*	*	17/3/2006
Citrus sinensis	Orange	*	*	*	17/3/2006
Cocos nucifera	Coconut	*			Roll over
Colocasia esclenta	Leaves, taro	*			Roll over
Colocasia esclenta	Taro	*			Roll over
Cucumis sativus	Cucumber	*	*	*	16/6/1999
Cucurbita maxima	Squash	*	*	*	7/7/1999
Dioscorea sp.	Yam	*			Roll over
Manihot esculentus	Cassava	*			Roll over
Phaseolus sp.	Beans, Green/French	*			Roll over

Scientific name	Common name	RG1	RG2	RG3	IHS date
Solanum melongena	Eggplant	*	*	*	14/01/2005
Vanilla	Vanilla	*			Roll over
Xanthosoma sagittifolium	Leaves, tarua	*			Roll over
Xanthosoma sagittifolium	Tarua	*			Roll over
Zea mays	Sweetcorn	*			29/7/1998
Zingiber officinale	Ginger	*			29/6/1998

1.2 Bilateral Quarantine Arrangements

In the case of risk goods that are potential hosts to exotic fruit fly species the requirements for managing the risk of fruit fly species being introduced into New Zealand in association with these risk goods are further elaborated through technical arrangements between the New Zealand Ministry of Agriculture and Forestry (NZMAF) and the counterpart National Plant Protection Organisation in the country of origin of the risk goods. These technical arrangements are known as Bilateral Quarantine Arrangements (BQAs), and typically (but not always) seek to manage the risks associated with fruit fly host products offshore before the product arrives in New Zealand.

A BQA documents New Zealand's requirements for managing fruit fly species of economic significance that are potentially associated with fruit and fruiting vegetables imported into New Zealand from an exporting country. Specifications for each approved fruit fly management pathway are included as an Appendix to the BQA. A summary of those fruit fly host commodities permitted to be exported to New Zealand from Vanuatu, and the agreed fruit fly management (or "Treatment") pathways are provided in Table 1-2.

Table 1-2 Summary of fruit fly host commodities permitted to be exported to New Zealand from Vanuatu, grouped by their respective fruit fly treatment pathway [Extracted from Biosecurity New Zealand Standard 152.02]

BQA Appendix	Treatment	Specification	Commodity
1	Fruit Fly Pest Free Areas	"Country freedom" from exotic fruit flies	All fruit fly host material covered by a valid import health standard.
2	Non-host Status	Non-host status based on maturity	Cucumber (*Cucumis sativus*) Pineapple (*Ananas comosus*) Squash (*Cucurbita maxima*) Tahitian lime (*Citrus latifolia*) Pomelo – variety Reinkin (*Citrus maxima*)
3	Heat Treatment	Fruit temperature raised from ambient to 47.2°C and then held for a minimum of 20 minutes	Eggplant (*Solanum melongena*) Grapefruit (*Citrus paradisi*) Lemon (*Citrus limon*) Lime (*Citrus aurantiifolia*) Mandarin/tangerine (*Citrus reticulata*) Orange (*Citrus sinensis*) Papaya (*Carica papaya*) Tangelo/tangor (*Citrus reticulata x Citrus paradisi*)

Those commodities in Table 1-2 that are covered by the New Zealand-Vanuatu BQA Appendix 3 are currently permitted to be exported to New Zealand from Vanuatu using the High Temperature Forced Air (HTFA) treatment pathway. The economically significant fruit fly species associated with these commodities at which the HTFA treatment is targeted is *Bactrocera trilineola*. For further information about this species please refer to the Secretariat of the Pacific Community species profile at http://www.spc.int/pacifly/Species_profiles/B_trilineola.htm.

Status of the Vanuatu HTFA Unit

The Vanuatu HTFA unit is unique in the South Pacific as it was originally built for another application and subsequently modified by Quarantine Technologies International (QTI) to conform to NZMAF Standards. It is different to the other HTFA units manufactured by QTI and used in the South Pacific.

The HTFA unit was modified and installed in Vanuatu in late 2003/early 2004, and subsequently audited by the NZMAF in late May 2004. The unit was officially accredited by NZMAF prior to the release of the IHS for eggplant in January 2005.

NZMAF issued further IHS' in 2006 for limes, lemons, grapefruit, mandarins, tangelos, oranges and papaya. NZMAF import records indicate consignments of grapefruit were exported to New Zealand in 2006 and lemons were exported to New Zealand until 2008. No imports of papaya or eggplant have been recorded in the NZMAF imports database, however, local memory recalls that eggplant were treated at the facility. Perhaps these were test runs to determine the effects of the treatment on fruit quality, with the product never having been exported from Vanuatu.

From discussions with various parties in Vanuatu with historical knowledge of the HTFA treatment pathway it is apparent that motivation to use the facility rapidly declined following the passing of the manager (and key operator) of the facility in 2007. It is also apparent that exports to New Zealand by the HTFA treatment pathway were sporadic and of a test nature; ongoing commercial trade was never realised. At that time there was also a considerable focus on exporting to New Caledonia which apparently detracted from the focus on the New Zealand market. This may also have been a contributing factor to commercial trade with New Zealand never having been established.

Local knowledge and NZMAF import records indicate that the HTFA unit has not been operated since 2007, or possibly 2008. A visit to the facility revealed that superficially the unit itself appears to be in a state of good repair and fully intact. All readily visible cabling to and within the unit also appears to be in original condition. The only observable discrepancy with the unit is the loss of the computer and associated QTITreat software used to control and operate the unit and record temperature sensing information. A data-logging interface was also not observed during the visit, however, it is not known at this point how the temperature sensors are interfaced with the computer. Those with historical knowledge of the unit also confirmed the above-mentioned observations.

There is no way, from observations alone, to ascertain whether the electronics, fan motors, hot water boiler and hot water pump are serviceable. There is also no way to determine whether the heat sensors in the unit are functioning correctly just through observation. The serviceability of these components could only be investigated once the unit was interfaced with a controlling computer and tested. Given that the unit has not been operated for some time it is more than likely that some of the electronic and mechanical components may be unserviceable.

The facility itself also appears to be in a good state of repair. The secure side of the chamber appears solid and intact, with no breaches to its security that may allow fruit fly entry observed.

Actions Needed to Make the HTFA Unit Trade-Ready

3.1 Overview

There are two broad sets of actions necessary to make the unit fully operational in the sense that it will be ready to "treat product for export to New Zealand". Initially, a suitable personal computer with the QTITreat controlling software installed will need to be sourced and connected to the unit. The unit will need to be tested to prove the operation of working components, and any unserviceable components would need to be repaired/replaced. The machine would then need to be tested to prove that it can deliver the requisite treatment, including suitable ramp-up and ramp-down temperatures within those parameters necessary to maintain fruit quality.

Once the unit was considered to be functioning correctly it would then be necessary to achieve NZMAF accreditation of the unit and treatment pathway for export. The chamber would need to be thermally mapped to determine the "cold spots" where the probed fruit would need to be positioned during treatment runs. Treatment operator/s would need to be able to demonstrate their competency in fulfilling the treatment specifications, as would those that will be calibrating the temperature sensors, installing sensors in fruit and positioning probed fruit within the chambers.

Once the Vanuatu National Plant Protection Organisation (NPPO) is satisfied that the treatment pathway meets New Zealand's requirements they would need to seek NZMAF accreditation for the facility. A NZMAF audit may take about 2–3 days, depending on the scope of the audit.

The overview provided above is expanded upon in the following sections.

3.2 Actions Needed to Make the HTFA Unit Functional

3.2.1 New Computer Equipment and Software

Given the relatively low processing requirements for controlling/monitoring the system and capturing treatment data a personal computer with reasonably basic specifications should be capable of fulfilling this function. The developer of the QTITreat software prefers to use a Windows XP Pro platform to run the software. Quarantine Technologies International estimates they could supply a new computer with the QTITreat software loaded and tested, as well as a flash drive loaded with the QTITreat software and additional program to load the software onto a backup computer, for approximately NZ$2800. This price would also include an updated operating manual for the system.

A basic printer would also be needed to print the treatment log, at an estimated cost of NZ$100.

3.2.2 Test and Repair

Once the personal computer loaded with the QTITreatment software has been installed the unit will need to be tested, initially to ascertain what components may be unserviceable, and secondly to confirm that it can meet the NZMAF treatment specification.

Given that the unit has not been operated for some time it is likely that some of the electronic and/or mechanical components may have become degraded or unserviceable. Some costs for components that may need to be replaced have been estimated by Quarantine Technologies International and are given below. Note that not all of these components may need replacing.

- Major motor controller of the hot water pump NZ$1800 (it is likely that this will need to be replaced)
- Complete electronic control system NZ$3800 (full system may not be needed)
- Signal isolators and line filters NZ$400 each
- A new set of temperature sensors, at NZ$550 per sensor, would cost NZ$5500 (a full set may not be needed)

3.2.3 Thermal Mapping

Thermal mapping is a procedure that is used to ascertain the appropriate locations to position probed fruits during treatment. The correct positioning of probed fruit is critical to ensure that all fruit in a treatment batch achieves the minimum treatment specification. The principal relies on measuring the pulp temperature of the largest fruit in a treatment batch which are positioned in the coldest locations in the chamber. In effect, all other fruit in the treatment chamber will exceed the minimum treatment specification.

The unit will need to be mapped and the results used to identify any “cold” spots in the chambers. Records of the thermal mapping trial will need to be maintained for reference during treatment runs, and will need to be current for NZMAF assessment during audit.

The thermal mapping exercise would need to be conducted once the unit has been tested and any unserviceable components have been repaired/replaced. The cost of this exercise would be included in the estimated figure provided in Section 4.2.4 below.

3.2.4 Expertise

It would be necessary to import expertise to install and interface the controlling computer, test the unit and identify and carry out any remedial actions that may be necessary, and perform thermal mapping of the chamber. The most likely, and perhaps only, source of expertise would be Quarantine Technologies International. Quarantine Technologies International estimates that these activities would take a total of seven days. Estimated costs are provided below:

- Seven days to repair, test and map the HTFA unit at NZ$3680 total
- Two days travel time at NZ$1050 total
- Seven nights’ accommodation and per diems at NZ$1750 total

3.2.5 Cost Summary

The following cost summary is based on the figures estimated above and provides an indication of the minimum cost of getting the HTFA unit to a stage that would be considered ready to meet New Zealand’s treatment specifications.

Table 3-1 Summary of the estimated minimum costs to make the HTFA unit fully functional.

Item	Estimated cost (NZ$)	Estimated cost (VUV)
New computer loaded with QTITreat software (includes back-up on flash drive and current operational manual)	$2800	194,052
Seven days for QTI consultant to repair, test and map the HTFA unit onsite	$3680	255,039
Two days travel time for consultant to travel to and from Port Vila	$1050	72,769
Seven days per diem at NZ$250/day	$1750	121,282
TOTAL	**$9280**	**643,142**

Depending on the condition of electronic and/or mechanical components of the unit, which will only be able to be ascertained during testing, further costs could be expected. It is estimated in a worst case scenario that up to a further NZ$12000 (841,000) may be needed.

3.3 Actions Needed to Make the HTFA Unit Ready for Export

3.3.1 Operating Manuals and Procedures

The HTFA treatment pathway will need to be fully documented. The three operating manuals/operating procedures previously accepted by NZMAF and referred to in Appendix 3 to the BQA will need to be checked for currency and updated where necessary.

If updates to the manual/procedures are necessary these documents should be forwarded to NZMAF for review and acceptance prior to the arrival of the NZMAF audit team.

The manuals/procedures referred to in Appendix 3 to the BQA that may require updating are:

- The Vanuatu Quarantine and Inspection Service document “Quarantine Procedures for the export of fruit fly host commodity from Vanuatu to New Zealand using high temperature forced air”
- “Vanuatu Fresh Disinfestation Facility – Operation Manual for commercial hot air treatment (high temperature forced air/vapour heat treatment)”
- “Vanuatu Fresh HTFA Procedure Manual”

3.3.2 Training

It is unlikely that expertise in operating the unit is current or even available, so training would need to be sourced for the intended operators of the unit. Training could be provided by the manufacturer in conjunction with their testing of the unit outlined above.

3.3.3 Approval by the Vanuatu NPPO

Prior to seeking accreditation by NZMAF the Vanuatu NPPO must be satisfied that the unit can be competently operated to treat export fruit in accordance with the NZMAF treatment specification. Depending on the level of involvement the Vanuatu NPPO has with the repair, testing and mapping of the HTFA unit it may choose to audit the treatment facility or otherwise may be satisfied that the unit meets NZMAF specification through their involvement in the repairs to the unit.

Costs associated with the Vanuatu NPPO approval of the HTFA unit would likely be negligible given their commitment to assisting industry establish trade with New Zealand via this treatment pathway.

3.3.4 NZMAF Accreditation of the HTFA Treatment Pathway

The Vanuatu NPPO will need to liaise with NZMAF to seek re-accreditation of the unit. Given the discontinuity in treatments and the length of time the unit has been unused and/or unserviceable it is likely that NZMAF would need to conduct a full systems audit of the HTFA treatment pathway in Vanuatu before it could be re-accredited for exports. It is probable that NZMAF would need between 2 to 3 days in Port Vila to conduct a full systems audit of the HTFA treatment pathway; this would allow time for a second treatment to be conducted should any issues arise during observation of an initial treatment run. It would be reasonable to allow a full 4–5 days for the audit, including flight time for a NZMAF auditor to travel to Port Vila.

NZMAF has indicated that resources for re-accreditation of the HTFA treatment pathway in Vanuatu have not been included in their current work program, and therefore, no funding has been specifically allocated for this activity. Accordingly, funding for re-accreditation activities (ie. an observational audit) within the current work program year would need to be provided by another party.

At a minimum it would be reasonable to expect that the costs for flights and per diems would need to be provided. Estimates for these costs, for a single auditor, are provided below:

- Flights Wellington –Port Vila return NZ$1200
- Per diems in Port Vila for 3 nights NZ$1050

It is not known at this time whether NZMAF would charge for the auditor's time, or whether this would be contributed in-kind.

3.3.5 Cost Summary

The tangible costs associated with having the HTFA treatment pathway accredited to treat fruit for export to New Zealand relate to the costs of a NZMAF audit of that treatment pathway. The minimum cost would be expected to be in the vicinity of NZ$2250 (157,485 Vatu).

Trade-related Considerations

4.1 Permitted Commodities

Those commodities for which there is a valid IHS and which are listed in Appendix 3 to the New Zealand – Vanuatu BQA are permitted to be exported to New Zealand via the HTFA treatment pathway. At this time this includes:

- Eggplant (*Solanum melongena*)
- Grapefruit (*Citrus paradisi*)
- Lemon (*Citrus limon*)
- Lime (*Citrus aurantiifolia*)
- Mandarin/tangerine (*Citrus reticulata*)
- Orange (*Citrus sinensis*)
- Papaya (*Carica papaya*)
- Tangelo/tangor (*Citrus reticulata x Citrus paradisi*)

4.2 Production Levels

Indications from industry parties that were met in Port Vila suggest that while there are no current plantings of any permitted commodities for export markets there is generally enough produce to cater for opportunities should an export market arise. It is apparent that some producers have plans to increase production levels should the HTFA treatment pathway be reinstated.

For eggplant and papaya it is relatively easy to build up production levels in a short timeframe. Citrus requires longer-term planning as it can take up to 5 years before a sufficient crop is available.

It appears to be a “catch 22” situation in some regards: some producers are eager to enter the New Zealand export market but would be cautious to increase production levels until the pathway has been reinstated and positive returns are demonstrated. On the other hand, should time and money be invested in having this treatment pathway reinstated without any demonstrable production capacity?

4.3 Logistics and Costs

Discussions with various parties revealed that the logistics of the pathway, both domestically and internationally, is quite complicated, unreliable and costly.

4.3.1 Transportation to the HTFA treatment facility

Contractual arrangements and management of the treatment facility have not been determined as yet, so it is not known who will be responsible for arranging transport between production areas and the treatment facility.

Obviously, the cost of transporting produce to the treatment facility varies in relation to the distances involved. Not all producers have vehicles that can be used to transport sufficient quantities of produce into Port Vila, and on the assumption that this service may need to be purchased, these costs should be factored in.

Discussions with producers indicate that where transport needs to be hired it will cost approximately 10000 Vatu to move 600–700kg of produce a distance of 10–15km in a 1 ton pickup to the HTFA

treatment facility in central Port Vila. This may increase to 15000 Vatu for greater distances up to 25 km. It would not be economically viable to source product from other Islands in Vanuatu.

Slightly cheaper transport can be had although it is less reliable and would not be appropriate to use where orders need to be met.

4.3.2 Sorting and Grading

The point that sorting and grading occurs will be dependent on exporter-producer contractual arrangements, as well as arrangements with the treatment facility. Where a producer is also an exporter it is likely that product will be graded to a high degree before arriving at the treatment facility, and accordingly, all or most of the product will be available for treatment.

Where an exporter purchases product from a producer for treatment and export, and unless specific contractual arrangements are put in place grequiring quality standards, it is possible the product will need to be sorted at the treatment facility to save on double handling. That is, double handling would involve transporting the product to the exporter's premises for sorting and grading before transporting it to the treatment facility.

This approach may be inefficient in that not all product arriving at the treatment facility will be of export quality and the treatment facility may not be used at its optimal capacity. For example, if 700kg of relatively unsorted/ungraded fruit arrives at the treatment facility a percentage of this fruit may be culled leaving a smaller treatment batch.

4.3.3 Treatment Capacity

Each side of the treatment chamber is thought to hold up to approximately 1 ton of fruit, so a theoretical 2 tons of fruit can be treated per treatment batch. However, in reality, and particularly with less dense fruit such as eggplant, it is thought that between 150 and 500 kg would be the maximum capacity per side of the chamber. A reasonable estimate for the purpose of this review would be a maximum of 600–800 kg of fruit per treatment batch.

It has also been estimated that a treatment run, from the time that loading of the chambers commences to the time that treated fruit has been removed from the chambers into the secure area takes anywhere from 4 to 8 hours. A reasonable estimate for completion of a treatment batch for the purpose of this review is a minimum of 6 hours, which includes 1 hour for unloading at the facility, sorting and grading, and 5 hours for the actual treatment. Accordingly, one treatment run is possible during a normal work day.

Some discussions were held on increasing the number of work shifts per day to effectively increase the number of treatment runs that could be carried out. While theoretically possible some considered that it would not be practical because attention to detail declines rapidly after normal work hours, potentially leading to both quality and phytosanitary issues. The costs associated with penalty rates for workers and quarantine supervision may also be prohibitive outside of normal working hours.

4.3.4 Treatment Costs

The three major costs associated with the treatment facility are labour, electricity and phytosanitary supervision, inspection and certification.

Electricity

Electricity is relatively expensive in Vanuatu, costing on average 37.65 Vatu/kWh. There is also a standard 80,000 Vatu/month fixed charge for access to a 3-phase supply.

Quarantine Technologies International estimates that the HTFA unit draws approximately 15kW. At a cost of 37.65 Vatu/kWh for energy this equates to 564.75 Vatu/hour of operation. Therefore, a treatment of 5 hours duration would consume approximately 2824 Vatu of electrical energy.

This figure is approximate only, and does not include electrical energy consumed by other equipment/appliances used at the HTFA facility during treatment. It also does not factor in the relative proportion of the 80,000 Vatu/month fixed charge for a 3-phase supply that could be attributed to each treatment run, if this is the only activity being conducted at the site and assuming that the unit will be connected to a 3-phase supply.

In a worst case scenario, assuming that HTFA treatments are the only activity consuming electrical energy at the site (and therefore the 80000 Vatu/month fee must be apportioned against the HTFA treatments), and assuming 10–15 treatments were being conducted per month, the cost of energy per treatment may be in the order of 8157–10824 Vatu.

Given the level of uncertainty in the use of the facility, and the number of treatments that would be undertaken, it is not reasonable to draw any conclusions on energy cost per treatment except to speculate that it would be relatively expensive.

Labour

Labour costs in Vanuatu are relatively high in comparison to other Pacific Island Countries. Industry parties have estimated the real costs of an employee based on the minimum wage of 20,000 Vatu/month to be 1800–2000 Vatu per day. This figure takes into account all employee entitlements, and is for unskilled labour only. Skilled labour can be double or triple this amount, depending on the level of supervisory responsibility also attached to the position.

It is estimated that a treatment run would involve at least 2 unskilled and 1 skilled positions to load/unload product, install probes and supervise and monitor/control the treatment. The unskilled positions would not be utilised throughout the entire treatment and could be deployed to other duties while the treatment is in progress. However, if no other duties are available onsite it may be impractical to deploy them to another location for a relatively short period of time.

In a worst case scenario where the unskilled positions could not be redeployed to other duties for part of the treatment time, and assuming an 8 hour working day and 6 hour treatment length, estimated labour costs would be:

- 2 x unskilled positions for 6 hours at 250 Vatu/hour each = 3000 Vatu
- 1 x skilled position for 6 hours at 500 Vatu/hour = 3000 Vatu

Therefore, total labour costs for a treatment run may be in the vicinity of 6000 Vatu. Obviously, this is a simplistic approach to estimating labour costs and figures may vary significantly depending upon arrangements. If two treatment runs are conducted per day costs may be greater due to the introduction of penalty rates.

Phytosanitary supervision, inspection and certification

There is an expectation by the Vanuatu Department of Livestock and Quarantine that treatments will be supervised rather than monitored. Accordingly, a quarantine officer will need to be present through the entire treatment run. The daily rate for a quarantine officer is currently set at 2000 Vatu/day. This rate doubles where a quarantine officer is required to be in attendance outside of the normal working day.

For previous HTFA treated consignments exported to New Zealand the Quarantine Service did not charge for these activities, seeing their participation as a vital contribution to getting trade with New Zealand established. However, if trade should be re-established for this pathway the Quarantine Service will need to recover their costs and these charges will need to be met.

The standard cost for phytosanitary export inspection and certification is 5000 Vatu per consignment. It is likely that a single treatment run will constitute a single consignment for the majority of the time (see later discussion about airfreight), and therefore, this cost will generally be attributable to each treatment batch.

4.3.5 Freight Availability

Perhaps one of the major obstacles to trade in fresh products with New Zealand is freight, both in terms of availability and cost.

Air freight

Given the perishable nature of these products air freight is desirable. However, there are only two daily flights between Port Vila and Auckland, each with their respective issues.

Air Vanuatu operates a Boeing 737-800 which leaves Port Vila at 0700, arriving in Auckland at 1105. Space availability for horticultural exports is limited to 1000kg, and competition for available space may be strong. This would particularly be the case during the winter months of July and August when consignments of sweet corn are exported to New Zealand on a daily basis.

Air Vanuatu is seen as being quite unreliable as flights will at times leave before product has been loaded. There is also only one Air Vanuatu aircraft available to service Vanuatu, which adds to its perceived unreliability. Previously, under sharing arrangements with Qantas, if the Air Vanuatu aircraft became unserviceable for any length of time Qantas would provide a replacement aircraft. This arrangement is no longer in place and when the Air Vanuatu aircraft becomes unserviceable all flights are cancelled. On occasions there are no Air Vanuatu flights to Auckland for 2–3 days.

Another drawback with this flight is that with the 737-800s there is no option to use air containers. All cargo must be hand loaded and stacked in the cargo bay. The rounded shape of the cargo bay adds further issues for large cartons in that it is difficult to efficiently and securely stack the cartons.

Air New Zealand operates an Airbus Industrie A320 between Port Vila and Auckland. This flight is scheduled to leave Port Vila at 1100, arriving in Auckland at 1500. Air New Zealand is regarded as being quite fickle in that at certain times of the year they suspend flight operations and enter a code-share arrangement with Air Vanuatu for their flight. The general sense is that there is no reasonable competition in pricing between Air New Zealand and Air Vanuatu, and Air Vanuatu, with all its perceived failings, is the better option of the two.

The option to transit to Auckland via an Australian airport is not considered feasible. Costs would be prohibitive and delays at the Australian port would have a deleterious effect on the produce.

There is little likelihood that more flights, or larger aircraft, will become available in future. There is no indication that passenger numbers will increase significantly between Vanuatu and New Zealand. The approach to Port Vila airport is considered to be one of the most difficult in the world, greatly reducing the likelihood that larger aircraft will be utilised in future.

Sea freight

Sea freight, at this time, is not considered to be an option for freighting fresh produce to New Zealand. Shipping to, and within, Vanuatu is seen as being very unreliable. Shipping times vary depending on the route of the voyage, with a direct route between Port Vila and Auckland taking approximately 3 days.

4.3.6 Freight Costs

Given that airfreight, with Air Vanuatu, is considered to be the only option available at the present time this discussion will focus on those costs associated with moving product from the treatment facility to the airport for freighting with Air Vanuatu.

Where it is necessary to hire a truck (and driver) to transport a consignment from the treatment facility to the Air Vanuatu terminal the cost for 1 hour is 5000–7500 Vatu. These vehicles are generally about 3 ton in capacity, so any co-sharing of the load is desirable.

Charges for moving and loading product at the airport are at a set rate depending on weight. Forklifts used to unload and moved consignments cost 500 Vatu for a consignment up to 500kg, then an additional 500 Vatu for consignments between 500 and 1000kg. Handling (ie. loading and stacking in the aircraft) is 23 Vatu/kg. Where a consignment needs to be stored in a cool room overnight, which may often be the case, the cost is 20 Vatu/kg. The fee for the airway bill is a flat 5000 Vatu. Airfreight costs from Port Vila to Auckland are currently 110 Vatu/kg.

4.3.7 Cost Summary

The following cost summary is based on the estimated figures provided above and is a rough indication of costs only. In estimating the cost per treatment run the following assumptions have been made:

- Product is sourced from a farm a distance of up to 15km from the treatment facility.
- A total of 700 kg is sourced from a farm for a treatment run, however, after sorting at the HTFA facility 100 kg of fruit is culled leaving a total of 600 kg of fruit for treatment.
- Electrical energy costs are calculated on a typically worst case scenario where 3-phase power access costs 80,000 Vatu/month and this cost is apportioned against 15 treatments per month, each consuming 2,824 Vatu of electrical energy. Total cost per treatment (5 hours) is 8157 Vatu.
- Labour costs are based on the need for 2 unskilled and 1 skilled positions for 6 hours duration at a total cost of 1000 Vatu/hour.
- It is assumed that phytosanitary supervision by the Vanuatu NPPO would be purchased at the daily rate of 2000 Vatu/day.
- It is assumed that a consignment will be composed of fruit from a single treatment run.

- One consignment will be transported to the airport at a time (ie. no sharing of transport costs with other consignments).
- The weight of packaging material is not taken into account in these cost estimates.
- Costs for using the treatment facility are not considered in these cost estimates.

Table 4-1 Estimated costs for the HTFA treatment pathway, from the time of harvest through to the time of arrival of product in New Zealand.

Pathway component	Estimated costs (VUV)	Estimated cost per treatment run (VUV)
Transport from farm to HTFA facility	10,000	10,000
Treatment run – electricity	37.65 Vatu/kWh + 80,000 Vatu/month for 3-phase access	8,157
Treatment run – labour (includes sorting/grading prior to treatment)	2 x unskilled positions at 250 Vatu/hour each 1 x skilled position at 250 Vatu/hour	6,000
Phytosanitary supervision	2000 Vatu/normal work day	2000
Phytosanitary inspection and certification	5000 Vatu/consignment	5000
Transport of consignment to airport (where it is necessary to hire a vehicle and driver)	5000–7500 Vatu/load	5000
Unloading and moving product with a forklift	500 Vatu up to 500 kg, 1000 Vatu for 500 – 1000 kg	1000
Overnight storage of consignment in cool room	20 Vatu/kg	12,000
Loading and stacking of consignment in the aircraft	23 Vatu/kg	13,800
Airway bill	5,000	5,000
Air freight costs	110 Vatu/kg	66,000
TOTAL	**–**	**133,957**

Based on the above costs and assumptions it may cost 223 Vatu/kg of fruit from the time of harvest to the point of arrival in New Zealand. At the current exchange rate of NZ$1 to 70.17 Vatu this is approximately equivalent to NZ$3.18/kg.

The costs associated with import clearance, distribution and sale in New Zealand will add to the price of the retail product. It is difficult to ascertain the final retail price of any product in New Zealand as this will fluctuate with supply and demand.

Obviously, a much larger return than 223 Vatu/kg would be needed to make the cost of production, harvest and export viable.

4.4 The New Zealand Market

4.4.1 Commodity Returns

It is reasonable to expect that returns would fluctuate considerably in the initial export phase in response to competition from other suppliers. Subsequent trade may remain relatively opportunistic, at least until consistent trade and confidence is established in the pathway. It is very difficult to provide

an indication of the returns that could be expected for permitted commodities as this will change over time.

At the time of this review limes were considered to have the best potential in the New Zealand market, with returns of NZ$14 (970 Vatu)/kg expected. Trade in other citrus commodities was considered to be relatively nonviable at this time, except on a very opportunistic basis, given the high volumes of relatively cheap US and Australian citrus that enter the New Zealand market. These two suppliers provide almost year-round coverage of other citrus varieties in New Zealand.

Eggplant is considered to have market potential, however, a shift in the varieties produced in Vanuatu or a change in varietal preferences in New Zealand may be necessary. The eggplant variety produced in Vanuatu is preferred by New Zealanders of Pacific and Asian descent, a market for which Fiji has established trade and potential competitive advantages. It is thought that in general New Zealander's that are not of Pacific or Asian descent prefer the Black Beauty (large-roundish) type eggplant fruit, for which returns of $3/fruit can be expected.

At the lower end of the return scale of potentially viable products is papaya. Varieties are available all year round in Vanuatu, however, there are considerable quality/consistency issues experienced. Competition with Fiji would be the major issue as this producer has been supplying the New Zealand market for some time and is currently investing considerable resources in research into growing and transporting their crops to both New Zealand and Australia. In Fiji a return of Fiji 30c (15 Vatu)/kg to growers for papaya is considered good and is achievable in the New Zealand market.

4.4.2 Competition and Export Windows

As with any supply and demand scenario there will generally be highs and troughs in returns from exports. A major limitation in starting up exports is that it may be necessary to ride out the troughs for some time in order to establish a market. Once importer/buyer confidence has been established it may then be possible to shift towards supplying more specific windows for selected commodities. However, if these demand windows do not correspond with production windows the market can be considered as lost and possibly should not be pursued.

Table 4-2 provides a brief summary of other potential suppliers of those commodities permitted to be exported from Vanuatu to New Zealand via the HTFA treatment pathway. By potential suppliers it is meant those countries for which IHS' and BQAs have been established.

Table 4-2 Summary of countries that are potential competitors with Vanuatu for products that can be exported to New Zealand by the HTFA treatment pathway [derived from Biosecurity New Zealand Standard 152.02].

Scientific name	Common name	Countries permitted to export to New Zealand
Carica papaya	Papaya	Australia, Cook Islands, Fiji, Philippines, Samoa, Tonga, US (Hawaii)
Citrus spp	Citrus (various)	Australia, Egypt, Japan (mandarins only), Mexico (oranges only), New Caledonia (Tahitian lime only), Samoa (Tahitian lime only), Spain (oranges only), US
Solanum melongena	Eggplant	Cook Islands, Fiji, New Caledonia, Samoa, Tonga

The treatment pathway for citrus and papaya from other countries may not necessarily consist of a heat treatment as it does for Vanuatu. For example, Australia can export citrus to New Zealand via

pest free area and cold disinfestation treatment pathways. Both Australia and the US (Hawaii) can export papaya to New Zealand via a gamma irradiation treatment pathway.

Although these countries are permitted to export these commodities to New Zealand it does not necessarily mean that they do and would be potential competitors with Vanuatu. However, some of these countries have long term commercial trade linkages and considerable market experience in a number of these commodities and may present considerable barriers to Vanuatu in terms of competition.

4.4.3 Varietal Issues

Although a commodity may be in demand in a given market it is important that market research is undertaken to ensure that varietal issues are not an impediment. The eggplant issue outlined above, whereby a different variety eggplant fruit than that produced in Vanuatu might have greater potential in the New Zealand market, demonstrates this.

In contrast, however, the bush lime trade demonstrates that markets can change when supplies of a commodity are very limited. It was noted during the visit that NZMAF recently permitted imports of bush limes from Vanuatu via a methyl bromide fumigation treatment pathway. Bush limes would typically not be in demand in the New Zealand market, however, given the shortage of limes in New Zealand demand (principally by the hospitality industry) effectively saw the opening of trade in this commodity.

4.4.4 Consistency of Supply

Perhaps one of the key issues in establishing and maintaining markets is that of providing consistent supply, both in terms of the agreed timing of trade and quality of product. Unless consistent supply can be established long term trade can be hampered through lack of confidence. This, of course, does not mean that opportunistic trade is not possible.

Two of the key factors that may hamper Vanuatu establishing long term trade are an inability to supply consistent product (in terms of quality) and an inability to supply enough product to meet market demands, when required. Product quality is a controllable factor (except where severe weather events occur), but it may take time to achieve this. For example, the quality of papaya grown in Vanuatu varies markedly. Variations in production methods and the quality of planting materials are two main contributors to this variation. Blemished and mishappen fruit are not necessarily discriminated against in the local market as they are in many foreign markets, so production controls used to prevent this may be minimal. Controls on planting material (seed) may also be minimal with growers opting to keep seed from each crop for subsequent planting rather than purchase seeds of better parentage.

The ability to supply sufficient quantities of fruit to meet market demands is partially controllable through the level of production, however, limitations in throughput of the HTFA unit and an inability to secure ongoing and consistent amounts of airfreight space are beyond the control of the export industry.

Additional Considerations

5.1 Contractual Arrangements, Roles and Responsibilities

Before the treatment pathway could become viable, and excluding any repairs needed in order to get the HTFA unit operational, contractual arrangements, roles and responsibilities in the export pathway need to be considered and clearly defined:

- At this time there is concern that access to the HTFA facility, in its present location, may not be available in the long term. The HTFA facility is privately owned and may be needed for other purposes in future. In order to secure confidence in the long term availability of the HTFA unit it has been suggested that the unit could be purchased and moved to another location.
- There is no clear picture as to how the export system would operate. Would a single entity be responsible for treatment and export of product? Or would there be a single treatment operator and multiple exporters that could use the treatment facility? If so, how would treatments be procured and prioritised among exporters?

It was suggested that strong competition between producers in Vanuatu means they are not predisposed to working together to reach a common goal. It may be difficult to bring producers together, under a common standard, to provide product for treatment.

5.2 Rising Labour and Freight Costs

As mentioned earlier, labour costs in Vanuatu are relatively expensive. Some parties indicated there is a chance that wages may be raised again by up to 50% in the near future. This may have significant flow-on effects to production, transport, treatment, packing and air freight costs.

Similarly, freight charges are open to increase at any time. Fluctuations in the price of fuels may result in freight costs becoming prohibitive.

5.3 Freight Space Availability

The freight space issues discussed earlier were indicative of the current situation. There is no guarantee that even these relatively small airfreight volumes will be available in future if competition for airfreight space increases.

5.4 Processing to Add Value to Products

There are strong views that rather than attempt to enter an already competitive market for perishable products, for which Vanuatu may be significantly disadvantaged in terms of costs and freight space availability, Vanuatu should collectively focus on identifying new opportunities and potential niche markets. Processing to add value to products is such a niche market and has the following advantages in comparison to trade in fresh fruit:

- Processing, by its nature, will generally manage pest and disease risks and minimise quarantine interventions, resulting in cost savings and reduced clearance times.
- Processing also tends to extend the shelf life of products, overcoming the disadvantages experienced in trading highly perishable products.

- Quality (in terms of visual appearance) of a product is typically not such an issue in processing as it is in the fresh fruit market, meaning that a significant proportion of the crop can be used. This also increases consistency in supply.
- Relatively inexpensive processes can be used for a significant increase in returns.

Juicing fruit is a good example of how value can be added to fresh fruits and considerable returns can be realised. Quality standards for juicing fruit are not as high as fresh produce, enabling more of the crop to be used.

Vanuatu imports significant volumes of fruit juice, both for the domestic market and the tourist trade. With some planning, training and access to juicing technology a significant proportion of this juice could be produced locally. Given that exports are not the objective, trade pathways would be greatly simplified.

5.5 Opening of the Australian Market

Australian Department of Agriculture, Fisheries and Forestry officials were in Vanuatu during the first week of May to discuss export pathways for papaya and Island cabbage. The outcomes of the visit are as yet unknown, however, it is possible that Australia may soon announce the commencement of an Import Risk Analysis or Policy Review for papaya fruit from Vanuatu.

If this was the case it is more than likely that a HTFA treatment would be assessed as the management option for economically significant fruit fly species in Vanuatu. Depending on the outcomes of Australia's assessment trade in papaya fruit may be permitted in the next 2 – 3 years. The relative advantages of the Australian market are:

- Australia is a bigger market than New Zealand and there is a possibility that greater returns for papaya fruit could be realised from this market.
- A reasonable number of commercial flights are available to Sydney and Brisbane, and there may be less competition for available space.
- A Toll cargo flight, with potentially a large freight capacity (up to 16 tons available from Vanuatu), operates weekly between Port Vila and Brisbane. However, freight costs at this time are approximately double those of commercial flights.

There may be an opportunity for other fruit fly host products to be assessed and permitted into the Australian market in future, however, this would be in the medium- to long-term future.

Conclusions

The HTFA unit could be made operational at a relatively modest cost (in comparison to the cost of sourcing and installing a new heat treatment unit). While operating, transport and phytosanitary costs, as they currently stand, are relatively expensive, they are not at this time too prohibitive in terms of reinstating the HTFA treatment pathway for trade in the higher value products (limes and eggplant) with New Zealand.

However, from a business perspective the benefits of reinstating the HTFA treatment pathway to facilitate trade with New Zealand in these commodities appear to be greatly outweighed by the associated risks, which are summarised below:

- Long term access to the treatment facility, in its present location, cannot be guaranteed.
- The limited and inconsistent availability of airfreight space will hamper the establishment of regular commercial trade. It is likely that trade would be opportunistic at best.
- There is no indication that airfreight availability will increase in future, and competition for available airfreight space will remain strong.
- Sea freight, at this time, does not appear to be a viable option.
- An inability to produce consistent volumes and product of a consistent quality may also impede the establishment of regular commercial trade.
- Labour, transport, freight and energy costs, while not too prohibitive now, are subject to change at any time. Even modest rises in any of these costs will impact on returns to growers and exporters.
- Competition for exports from countries with well established trade in the New Zealand market for many of the permitted commodities would be strong throughout much of the year, again, potentially limiting trade to sporadic opportunities as they arise.

Given that limes (at least at present) appear to have most potential in the New Zealand market it seems redundant to pursue the use of a heat treatment for this commodity when methyl bromide fumigation is currently permitted. Although it is desirable to reduce the use of methyl bromide in quarantine applications, if long term trade in limes is desirable then other treatment pathways could be considered. For example, a systems approach based on poor host status and in-field controls could be investigated.

Eggplant is also considered to have a reasonable potential in the New Zealand market, however, the variety produced in Vanuatu is typically only preferred by New Zealanders of Pacific and Asian decent, and Fiji has long-term established commercial trade in this variety in the New Zealand market.

Perhaps the only factor in the short- to medium-term that would significantly increase the benefit/risk ratio for re-establishment of the HTFA treatment pathway is the potential of the Australian market becoming available for papaya from Vanuatu. At the time of this review, however, the outcomes of Australia's visit to Vanuatu during the first week of May are unknown. No announcement has been made publicly to indicate that Australia intends to undertake a risk analysis for Vanuatu papaya, so no further conclusions can be drawn about this potential market.

During discussions with various parties there was a strong view that the pursuit of trade in fresh produce in already competitive foreign markets may not be the best long-term option for Vanuatu. As a producer, Vanuatu is already disadvantaged because of the relatively (in terms of its Pacific neighbours and Asian producers) high costs of production, transport and treatment, as well as the limited and inconsistent availability of airfreight space available for fresh produce. There was a strong

view that it may be in Vanuatu's best interests to pursue niche markets for value-added products rather than attempt to establish or expand access for fresh produce in strongly competitive markets. The relative advantages of processing fresh produce are provided below:

- Processed commodities are generally less perishable and have a greater shelf life than fresh commodities, facilitating exports by seafreight which is considerably cheaper than airfreight.
- Product quality (visual appearance) is not typically a significant consideration when sourcing products for processing, allowing much greater flexibility for growers to sell more of their product.
- Processing fresh commodities typically removes many of the quarantine risks associated with these commodities, thereby decreasing the level of quarantine interventions at foreign borders.
- Vanuatu itself imports significant volumes of processed commodities, some of which could be produced locally with relatively minimal investment in technology.

Limitations

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Appendix A Acknowledgements

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