



# Systems Approaches

## Case Study: Exporting NZ tomatoes

Joanne Wilson & Stephen Butcher

November 2015

*Growing and Protecting New Zealand*



[www.mpi.govt.nz](http://www.mpi.govt.nz)



# Outline

## 1. Introduction

- a) Systems approaches
- b) critical control points

## 2. Case Study: Exporting tomatoes using a systems approach

- a) Background – the industry
- b) Background - the pest of concern
- c) Designing the systems approach (applying Annex 1)
- d) Summary of system

## 3. Group Exercise



# Systems Approaches

Systems approach = 2+ measures that are independent of each other

An independent measure may include dependent measures



# Systems Approaches

- SA can be more difficult to develop and implement than a post-harvest treatment (@probit 9 efficacy)
- The difficulty depends on:
  - Biological characteristics of pest,
  - Biological characteristics of host and its production,
  - Availability of measures
  - Practicality or feasibility of measures
  - Producer etc. acceptance
  - Importing country acceptance



# Systems Approaches

- Types of measures in a systems approach can include:
  1. Pest reduction
  2. Pest exclusion
  3. Pest removal (e.g. brushing)
  4. Pest elimination (e.g. treatment)
- Measures can be applied pre-production, during production, at harvest, post-harvest and during shipping and distribution



# Designing a systems approach using CCP

## ANNEX 1 to ISPM 14

1. Determine the hazards and the objectives for measures within a defined system.
2. Identify independent procedures that can be monitored and controlled.
3. Establish criteria or limits for the acceptance/failure of each independent procedure.



## Designing a systems approach using CCP (cont'd)

4. Implement the system with monitoring as required for the desired level of confidence.
5. Take corrective action when monitoring results indicate that criteria are not met.
6. Review or test to validate system efficacy and confidence.
7. Maintain adequate records and documentation.



# Background: NZ tomato industry

- Less than 300 growers
- Large (5-20 hectare) high technology greenhouses
- Very few tomatoes grown outdoors
- Grow a large number of specialty varieties
- Fresh exports approx. \$8.9m mostly to Australia









# Background: Pest of concern (CaL.)

## *Candidatus Liberibacter solanacearum* (CaL.)

A bacterium first identified in NZ in 2008

NZ voluntarily suspended trade while the following were investigated:

- Validated the pest ID
- Distribution of the disease in NZ
- Hosts affected
- Transmission
- Options (eradication, containment, management)
- Market response



# Background: Pest of concern (CaL.)

- **Hosts:** tomato, capsicum, potato and other solanaceous crops
- **Spread:** Vectored specifically by *Bactericera cockerelli* (tomato/potato psyllid). Not spread mechanically, by seed, wind or rain.
- **Impact:** Crop losses are dependent on vector pressure.
- **Control:** measures targeting the vector



# Background: Pest of concern (CaL.)

- **Symptoms:** On tomatoes it causes spiky and chlorotic apical growth, leaf curling and mottling, stunting and fruit deformation





# Background: CaL. symptoms on tomato





# Background: The vector

## Tomato potato psyllid, *Bactericera cockerelli*



- First identified in NZ in 2006
- Feeds by piercing plant tissues and sucking phloem
- Transmits CaL. plant to plant and from adult to egg
- The only vector of CaL.
- Lays eggs on stems and leaves



# Tomato potato psyllid, *Bactericera cockerelli*

TPP controlled by:

- Yellow sticky traps
- Pesticides but may affect beneficials
- Generalist predators
- Removal and destruction of affected leaves
- Removal and destruction of alternate hosts from around greenhouses





# Designing the Systems Approach

1. Determine the **hazards** and the **objectives** for measures within a defined system.

**Hazard** = the vector (TPP), as the bacterium cannot be transmitted from infected fruit without it. The vector is not present in Australia.

**Objective** = Measures must prevent the vector (TPP) or disease being present on fresh tomatoes at the time of export.



# Designing the Systems Approach

2. Identify **independent procedures** that can be monitored and controlled.

Pathway Step	Activities
1. Pre-Production	<b>Pest Reduction</b> <ul style="list-style-type: none"><li>• Plant pest free seedlings from supplier with psyllid controls in place</li><li>• Pre-season greenhouse cleaning, pesticide fogging, exterior weed control</li></ul>



Photo: Deb Anthony



Photo: Status Produce



# Designing the Systems Approach

2. Identify **independent procedures** that can be monitored and controlled.

Pathway Step	Activities
2. Production	<p><b>Pest Reduction</b></p> <ul style="list-style-type: none"><li>• Controlled entry to greenhouse. Double door access to reduce presence of pests</li><li>• Greenhouse dedicated clothing and hygiene</li><li>• Destroy infested seedlings</li><li>• Remove and destroy diseased plants</li><li>• Waste plant material managed</li><li>• Yellow sticky traps for monitoring and to limit psyllids migrating into greenhouse</li><li>• Pesticide application(s) as required</li><li>• Biological controls/generalist predators</li><li>• Manage alternate hosts and buffer zones around greenhouses</li></ul>





Photos: Deb Anthony





Photo: Deb Anthony



Photo: Deb Anthony





Photos: Deb Anthony



# Designing the Systems Approach

## 2. Identify **independent procedures** that can be monitored and controlled.

Pathway Step	Activities
3. Harvest	<b>Pest Reduction</b> Removal of truss during harvest. Nymphs and adults may lodge between calyx and fruit. Eggs may be present on stems
4. Post-harvest	<b>Pest Reduction</b> <ul style="list-style-type: none"><li>• Double door entry</li><li>• Traps in brushing area and secure post-brushing area</li><li>• Waste plant material managed</li></ul> <b>Pest Removal</b> <ul style="list-style-type: none"><li>• Export only tomatoes without truss</li><li>• Remove psyllid eggs, nymphs or adults by brushing</li><li>• Secure post-brushing product storage</li><li>• Segregation from non-brushed and non-compliant product</li></ul>



Pallets are shrouded with pest-proof netting or plastic film to prevent reinfestation



Photos: Deb Anthony







How any products or products not at any side of the standards required.

to be adhered to at all times.

ing packed, the QC Inspectors are not to other work outside of their QC tasks.

not, without representation, to stop or that they believe may not meet the

affected Phytosanitary Inspector is given that we will not run for export.

lead to a failure of our product to meet or that could put any of our be treated as serious misconduct.

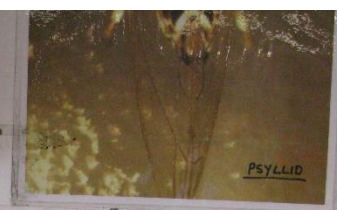
**Fred Fardick**  
General Manager, Global Produce

(All sizes are in mm diameter)

Size	Weight	Volume
10	0.0001	0.0001
12	0.0002	0.0002
15	0.0005	0.0005
20	0.0010	0.0010
25	0.0020	0.0020
30	0.0030	0.0030
35	0.0050	0.0050
40	0.0080	0.0080
45	0.0120	0.0120
50	0.0180	0.0180
55	0.0250	0.0250
60	0.0350	0.0350
65	0.0480	0.0480
70	0.0650	0.0650
75	0.0850	0.0850
80	0.1100	0.1100
85	0.1400	0.1400
90	0.1700	0.1700
95	0.2100	0.2100
100	0.2500	0.2500

Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora
Phytophthora	Phytophthora	Phytophthora	Phytophthora	Phytophthora

**APIN CERTIFICATES**



**AUSTRALIAN IMPORT PERMITS**

## Potato & tomato psyllid

Horticulture New Zealand

**POTATO AND TOMATO PSYLLID FACTS**

- What is it?**
  - The potato & tomato psyllid is a small, winged insect, about 2-3 mm long, with a yellowish-brown body and dark wings.
  - It is a pest of potato and tomato crops, as well as other plants in the Solanaceae family.
  - It is native to North America and was introduced to New Zealand in 1901.
  - It is a pest of potato and tomato crops, as well as other plants in the Solanaceae family.
- What does it do?**
  - It feeds on the sap of the plant, causing damage to the leaves and stems.
  - It can also transmit the virus that causes the potato and tomato psyllid virus.
  - It is a pest of potato and tomato crops, as well as other plants in the Solanaceae family.
- How to control it?**
  - Use insecticides to control the psyllid.
  - Use resistant varieties of potato and tomato.
  - Use biological control.
  - Use cultural control.

**Potato & tomato psyllid life cycle**

The life cycle of the potato & tomato psyllid is divided into four stages: egg, nymph, adult, and pupa. The adult stage is the most damaging to the plant, as it feeds on the sap and transmits the virus. The pupa stage is the most vulnerable to insecticides.

Photos: Deb Anthony

**AUSTRALIAN IMPORT PERMITS**

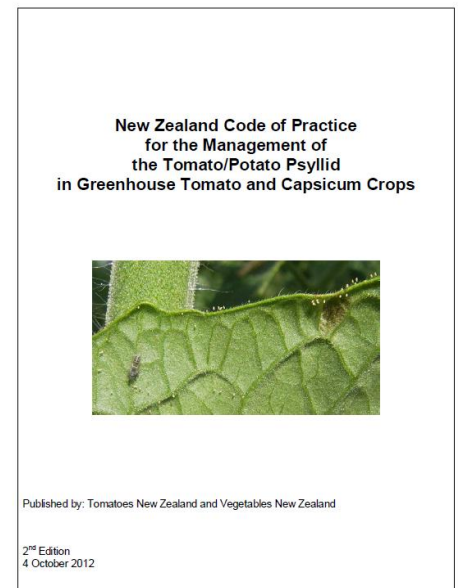


# Designing the Systems Approach

## Independent Measures

- (1) **Pest Reduction** – achieved /documented through Code of Practice
- (2) **Pest Removal** – verified through inspection

Verification of System through Audit





# Designing the Systems Approach

## 3. Establish criteria or **limits for the acceptance** of each independent procedure.

Measure	Limit
Pest Reduction Efficacy = Medium	<ul style="list-style-type: none"><li>• No infested seedlings</li><li>• Minimal entry of pests into greenhouse</li><li>• Action threshold established to determine level of pest control required during production and post-harvest</li><li>• No psyllids detected in post-brushing secure area.</li></ul>
Pest Removal Efficacy = High	<ul style="list-style-type: none"><li>• All trusses removed at harvest</li><li>• All tomatoes for export to be brushed</li><li>• Methods to prevent reinfestation</li></ul>



# Designing the Systems Approach

4. Implement the system with **monitoring** as required for the desired level of confidence.

Measure	Monitoring
Pest controls during production	<ul style="list-style-type: none"><li>• Scheduled crop scouting (at least 1 row/8 m bay scouted weekly) Yellow sticky trap catches checked</li><li>• Crop monitoring for psyllid and symptoms of CaL. by working staff</li><li>• Additional monitoring of psyllid 'hot spots'</li></ul>
Removal of truss	<ul style="list-style-type: none"><li>• All trusses removed</li><li>• Verified by picker inspection</li></ul>
Brushing	<ul style="list-style-type: none"><li>• Brushing equipment is operational</li><li>• All export fruit is brushed and secured following brushing</li></ul>
Post-harvest pest controls	<ul style="list-style-type: none"><li>• Regular checks of traps within packhouse and secure product area</li><li>• Phytosanitary inspection</li></ul>



# Designing the Systems Approach

5. Take **corrective action** when monitoring results indicate that criteria are not met.

Measure	Corrective actions
Pest reduction	<ul style="list-style-type: none"><li>• Destruction of infested and waste material</li><li>• Pesticide applications</li><li>• If high levels, suspend from export</li></ul>
Pest removal	<ul style="list-style-type: none"><li>• Re-dress if truss present or re-direct for sale in NZ</li><li>• Re-brush or fumigate product with methyl bromide</li><li>• Suspension of packhouse if psyllids detected in post-brushing secure area until problem determined and rectified</li></ul>



# Designing the Systems Approach

## 6. **Review or test** to validate system efficacy and confidence.

System reviewed by:

- Pest management records
- Non-compliance reports and corrective actions
- System procedures
- Industry standards
- Phytosanitary inspection records
- Internal and external third party audit processes
- Interception reporting by the importing country



# Designing the Systems Approach

## 7. Maintain adequate **records** and **documentation**.

	Records
Production Site/Grower	<ul style="list-style-type: none"><li>• Registration details</li><li>• Documented system for meeting the export protocol</li><li>• Staff training records e.g. competency assessments for scouts</li><li>• Pest management records and spray diary</li><li>• Crop monitoring records</li><li>• Inventory records (harvest dates, production site harvested, volumes and packhouse)</li></ul>



# Designing the Systems Approach

## 7. Maintain adequate **records** and documentation.

	Records
Packhouse	<ul style="list-style-type: none"><li>• Registration details</li><li>• Documented system for meeting the export protocol</li><li>• Inventory (volume received, packing dates, dispatch dates and destination and grower)</li><li>• Staff training records</li><li>• Pest management records e.g. trap catches</li><li>• Internal audit reports</li><li>• Phytosanitary inspection</li></ul>
Exporter	<ul style="list-style-type: none"><li>• Registration details</li><li>• Documented system for meeting the export protocol</li></ul>



# Summary of System

Pathway Step	Measure	Risk Management Outcome	Monitoring	Contingencies	Documentation
Pre-production	Pest Reduction	<ul style="list-style-type: none"> <li>• Pest free seedlings</li> <li>• Pre-season cleaning, fogging &amp; weed control</li> </ul>	<ul style="list-style-type: none"> <li>• Visual checks of seedlings entering greenhouse</li> <li>• Production site inspection</li> </ul>	<ul style="list-style-type: none"> <li>• Spraying or drenching infested seedlings</li> <li>• Destroy infested seedlings</li> <li>• Re-clean, fog etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Industry Code of Practice</li> <li>• Grower standard operating procedures (SOP)</li> </ul>
Production	Pest Reduction	<ul style="list-style-type: none"> <li>• Pest has limited entry to greenhouse</li> <li>• Low level infestations are managed</li> </ul>	<ul style="list-style-type: none"> <li>• Staff entry, hygiene and training records</li> <li>• Trapping and scouting records</li> <li>• Alternate host management</li> <li>• Internal audit</li> </ul>	<ul style="list-style-type: none"> <li>• Retraining of staff</li> <li>• Measures invoked when pest thresholds reached</li> <li>• Alternate hosts removed or sprayed</li> </ul>	<ul style="list-style-type: none"> <li>• Industry Code of Practice</li> <li>• Grower SOP</li> <li>• Grower registration to programme</li> </ul>
Harvest	Pest Removal	<ul style="list-style-type: none"> <li>• No pests hidden under calyx</li> </ul>	<ul style="list-style-type: none"> <li>• Visual checks of harvested fruit</li> </ul>	<ul style="list-style-type: none"> <li>• Redress</li> </ul>	<ul style="list-style-type: none"> <li>• Grower SOP</li> <li>• Grower registration</li> </ul>
Post-harvest	Pest Removal	<ul style="list-style-type: none"> <li>• All pests remaining on fruit surface removed by brushing</li> </ul>	<ul style="list-style-type: none"> <li>• Visual checks</li> <li>• Internal audit</li> <li>• Phytosanitary inspection</li> </ul>	<ul style="list-style-type: none"> <li>• Re-brush</li> <li>• Fumigate</li> <li>• Direct to domestic market</li> </ul>	<ul style="list-style-type: none"> <li>• Packhouse SOP</li> <li>• Packhouse registration</li> </ul>
	Pest Reduction	<ul style="list-style-type: none"> <li>• Pest has limited entry to packhouse</li> <li>• Pests unable to reinfest fruit after brushing</li> </ul>	<ul style="list-style-type: none"> <li>• Staff entry, hygiene and training records</li> <li>• Trapping records</li> <li>• Internal audit</li> </ul>	<ul style="list-style-type: none"> <li>• Re-brush</li> <li>• Fumigate</li> <li>• Direct to domestic market</li> </ul>	<ul style="list-style-type: none"> <li>• Packhouse SOP</li> <li>• Packhouse registration</li> <li>• Exporter registration</li> </ul>

## External Audit