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DEPARTMENT OF **PRIMARY INDUSTRY AND FISHERIES**

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Mangoes – a conditional non-host for fruit flies?

Investigating the potential for new market access protocols that do not rely on post-harvest treatments

Austin McLennan, Senior Entomologist, Katherine Research Station - 27 May 2015

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Steps in the logistics of Mango

Process	Time Interval
Harvest, hold and cool fruit	Day 1
Package fruit	Day 2
Cool fruit to 14^0 C	Day 3
Transport fruit to Disinfestation Facility	Day 8
Disinfestation process	Day 10
Sea freight to China at 14^0 C	Day 31
Ripening on arrival	Day 35
Distribution to supermarket	Day 36.

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Post-harvest disinfestation

"Default to Transparency"

Relevance to current fruit fly protocols..

The first thing…

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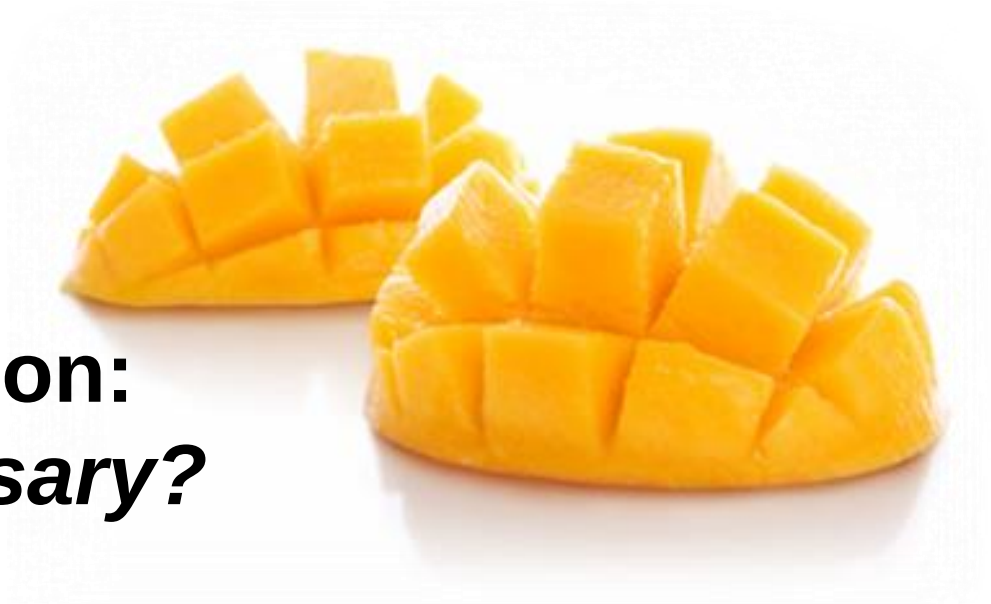
Disinfestation – the issues

- Expensive
- Can reduce fruit quality
- Chemical treatments are under review
- Restrictions on market access
- OH&S issues
- Consumer



The Big Question:

Is it even necessary?

What if….

- **What if you could…**
- **Get rid of dimethoate and fenthion from your packing sheds?**
- **Get rid of the need for fumigation, VHT or irradiation treatments to reach export markets?**
- **Deliver untreated premium quality mangoes to the consumer with even less chance of fruit fly detection than the current system?**

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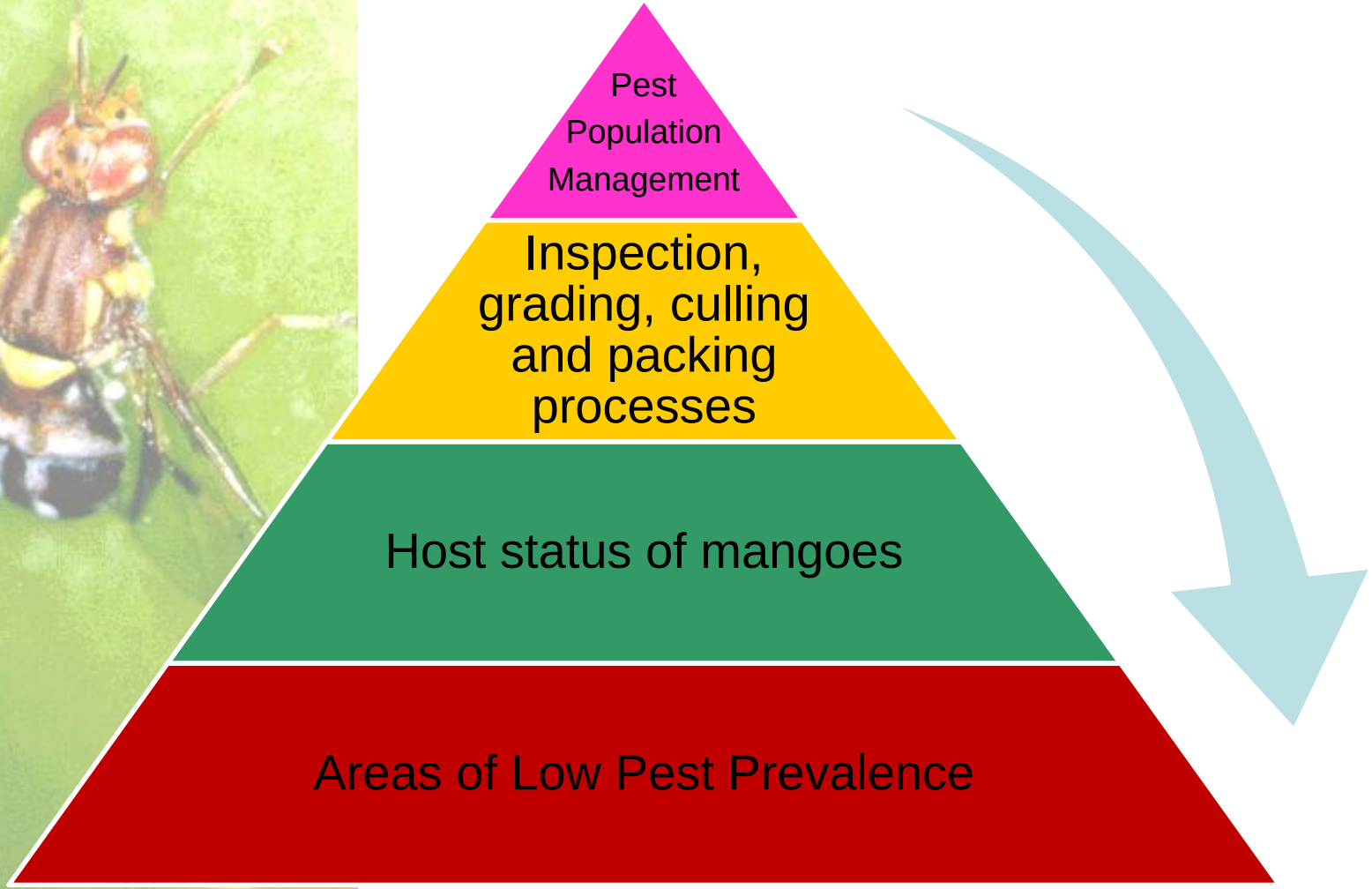
Systems approach: overview



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Systems Approach for Market Access

- **Requires understanding of:**
  - **Fruit fly abundance in the current production system**
  - **Host status of hard mature fruit**
  - **Impact of quality control procedures to prevent ‘at risk’ untreated fruit from entering the supply chain.**
  - **Ability to further suppress fruit fly populations through area-wide management tactics**

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The mango advantage?

Key question

Host status of hard mature mangoes at commercial harvest

"a conditional non-host?"

Summary: Host status investigations

1. **Large scale collections of commercially-harvested untreated fruit**

   - Exposed to natural field populations of pest fruit flies

2. **Experimental collections of progressively maturing fruit**

   - Exposed to natural field populations of pest fruit flies

3. **Cage studies – 2014 – species and variety comparisons - NEW**

   - Exposed to extreme levels of pest fruit flies in a non-choice situation

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Snapshot: fruit assessments

1. Collections of unsprayed, commercially-harvested fruit

2. Commercial grading of collected fruit

3. Grading of fruit by softness at the laboratory.

4. Measuring fruit quality (dry matter, colour etc.)

5. Assessing presence/absence of fruit fly larvae – after fruit have ripened fruit for 10-12 days

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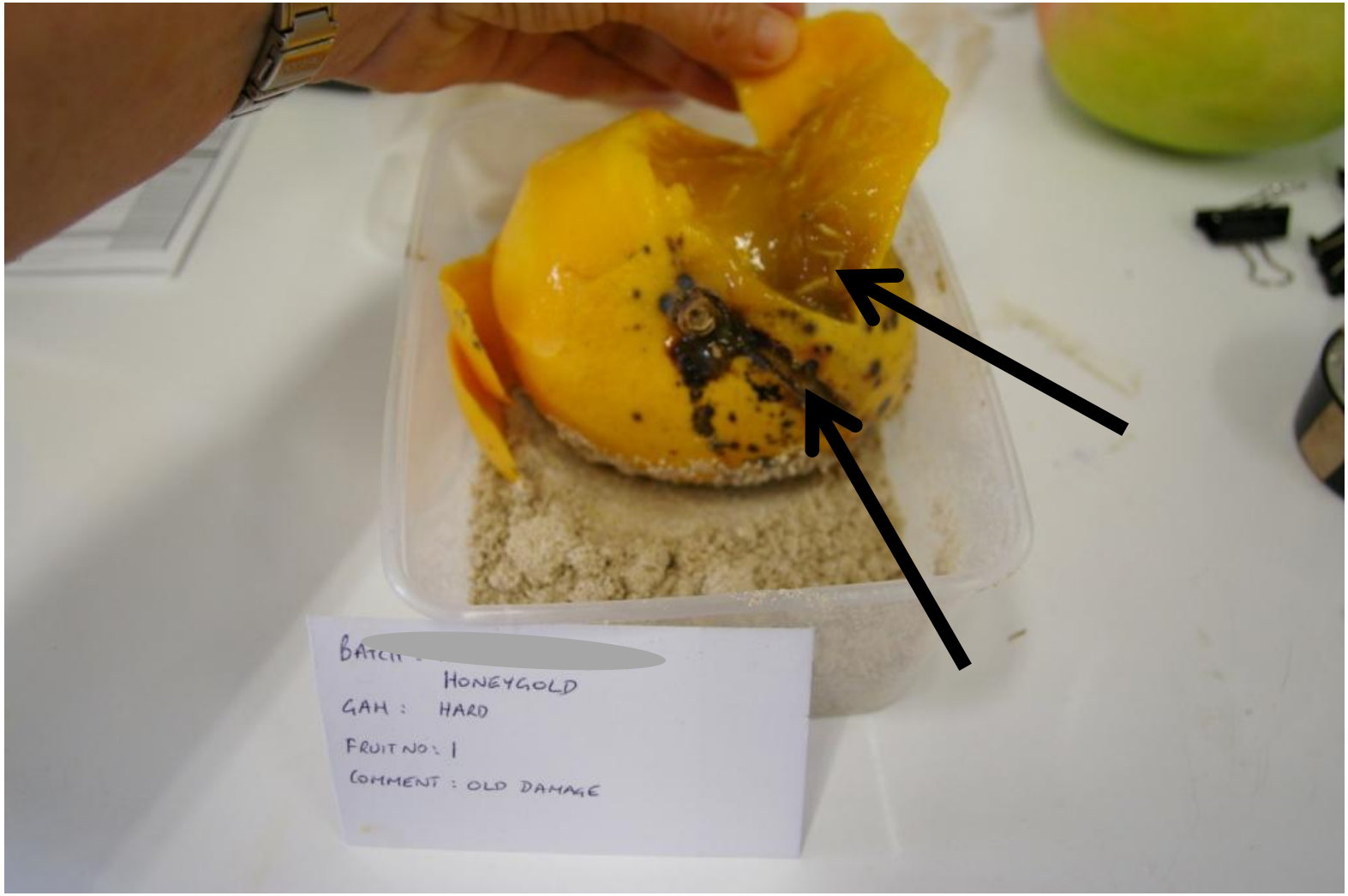
Snapshot: fruit assessments 2012



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Snapshot: Host status cage trials

Reason:

- Investigating 'Conditional non-host' status' for mangoes

- Results can be applied to all growing regions, irrespective of different regional fruit fly populations.
- Methods are logistically complex
- 2014 – 9 x full scale trials, Katherine and Darwin

Snapshot: Host status cage trials

Table 1. Number and details of cage trial sites

Mango cultivars	Fruit fly species tested	
	Bactrocera jarvisi	***Bactrocera tryoni***
KP	2 x Darwin 1 x Katherine	2 x Darwin
B74	1 x Darwin 2 x Katherine	1 x Darwin
Honeygold	2 x Katherine	
R2E2	1 x Katherine	

Results overview

Some fruit did have fruit fly stings and fruit flies emerging from them. These fruit:

- were from a number of different varieties
- were from orchards in Darwin and Katherine
- had dry matters (DM%) of 14.8% and higher
- were stung only by *Bactrocera jarvisi*

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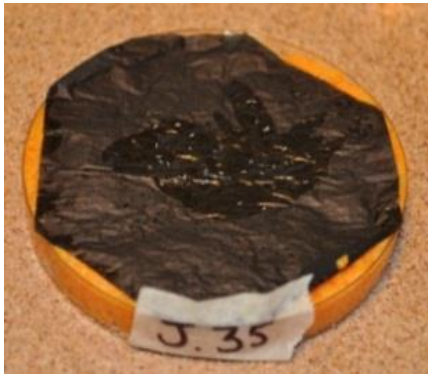
Snapshot: Host status cage trials



Host status trials: Discussion

1. These were **extreme tests** under high fruit fly pressure and no choice conditions and over-represent the risks of infestation in the field.

2. Under these test conditions, **some hard mature mangoes were infested** by *B. jarvisi.* No *B. tryoni* were reared from test fruit.

3. Apparent **differences were detected between varieties** in susceptibility – mechanisms are not understood but could include:
    - Resin canal distribution
    - Resin pressure
    - Resin composition
    - Larval nutritional requirements / other plant defences

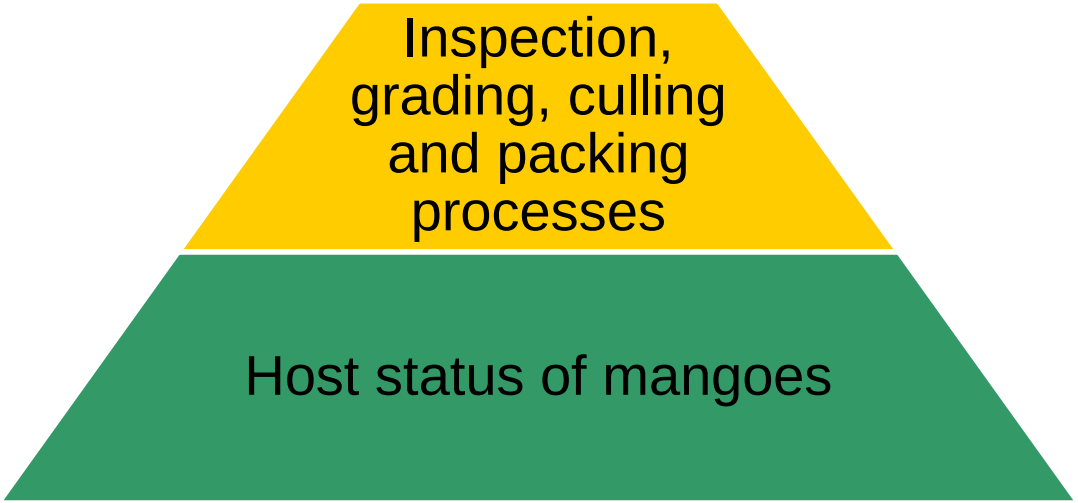
Host status trials: Discussion

4. No clear relationship was established between increasing maturity and susceptibility.

5. Implications for future work and successful development of a systems approach for mangoes - *e.g. possible role for fruit fly suppression etc.*

Systems approach: Evolving focus

Good enough?



Suppression Pilot #1: Male Annihilation Technique for *B. jarvisi*

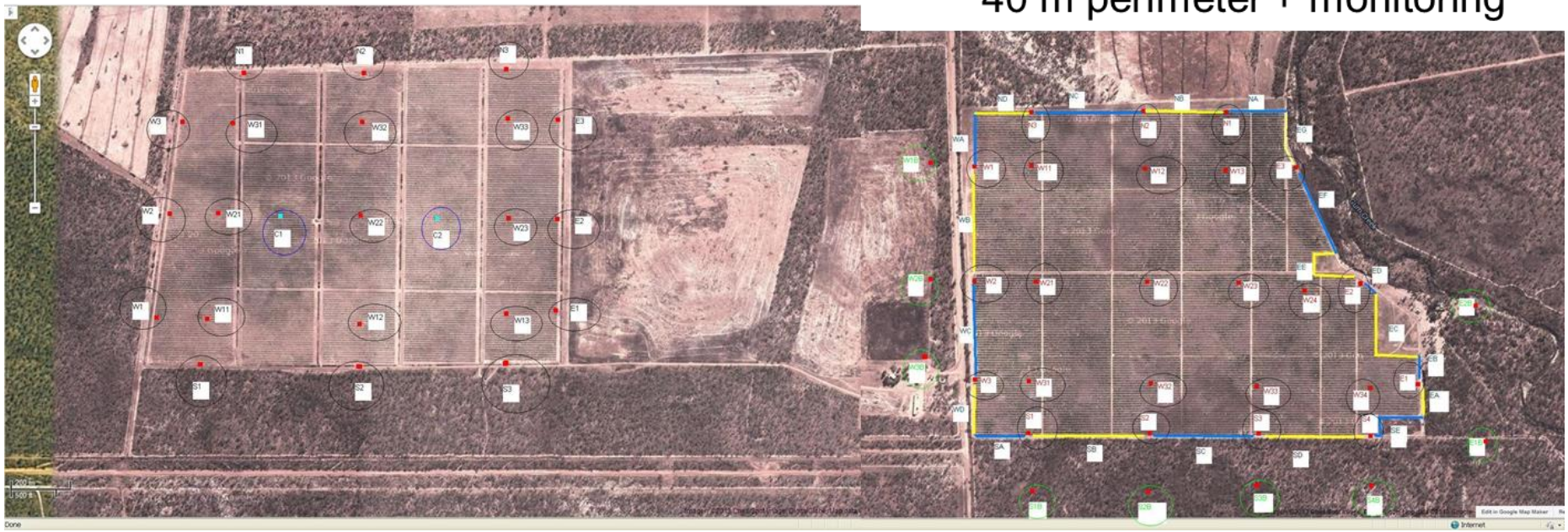
- Almost all fruit fly detections in our studies have involved *B. jarvisi*
- Almost all recent detections in the supply chain have involved *B. jarvisi*
- Infestation levels are low but what can we do to reduce this risk even further?

- A role for suppression?
- Male Annihilation Trial

Suppression pilot: Perimeter traps

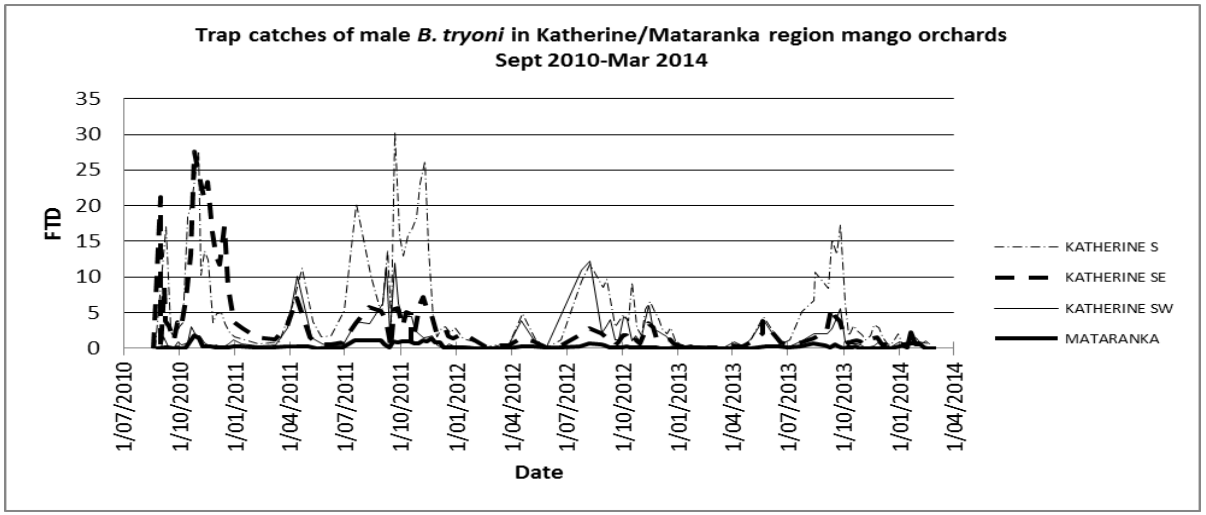
Untreated –
monitoring only

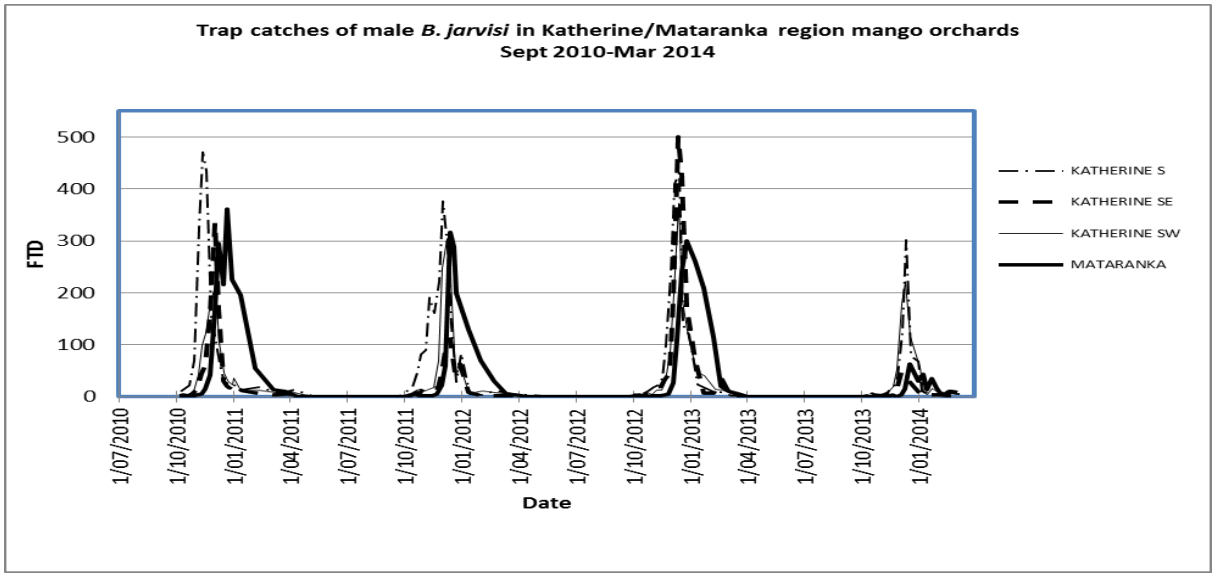
Treated –
40 m perimeter + monitoring



Protein-based traps:
attract female fruit flies

Trapping studies: completed





Baseline data:

Critical for evaluating the impact of pest suppression activities under systems approaches

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Systems approach: The future - 2015+

- **Baseline trapping data**
  - Now monitoring only for suppression trials
- **Conditional non-host status investigations**
  - Further investigate relationship between maturity and fruit fly risk + resistance mechanisms.
- **Quantify specific risk-reduction tactics**
  - Impact of grading, packing shed practices
  - MAT for *B. jarvisi*
  - Perimeter trapping
  - Protein bait sprays – pre and post harvest
  - Crop hygiene
  - Host plant management

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Systems approach: The future - 2015+

- **Consider integration with novel/additional elements – long term**
  - Low dose treatments?
  - Impact of post-harvest handling – e.g. in-transit disinfestation under Controlled Atmosphere
  - SIT
- **Whole system evaluations at commercial scale**
  - Incl. discussions with trading partners, regulators

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Systems Approach for Market Access

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  - **Ability to further suppress fruit fly populations through area-wide management tactics**
  - **and….**

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Collaborators and Collaboration

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Acknowledgements

Thanks to all grower co-operators and investors

NTMIA

Katherine Growers + others

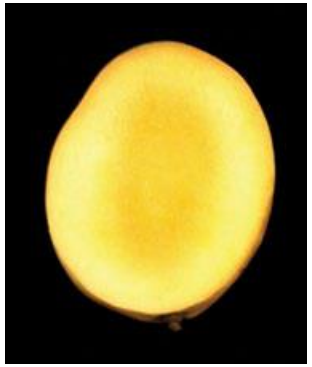
Horticulture Innovation Australia

NT DPIF

Commercial harvest of mangoes

Mature Firm Green

- Dry matter >14% <16.5%
- Flesh colour as per industry standard



NO defects

Class 1
Export grade

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