The suppression of the False Codling Moth, *Thaumatotibia leucotreta* in South Africa using an AW-IPM approach with a SIT component

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Background

• FCM sub-Saharan African pest of cultivated crops
• Phytosanitary pest on citrus with more than 88 hosts
• 1976
• Situation became worst after *T. leucotreta* developed resistance against insecticides
• Various pyrethroids and growth inhibitors in the benzoyl urea group
• Time for a new sustainable approach
• Multi-institutional research project in 2002, the sterile insect technique (SIT) was launched in 2007
• CRI; USDA; TIA; IAEA
• Area wide control program
Geographic distribution of false codling moth

Indigenous pest – restricted to Africa
Thaumatotibia leucotreta

Fig. 1. Citrus fruit infested by false codling moth.  
http://idtools.org/id/citrus/pests/factsheet.php?name=False+codling+moth

Fig. 2. Adult false codling moth.  
Up to 17 larvae found on one grape bunch
Principles for sustainable (pest)management
ECONOMICS
### Area planted per citrus group

<table>
<thead>
<tr>
<th>Variety Area</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valencia/Midseason</td>
<td>27,056</td>
</tr>
<tr>
<td>Navel</td>
<td>15,930</td>
</tr>
<tr>
<td>Soft Citrus</td>
<td>9,335</td>
</tr>
<tr>
<td>Lemon &amp; Lime</td>
<td>8,262</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>7,678</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>68,272</strong></td>
</tr>
</tbody>
</table>

![Pie chart showing percentage of area planted per citrus group]
From 90,000 t (2006) ($63,000,000) to 150,000 t (2015) ($137,500,000)
MAJOR EXPORT DESTINATIONS 2015

- Northern Europe: 22%
- Middle East: 21%
- Asia: 11%
- UK: 10%
- Far East: 9%
- Russia: 9%
- S. Europe: 7%
- Other: 4%
- USA: 4%
- Canada: 3%

Source: PPECB
Economic risk

- Phytosanitary pest (USA, Far East and EU)
- Zero tolerance
- Main insect pest on Citrus
- Economical Threats
Socio Economic impact

– Complement of workers have increased from 45 in 2010 to 160 in 2017 as programme expanded.

– The worker dependent ratio is 1:4, which means approximately 650 people financially benefit directly from the operations.
Apart from increased economic activity stimulated by the insectary itself, SIT also contributes to economic security of citrus farming operations by retaining export markets and thereby ensuring continued employment of farm workers.
Environment

must be bearable
NON IPM pest management

• Treadmill effect

• Not responsible

• Destroying of biodiversity

• Reactive approach
Systems approach

- IPM systems to control pest and preserve environment
- Supports beneficial organisms
- Pro active
- Nurtures and promote environment/diversity
# Pest management

<table>
<thead>
<tr>
<th></th>
<th>Chemical</th>
<th>vs</th>
<th>Biological/SIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable on long term?</td>
<td>NO</td>
<td></td>
<td>YES / NO</td>
</tr>
<tr>
<td>Impact on non-target species?</td>
<td>YES</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Impact on predators?</td>
<td>YES</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>IPM/area wide?</td>
<td>NO</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>Negative Effect on environment?</td>
<td>YES</td>
<td></td>
<td>NO/ YES</td>
</tr>
<tr>
<td>Short term solution</td>
<td>YES</td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>
What is SIT

• SIT (or SIR) is the mass-release of partially sterile insects to reduce the effective population of the species through competition and subsequent mating.

• Released insects are not necessarily 100% sterile.

• Males and Females are radiated and released.

• SIT is designed to work as an area-wide suppression technique.
What is SIT **not**?

- SIT is not a “silver bullet”.
- SIT will not eradicate the pest within a season.
- SIT is not meant to be a “stand-alone” control practice.
- SIT does not mean we can get complacent.
Radiated Lepidoptera (moths)

Parents (P)

radiated female (100% sterile)

Wild male (fertile)

No offspring

Diagram: Radiated female x Wild male = No offspring
Radiated Lepidoptera (moths)

Parents (P)

Offspring (F₁)

Wild female (fertile) × radiated male (partially sterile)

Sterile females and males = F₁ sterility
Program overview

- 18,000 ha
- 3 provinces
- 5 offices
The Program

• Ratios of 1:10 is maintained to ensure that the technique is effective.
• 1000 moths per ha are released twice a week in summer
• 2000 moths per ha are released once a week in winter.
• The graphs below, comparing results on a season-to-season base, illustrates how efficient this strategy has been and is an excellent indication of future success
Average wild moth per trap /week: N Cape

Graph showing the average wild moth per trap/week in different areas over a series of weeks.
Results: Gamtoos

- Fantastic start-up, suppressing wild FCM population from the word ‘GO’
Average infested fruit per tree: GAMTOOS
Wild FCM/Infestation SRV

Average no. FCM males per trap

<table>
<thead>
<tr>
<th>Season</th>
<th>FCM males</th>
<th>Infested fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011/12</td>
<td>1.5</td>
<td>0.20</td>
</tr>
<tr>
<td>2012/13</td>
<td>1.6</td>
<td>0.77</td>
</tr>
<tr>
<td>2013/14</td>
<td>2.2</td>
<td>0.37</td>
</tr>
<tr>
<td>2014/15</td>
<td>1.5</td>
<td>0.20</td>
</tr>
<tr>
<td>2015/16</td>
<td>1.1</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Average no. infested fruit per tree
Average wild moth trap/week Hex Valley

Wilde VKM HRV 2016/2017
Wild FCM/Infestation ERV

Average no. FCM males per trap

- 2007/08: 0.20
- 2008/09: 0.03
- 2009/10: 0.02
- 2010/11: 1.56
- 2011/12: 1.3
- 2012/13: 0.29
- 2013/14: 0.2
- 2014/15: 0.1
- 2015/16: 0.02

Average no. infested fruit per tree

- 2007/08: 1.5
- 2008/09: 0.5
- 2009/10: 0.4
- 2010/11: 1.5
- 2011/12: 1.3
- 2012/13: 0.66
- 2013/14: 0.5
- 2014/15: 0.06
- 2015/16: 0.02
Effect of SIT in ERV W-Cape: Pre SIT

![Bar chart showing the average wild FCM trap/week from 2006/07 to 2014/15. The chart indicates a significant decrease in wild FCM trap/week after 2006/07.](chart.png)
Future Plans

• Become an centre of excellence for FCM management.
• Double our capacity.
• Investigate the use of alternative biological products, not only for FCM, but other phytosanitary pests.
• Become the number 1 choice for area wide biological control of pests in South Africa.
SPECIAL THANKS

- IAEA
- XSIT