Insect exclusion nets. Experience in apple and peach orchards in NW Italy.

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Apple orchard
Aim

- To avoid the entrance of *Cydia pomonella* in apple orchards,
- To reduce the number of chemical treatments (healthy fruit and environmental safety).

Other advantages:

- Secondary effect on the entrance of other phytophagous (*Ostrinia nubilalis, Cydia molesta, …*),
- Efficient barrier against newly introduced phytophagous (*Halyomorpha halys*)
Single-row system
(1 net per row of apple trees)

France

Single-plot system
(i.e. one net for the entire orchard)

Italy
Single-plot system
Adopted in Piedmont – NW Italy

Experimental trials
2011-2013
In collaboration with CReS
financially supported by REGIOPIEMONTE
Scheme of the experimental site in 2011

2010 damage 20%

Pest control in 2010: mating disruption + 5 treatments

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Scheme of the experimental site in 2011

- Alt’Carpo
  - anti-hail net + exclusion net on sides 4×4 (2.2×5.4 mm)
- control
  - only anti-hail net

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Cv Golden Delicious
Verzuolo (Cuneo, NW Italy)
Spacing of plantation: 4.3 × 1.3 m
Length of rows: 130 m
Density: 1,790 plants/ha
2011
Alt’Carpo single-plot system placed at the beginning of May
Pest monitoring

✓ Weekly surveys for *Cydia pomonella* by means of combo traps
✓ Weekly surveys for *Argyrotaenia pulchellana*, *Ostrinia nubilalis* and *Cydia molesta* by means of pheromone traps
✓ Weekly surveys for fruit damage (1,000 fruits at each survey)
✓ Fruit damage at harvest

**Control strategies**

✓ No mating disruption
✓ Knock down treatment (Clorantraniliprole) at the beginning and at the end of May on all the orchard
✓ Alt’Carpo: treatments only if necessary (in relation to monitoring)
✓ Control: treatments following advisory service

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Cydia pomonella 2011

Cydia pomonella - Alt' Carpo

Cydia pomonella - Control

N. captures/trap

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**Cydia pomonella 2012**

![Graph showing the number of Cydia pomonella captures/trap over time.](image)

- **C. pomonella - Alt’Carpo**
- **C. pomonella - Control**

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Cydia molesta 2011

<table>
<thead>
<tr>
<th>Date</th>
<th>N. captures/trap</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-mag</td>
<td>2</td>
</tr>
<tr>
<td>24-mag</td>
<td>1</td>
</tr>
<tr>
<td>7-giu</td>
<td>1</td>
</tr>
<tr>
<td>21-giu</td>
<td>7</td>
</tr>
<tr>
<td>5-lug</td>
<td>7</td>
</tr>
<tr>
<td>19-lug</td>
<td>2</td>
</tr>
<tr>
<td>2-ago</td>
<td>8</td>
</tr>
<tr>
<td>16-ago</td>
<td>7</td>
</tr>
<tr>
<td>30-ago</td>
<td>1</td>
</tr>
<tr>
<td>13-set</td>
<td>2</td>
</tr>
</tbody>
</table>
Cydia molesta 2012

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Fruit damage 2011

% fruit damage

Alt' Carpo  Control

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Fruit damage 2012

[Graph showing fruit damage over time for Alt'Carpo and Control groups, with peaks in 3-ago and 27-lug, and troughs in earlier and later months.]
## Treatments

In 2011-2013 damage at harvest was lower or similar to that in the control, but with a reduced number of chemical treatments.

<table>
<thead>
<tr>
<th>Year</th>
<th>Control strategy</th>
<th>harvest damage</th>
<th>n. treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>mating disruption</td>
<td>20.00%</td>
<td>5</td>
</tr>
<tr>
<td>2011</td>
<td>only pesticides</td>
<td>0.28%</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Alt’Carpo</td>
<td>0.09%</td>
<td>3</td>
</tr>
<tr>
<td>2012</td>
<td>only pesticides</td>
<td>0.13%</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Alt’Carpo</td>
<td>0.02%</td>
<td>1</td>
</tr>
<tr>
<td>2013</td>
<td>only pesticides</td>
<td>0.25%</td>
<td>4</td>
</tr>
<tr>
<td>(another apple orchard)</td>
<td>Alt’Carpo</td>
<td>0.30%</td>
<td>1</td>
</tr>
</tbody>
</table>
Cost analysis

Anti-hail nets 18,000 €/ha

Alt’Carpo: additional costs 2,300 €/ha

15 years service life
2,300 €/ha : 15 years = 153.33 € per year/ha
+ 1 knock down treatment (93.39 €/ha) \( \rightarrow \) 246.72 € per year/ha

Mating disruption
452.30 € per year/ha
Reduce fruit damage (fruit drop and cat-facing) caused by mirid bugs *Lygus rugulipennis*, *Adelphocoris lineolatus*, *Calocoris norvegicus*.

Peach orchards neighbouring with winter cereals are the most damaged by mirid bugs.

At harvest of wheat and barley *L. rugulipennis* migrates to neighbouring crops.
Anti-bug net

Net 1.4 × 1.7 mm

- Hooked to the anti-hail net
- Ground anchor system

Experimental trials

2009-2010

In collaboration with CReS

financially supported by
Scheme of the experimental site in 2009-2010

peach, bean, maize, grass

S \ E
N \ O
Life + Susafruit Workshop - Zagreb, November 5-6, 2014.
Reduction of fruit damage on the rows neighbouring herbaceous crops

<table>
<thead>
<tr>
<th>Row 1</th>
<th>Row 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>with net</td>
<td>with net</td>
</tr>
<tr>
<td>without net</td>
<td>without net</td>
</tr>
<tr>
<td>% damaged fruits</td>
<td>4.0 ± 0.5</td>
</tr>
</tbody>
</table>

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Future perspectives

- Use of different nets
  - Different colours
  - Different meshes

1 x 1.5 mm 0.6 x 1.6 mm
Future perspectives

To test exclusion nets against newly introduced pests

- *Drosophila suzukii*

- *Halyomorpha halys*