Update on *Drosophila suzukii* (SWD) monitoring and control (SF-145)

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**NRI:** David Hall, Dudley Farman
Year 4 (final year)

1. National monitoring
2. Bait Sprays
3. Repellents
4. Parasitoids
5. Attract and Kill (device and lure optimisation)
6. Risk to blackcurrants
Pest population dynamics in the UK

- Numbers higher in 2016
- More data coming in
- 4 x higher in 2015-16 winter
- Low catches until early August
- High numbers at time of late ripening crops
Mean number SWD per trap per week

Week

South East 1
South East 2
South East 3
South East 4
South East 5
South East 6
East England 1
East England 2
West Midlands 1
West Midlands 2
West Midlands 3
Scotland
Regions

Mean number SWD per trap per week

Week

South East 1
South East 2
South East 4
South East 5
South East 6
East England 1
East England 2
West Midlands 1
West Midlands 2
West Midlands 3
Scotland

Plant Science into Practice
Mean number SWD per trap per week

Week

Regions

East England 1
East England 2
West Midlands 1
West Midlands 2
West Midlands 3
Scotland

Plant Science into Practice
Female fecundity (2016)

Farm 1

% at each stage

- 5 Shrivelled eggs
- 4 Mature eggs
- 3 Ovaries with eggs
- 2 Ovaries
- 1 No ovaries

Date


Plant Science into Practice
Interaction between SWD and extra floral nectar

Gijsbert Hakkert

Early arrival in cherry orchards

Why?

Bud break

Extra-floral nectaries?

Plant Science into Practice
Bait sprays: Background

Aims: Investigate attraction of commercial baits, substances and yeasts to SWD

1. Develop bioassay for testing bait in lab

2. Determine most attractive baits for Attract & Kill strategy, to increase SWD pesticide contact and uptake
Bait sprays methods and materials

- Multiple laboratory bioassays
- Replicated within experiments

- 30-60 minute feeding observations;
  - Droplet on leaf in Petri dish

- Length of time to feed;
  - Long time to feed
  - Adding blue food dye to bait
  - Record gut content after 12 hours

- Large arena bioassay 24 hour attract and kill;
  - Still humid air
  - Small beakers of baits

Plant Science into Practice
Results Screening on leaf in Petri dish 1

- Sugar + 4% Yeast: 16%
- Brewery waste: 50%
- Combi-protec: 100%
- Gasser: 100%
- Molasses + 4% Yeast: 100%
- Strawberry juice: 100%
- Fermented juice: 100%

Number of SWD per test

- Attract
- Water
- Strawberry
- No response

Plant Science into Practice
Results Screening on leaf in Petri dish 2

- **attract**
- **water**
- **strawberry**
- **no response**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1.6%</th>
<th>5%</th>
<th>8%</th>
<th>50%</th>
<th>100%</th>
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<tbody>
<tr>
<td>Sugar +0.4% yst.(S)</td>
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<td>Sugar + yeast(H)*</td>
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<td>Combi-protec</td>
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<td>Sugar + yeast(H)**</td>
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<td>Ferment. strawb. jce.</td>
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<td>Strawberry juice</td>
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</table>

Number of SWD per test
Results Screening on leaf in Petri dish

- 8-16% sugar solution + yeast more attractive than Combi-protec, Gasser, molasses or strawberry Juice

- After 1 hour, high proportion of SWD with no response but after 12 hours, nearly all SWD had blue dye in gut

- Hence feed on bait over a longer period of time
Results large arena bioassay 1

LSD (P = 0.05)

Number of SWD attracted

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of SWD attracted</th>
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<tbody>
<tr>
<td>Sugar +4% yeast</td>
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<tr>
<td>AC Vinegar</td>
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<tr>
<td>Attractor</td>
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<tr>
<td>Bioiberica</td>
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<td>Brewery waste</td>
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<tr>
<td>Combi-protoc</td>
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<td>Dros'Attract</td>
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<tr>
<td>Fermt. plum jc.</td>
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<td>Fermt. strawb. jc.</td>
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<tr>
<td>Gasser</td>
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<tr>
<td>Molass. +4% yst.</td>
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<tr>
<td>Strawberry juice</td>
<td>16</td>
</tr>
</tbody>
</table>
Results large arena bioassay 2

LSD $P = 0.05$

- Sugar+yeast H*: 1.6%
- Attracker: 5%
- Bioberica: 8%
- Brewery waste: 5%
- Combi-protect: 16%
- Dros'Attract: 50%
- Gasser: 100%
- Molasses: 8%
- Sugar+yeast H+: 50%
- AC Vinegar: 50%
- Fermt. strawb. jc.: 100%
- Strawberry juice: 100%
Results Screening in Large Arena

- Strawberry Juice, fermented strawberry Juice, Gasser and molasses most attractive
- Sugar solution + yeast not very attractive
- No difference in bait attraction between male and female SWD
1. Short term screening of bait droplets in Petri dishes produced different results to longer term large arena test

2. Low levels of attraction over 1 hour

3. Experiments with dye added to bait showed high levels of feeding over 12 hours

4. In short term Petri dish tests, sugar + yeast was more attractive than sugar alone or other baits

5. In 24 hour large arena tests, strawberry juice (fresh or fermented), Gasser and molasses were most attractive
Bait sprays: Next steps

1. Optimise bait with all-round short and longer term attractiveness

2. Explore the SWD attractiveness and growth of yeasts (e.g. *Hanseniaspora uvarum*) in the baits

3. Test the efficacy of pesticides with and without bait to kill SWD in laboratory bioassay

4. Test the efficacy of the best pesticide and bait treatments from laboratory bioassay in field crops
Aim: To determine whether we can prevent SWD detecting fruit or repel from fruit to prevent egg laying using repellent compounds.
Repellents: Trial 1

- 8 treatments (Table 5.3) - single compound in polythene sachet or rubber septum
- Hung in top of delta trap above petri dish of soft fruit
- Fruit collected after 2-3 days in cherry orchard
- Adult emergence
- Replicated 3 times with raspberries and strawberries July-Aug
- Release rates of the 7 compounds tested were measured at NRI by weight loss under laboratory conditions at 22°C.
Repellents: Trial 1 Results

The bar charts display the mean number of D. suzuki on different treatments. The treatments include Methyl salicylate, 1-octen-3-ol, Methyl anthranilate, Geosmin, Methyl N,N-dimethylantranilate, Methyl N-anthranilate, Butyl anthranilate, 2-undecanone/2-tridecanone, and Control. The results are compared, and the bars with different letters indicate significant differences. The charts suggest that some treatments significantly reduce the number of D. suzuki compared to the control.
Repellents: Trial 2

- 4 most successful compounds (G, H, C, A) + no compound
- 20 large point sources in each tree
- Single tree plots
- Delta traps containing raspberries
- Positioned top and bottom of canopy
- Adult emergence
• There were no significant differences in the number of adult *D. suzukii* that emerged between all treatments from the raspberries deployed in week 1 and 2 (overall mean 19.6 per 8 fruit)

• In addition significantly more *D. suzukii* emerged in week 2 (mean 29.1 per 8 fruit) than in week 1 (mean 10.0 per 8 fruit) \((F=34.32,_{1,76}, lsd=1.109, \; P<0.001)\)
• Five tested compounds show promise; methyl salicylate, 1-octen-3-ol, methyl anthranilate, geosmin and methyl N-methylanthranilate.

• Repellent devices placed from large point sources (sachets) in trees did not deter egg laying in fruits.

• However:
  – Populations of *D. suzukii* were high
  – No alternative feeding or egg laying resources in the orchard – hence pest pressure would have been high.

• Sprayable formulation = multiple small point sources and long lasting
2016 Research

- Year 4 (final year)

- National monitoring
  - Important because still on the rise

- Bait Sprays
  - Have potential to work in open field

- Repellents
  - Early season and formulation

- Parasitoids
  - Search for UK native species

- Attract and Kill (device and lure optimisation)
  - Ongoing and currently testing efficacy of current device

- Blackcurrant susceptibility to SWD
  - Potential future risk
Thanks to

Growers hosting trials
Funding and help from AHDB, Berry Garden Growers, RESAS, Worshipful Company of Fruiterers, British Summer Fruits, East Malling Trust

Industry steering group: Chaired by Marion Regan