



Developing biocontrol methods and their integration in sustainable pest and disease management in blackcurrant

**Jerry Cross, Xiangming Xu, Angela M Berrie
Michelle Fountain, Adrian Harris**
East Malling Research

Rex Brennan
James Hutton Institute

David Hall
Natural Resources Institute

**Horticulture LINK Project HL01105
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Aims of project

- **Develop alternative, sustainable biological methods for management of**
 - Grey mould (*Botrytis cinerea*)**
 - Leaf midge (*Dasineura tetensi*)**
 - Sawfly (*Nematus olfaciens*)**
- **Devise Integrated Pest and Disease Management (IPDM) programme**
- **Evaluated and refine in large scale field experiments in final two years of the project**

Botrytis

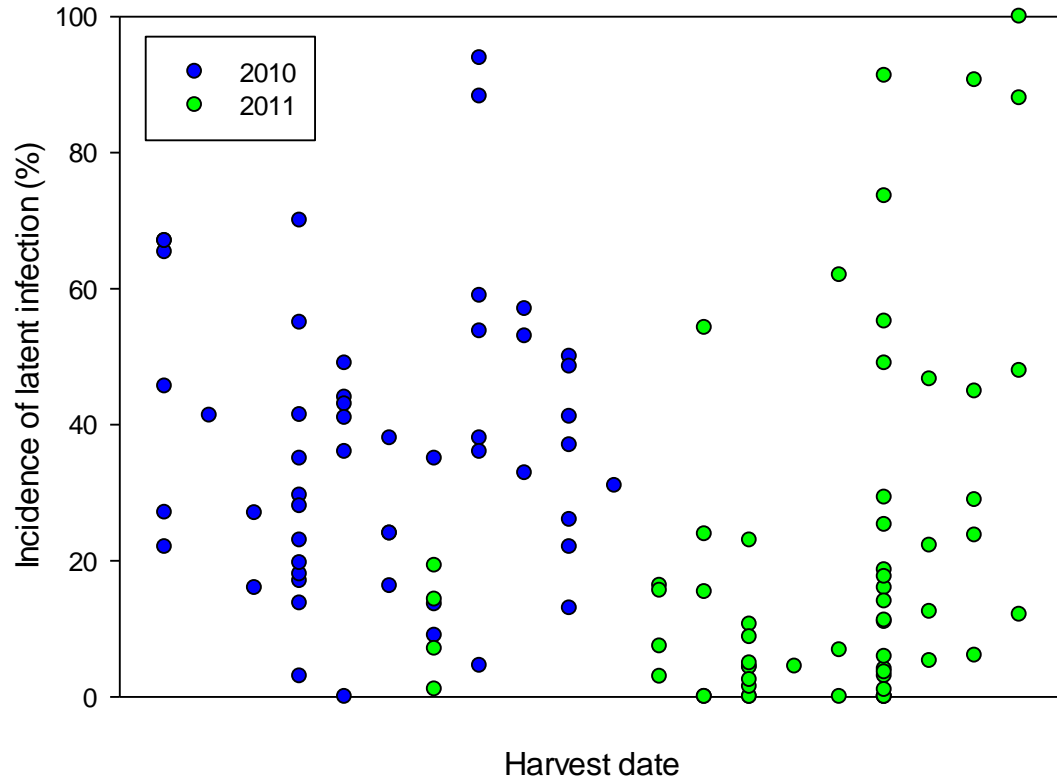
- **Correlation of varietal susceptibility with physiological characters**
- **Biocontrol Agents (BCAs)**
- **Pollination**
- **Filter blocking**

Botrytis susceptibility of varieties in relation to morphological characters

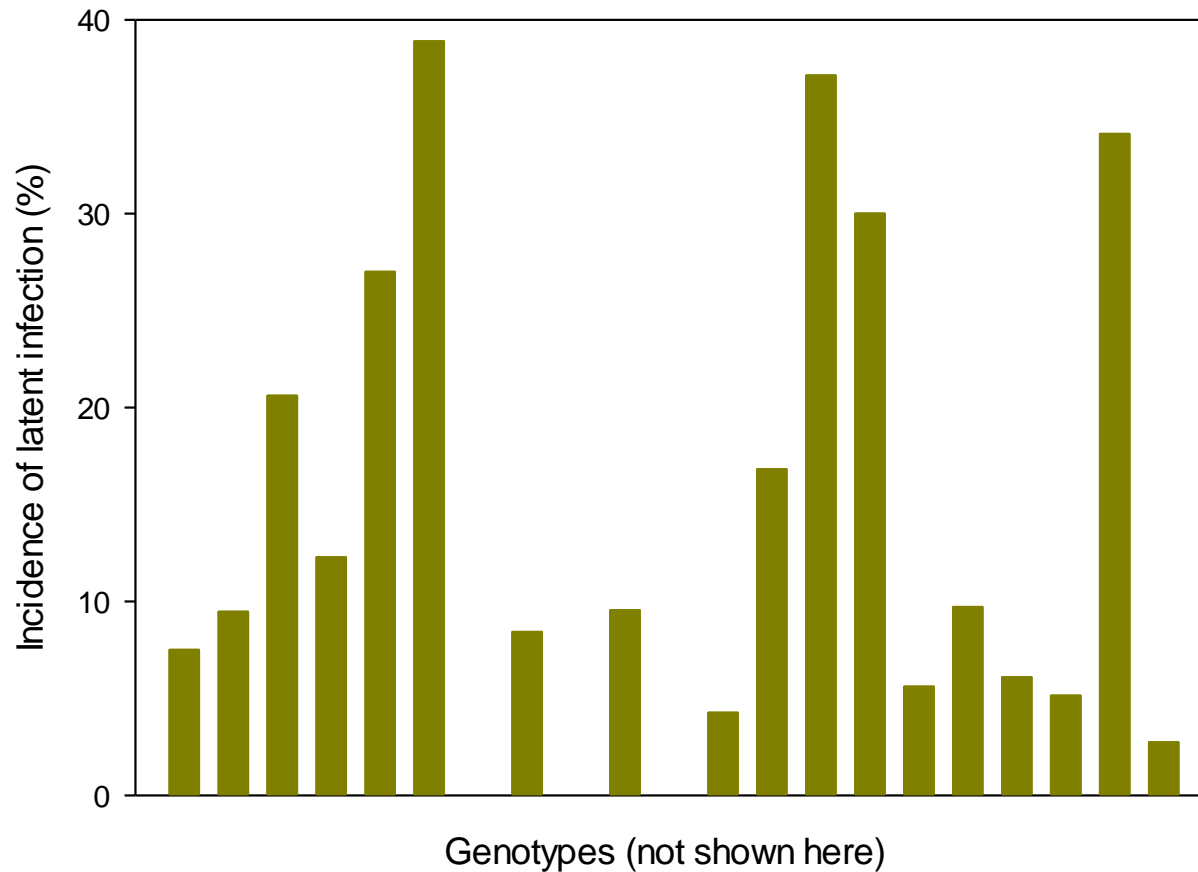
Sampling of variety trial sites

- **Botrytis increased with**
 - late development within a season**
 - number of flowers per node**
 - fruit losses on the ground**
 - decreasing fruit size**
- **Magnitude of correlations very low (0.22-0.37) although statistically significant**

Positive correlation of latent botrytis with late harvest date (variety trial sites)



Incidence of fruit infection (inoculated 4-5 weeks after flowering) on selected blackcurrant varieties



Evaluation of BCAs as part of an integrated programme with conventional fungicides

Biocontrol Agents (BCAs)

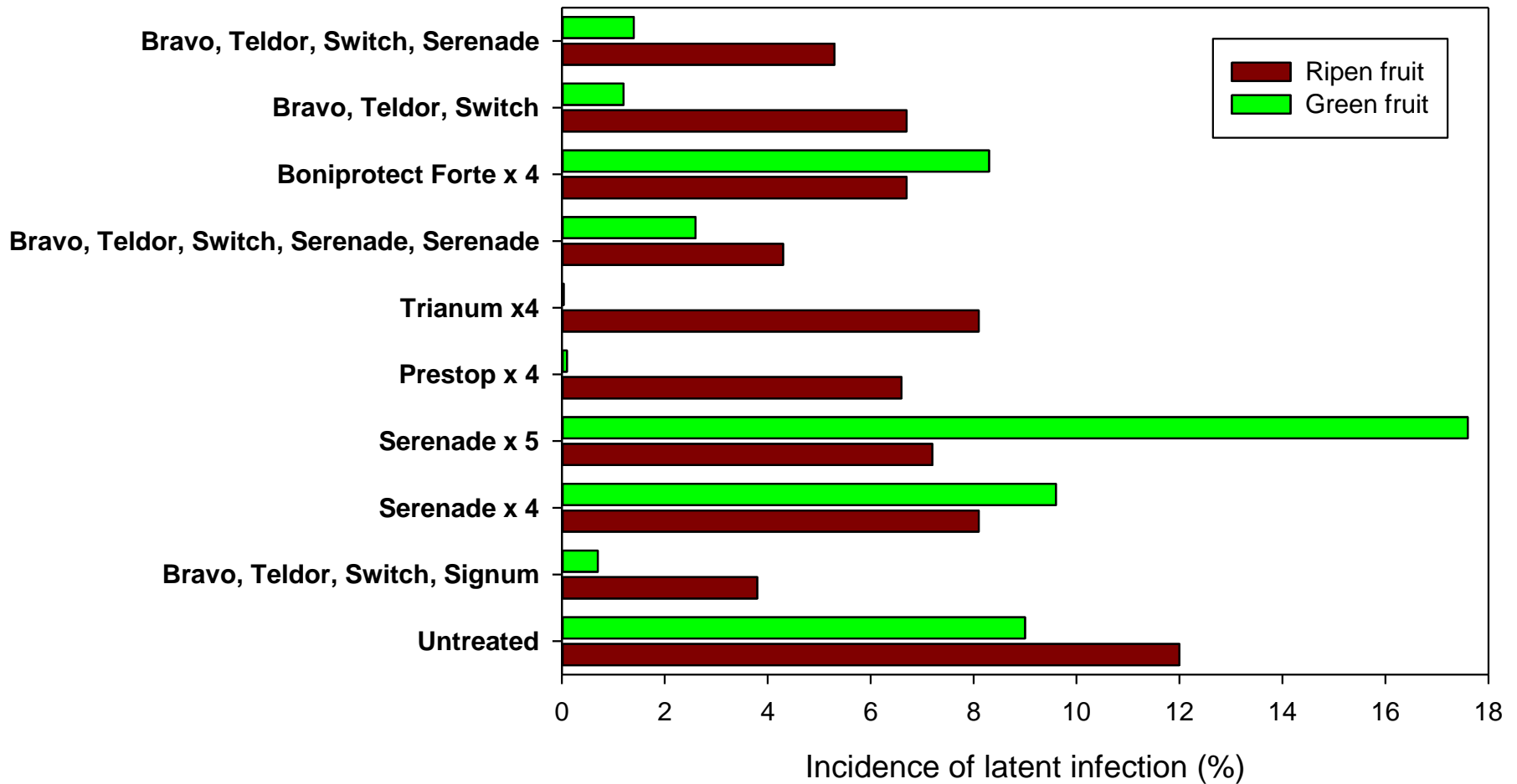
Seranade	<i>Bacillus subtilis</i>	Bacterium
Prestop	<i>Gliocladium catalanum</i>	Fungus
Trianum	<i>Tichoderma</i>	Fungus
Boniprotect Forte	<i>Aurobasidium pullulans</i>	Yeast

Treatments 2011 (Ben Tirran)

Sprays at 7-10 days from 1st flower

1. Untreated
2. Bravo, Teldor, Switch, Signum
3. Serenade x4
4. Serenade x5 from pre-flower
5. Prestop x4
6. Trianum P x4
7. Bravo, Teldor, Switch, Serenade, Serenade
8. Boniprotect Forte x4
9. Bravo, Teldor, Switch
10. Bravo, Teldor, Switch, Serenade

% latent infection in green and ripe fruit



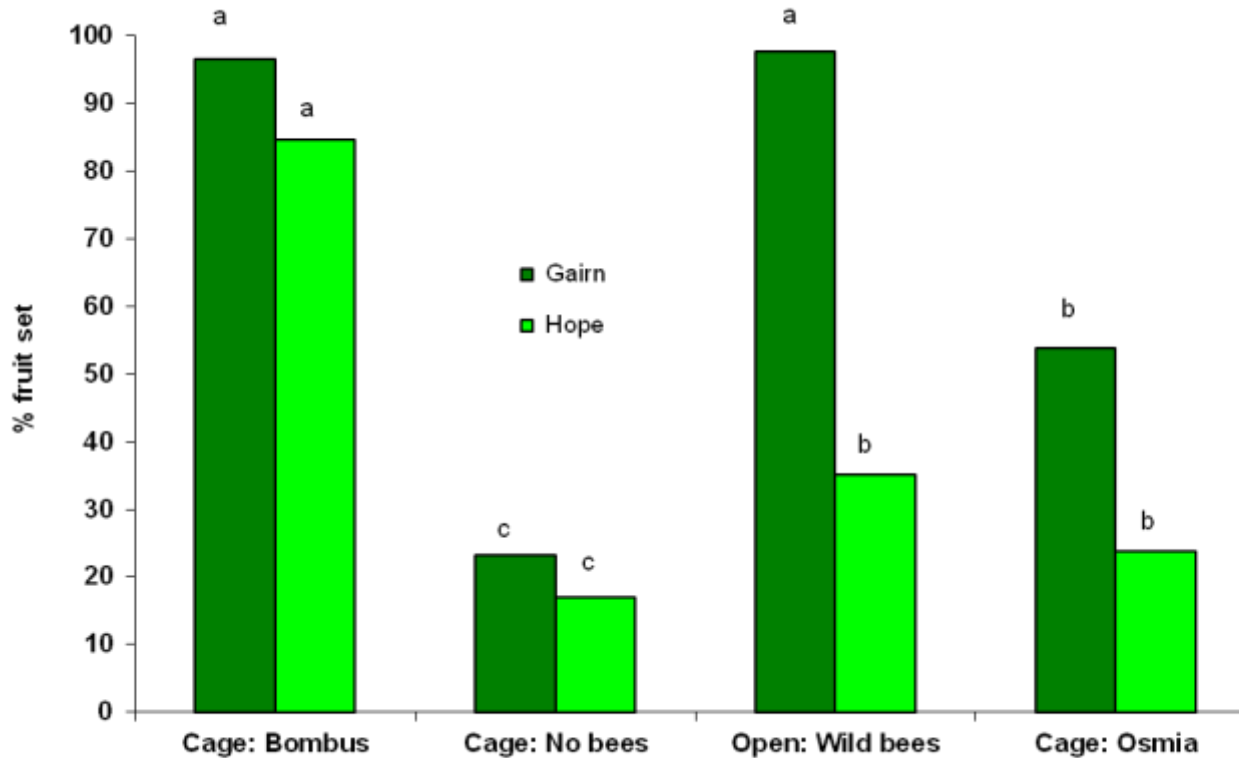
Control of infection during flower

- **All treatments reduced Botrytis**
- **Best treatment (4 x fungicide) reduced Botrytis from 12 to 3.8%**
- **Only 3 early fungicide sprays plus 2 late BCAs sprays as effective**
- **First 3 fungicide sprays are essential**
- **4 BCA applications reduced Botrytis from 12% to 6.6-8.1%**
- **BCAs much more costly than fungicides**
- **Repeated in 2012**

Pollination – 2010 cage trials



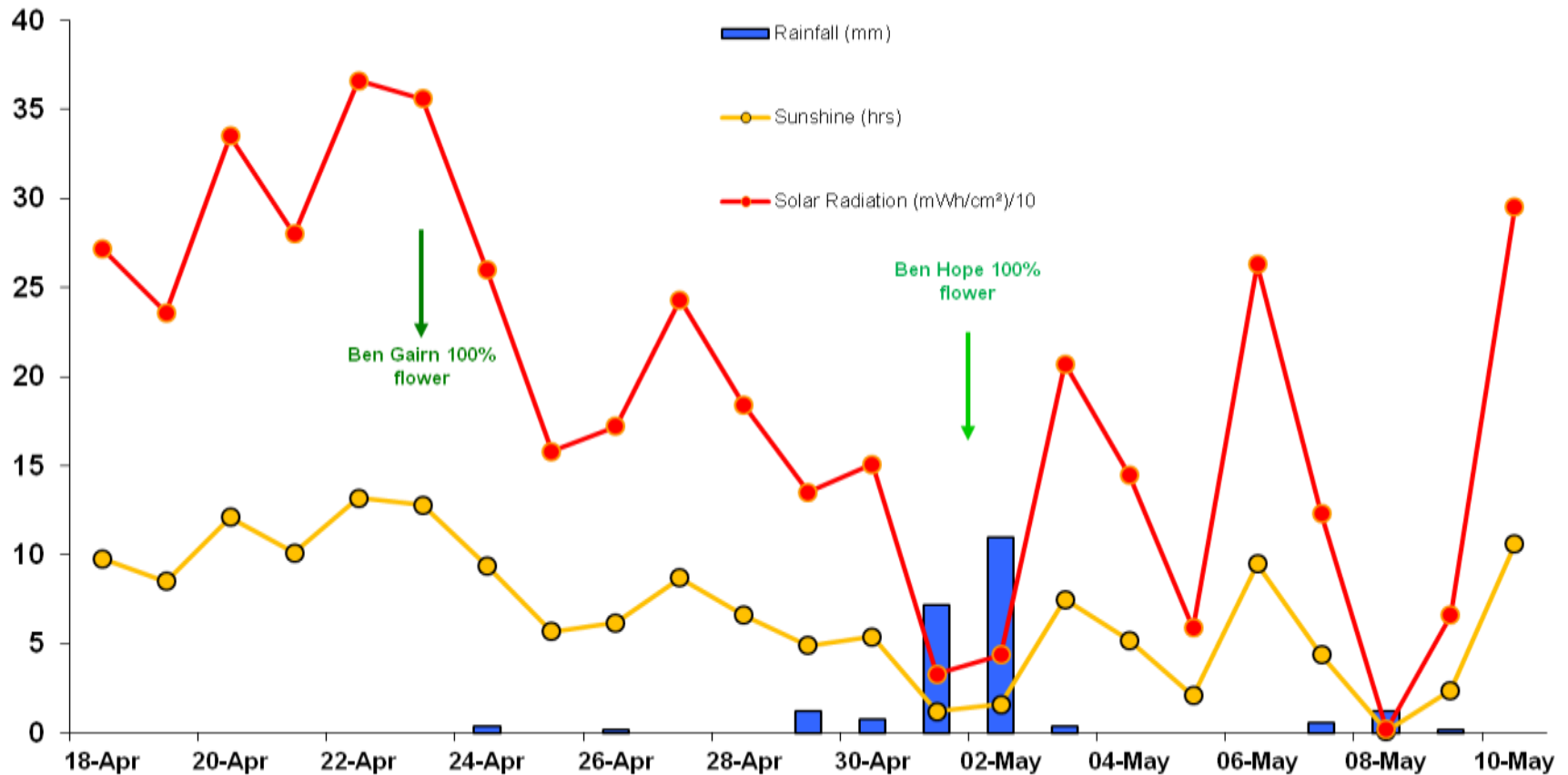
Fruit set



Gairn: Higher fruit set in Bombus and open pollinated

Hope: Poor fruit set in open

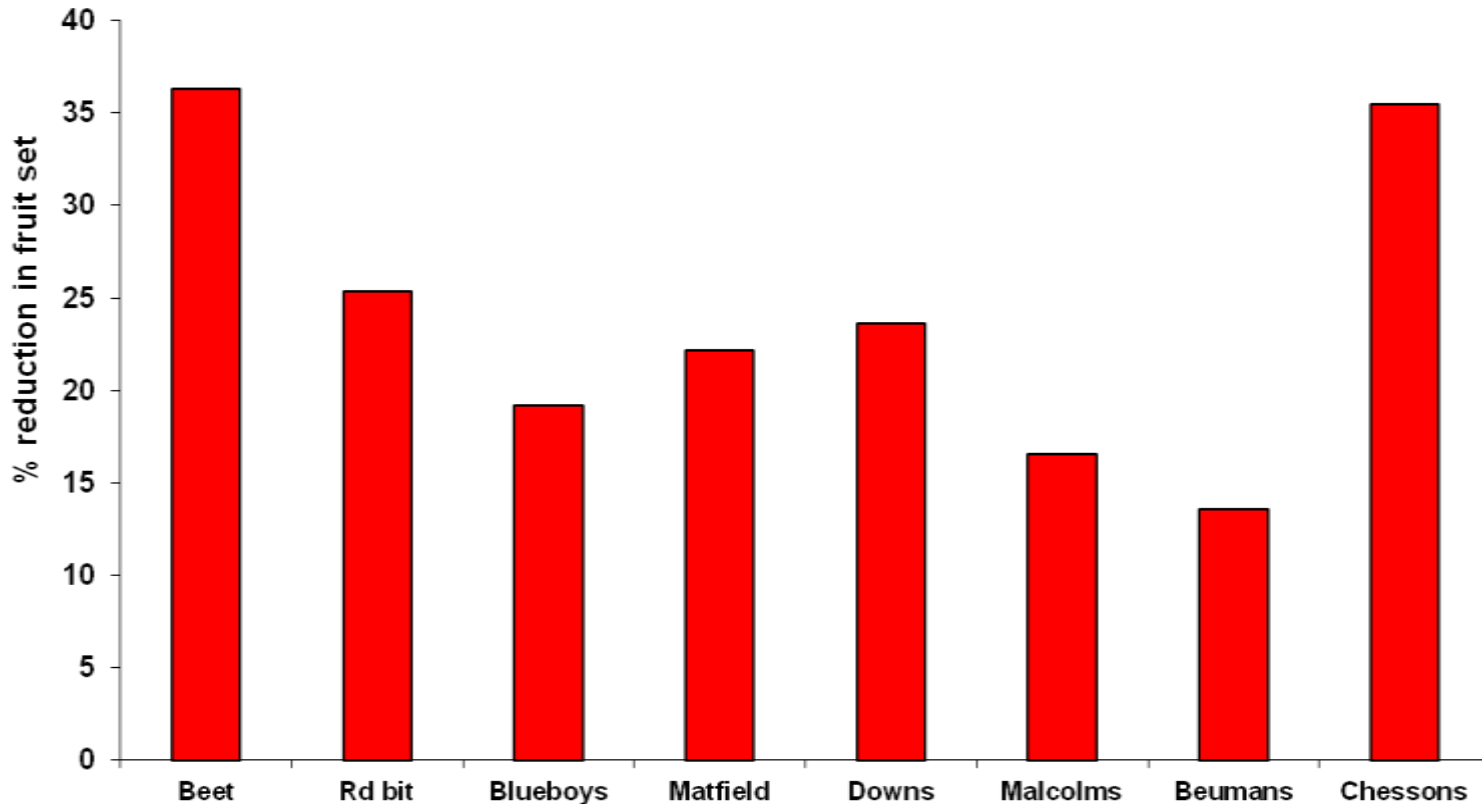
Weather conditions during flowering



2011 Insect exclusion trials



2011 Insect exclusion trials



Up to 35 % less fruit set on strigs with insect exclusion nets

Pollinator diversity in blackcurrant

2010 - EMR blackcurrant plantation on 3 sampling dates

Wild bees (10 sp.)

Bombus terrestris, *B. vestalis*, *B. apidarius*
Andrena carantonica, *A. nigroaenea*, *A. haemorrhoea*,
Halictus tumulorum,
Lasioglossum morio, *L. calceatum*,
Osmia rufa)

Hoverflies (4 sp.)

Epistrophe eligans, *Eupeodes luniger*, *Platycheirus peltatus*, *P. albimanus*

2011 – 8 commercial plantations on 1 date

Wild bees (10 sp.)

Bombus lapidarius, *B. terrestris*
Andrena dorsata, *A. flavipes*, *A. fulva*, *A. haemorrhoea*, *A. helvola*, *A. nigroaenea*, *A. nitida*
Lasioglossum calceatum

Bee fly

Bombylius major

Queen wasp

Dolichovespula saxonica

Hoverflies (2 sp.)

Melanostoma mellinum, *Syrphus ribesii*

Total 15 species of wild bee found altogether

Bees visiting blackcurrant flowers

	No. bees with blackcurrant pollen on head	Total No. assessed	% bees with blackcurrant pollen on head	% of pollen that was blackcurrant
<i>B. terrestris</i>	12	20	60	4
Other bees	15	40	38	18



Pollination- conclusions to date

- **Vulnerability of blackcurrant to poor pollination in poor weather - not adequate for insect activity**
- **Up to 36% less fruit set if flowers not visited by insects**
- **Supplementing natural populations of pollinating insects with bumblebees may ensure a high yield**
- **9 plantations - 15 species of wild bee identified**
- **Very few honeybees**
- **Bumblebees from the nest boxes and wild solitary bees were shown to forage on blackcurrant by the identification of the pollen on their heads**
- **Affects on Botrytis not yet validated, but bees carry Botrytis spores**



Objective 2 – leaf midge





Objective 2 – leaf midge

- **Crop damage assessment
established bushes
cut down bushes**
- **Pheromone trap calibration**
- **Efficacy and timing insecticides**
- **Feasibility of pheromone control**

Crop damage assessment

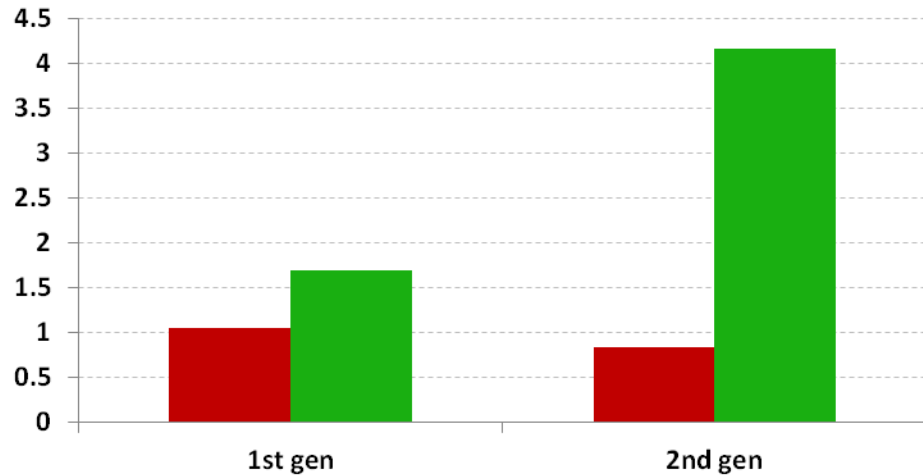
Farm	County	Variety	Age (yrs)
Mile Oak	Kent	Alder	7
Wellbrook	Kent	Alder	7
Red House	Suffolk	Hope	9
Newlands	Kent	Hope	7
Oxhouse	Hereford	Tirran	4
Bradfields	Somerset	Tirran	18 (3 cut)
Bradenham	Norfolk	Tirran	2

Bradfields Fm, Somerset - Ben Tirran

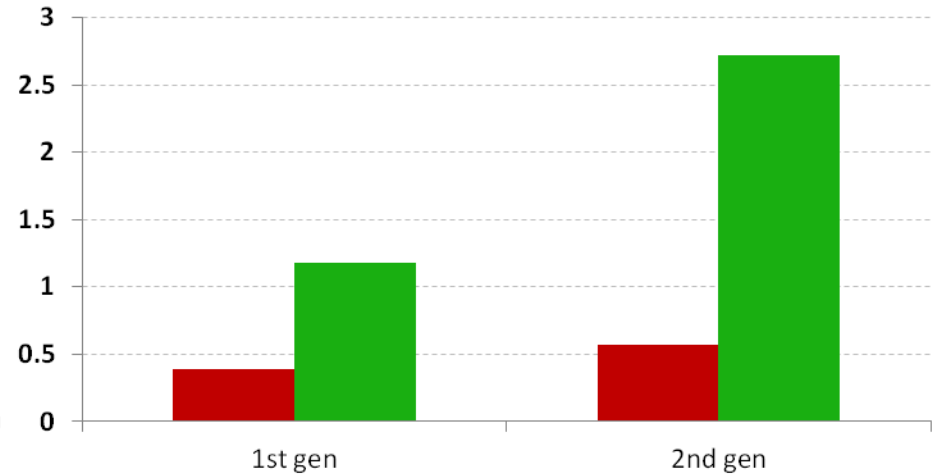


Leaf midge crop damage assessment 2010

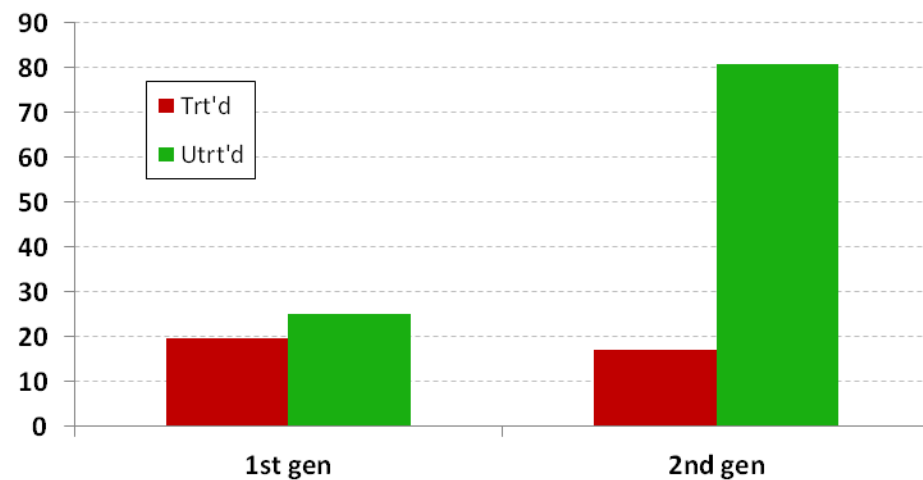
Midges/trap/day



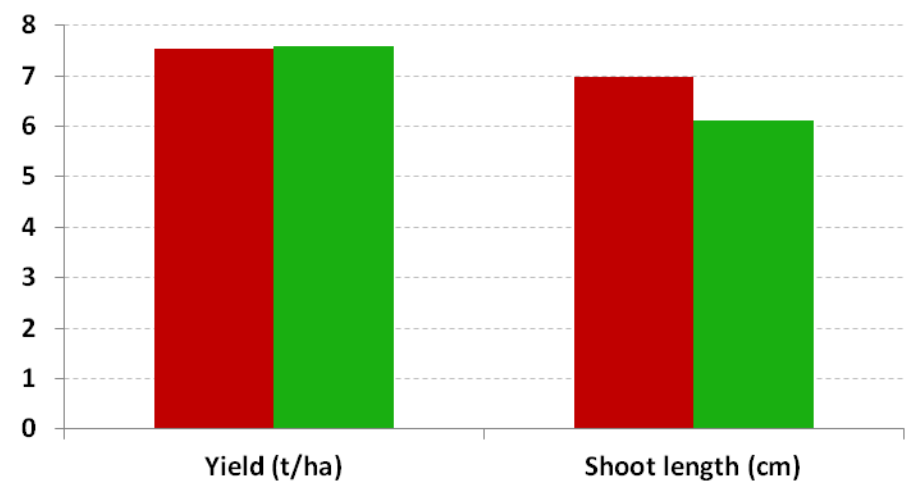
Galls/shoot



Peak midges/trap

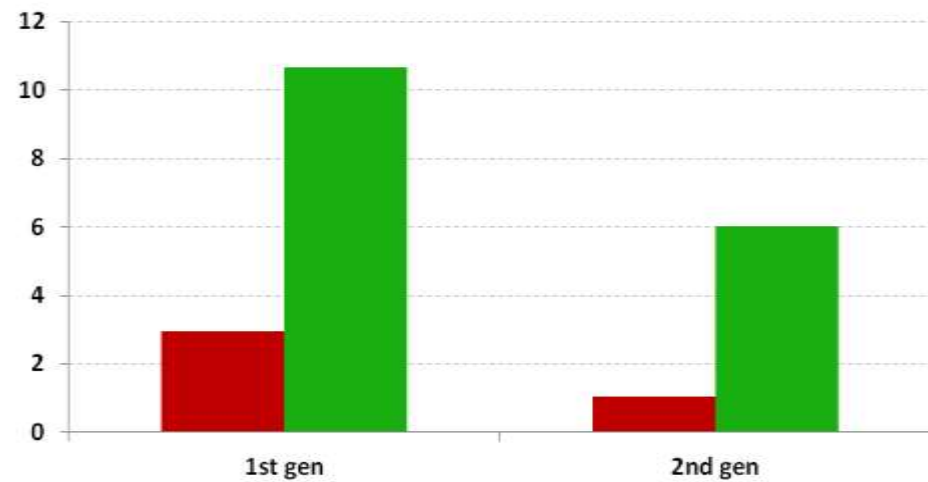


Yield & growth

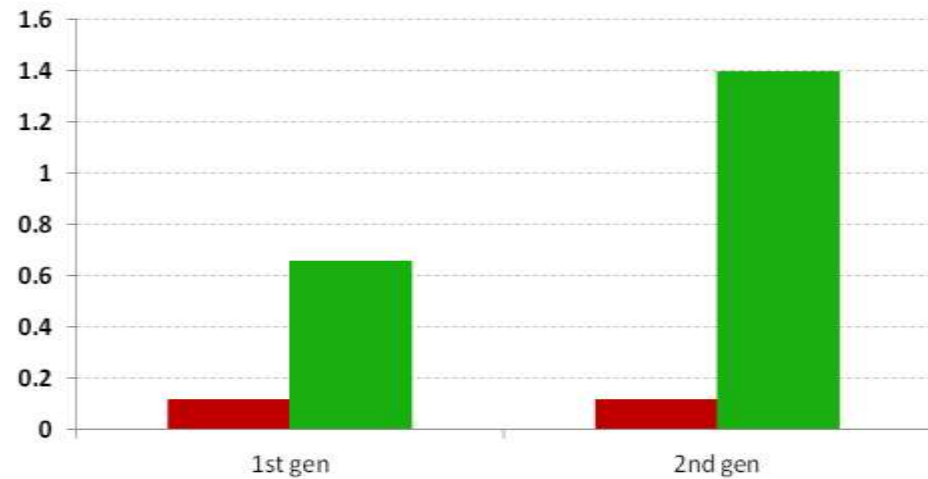


Leaf midge crop damage assessment 2011

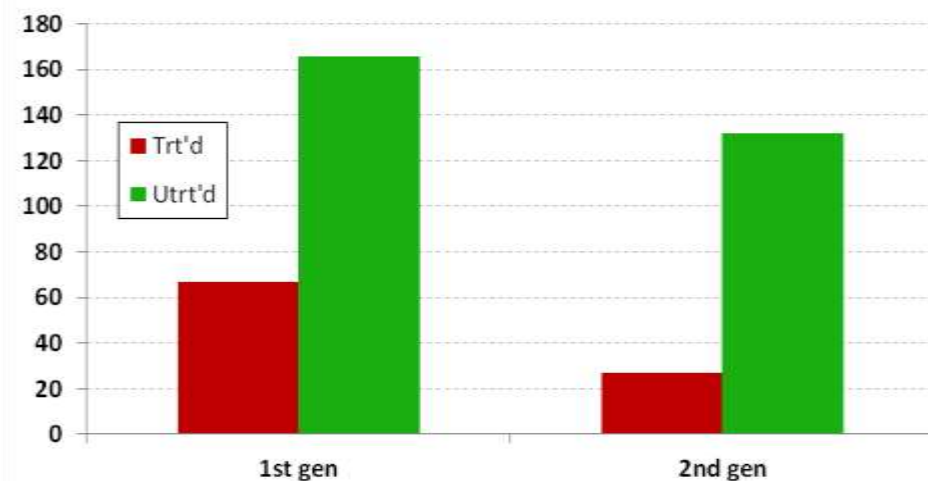
Midges/trap/day



Galls/shoot



Peak midges/trap



Yield & growth

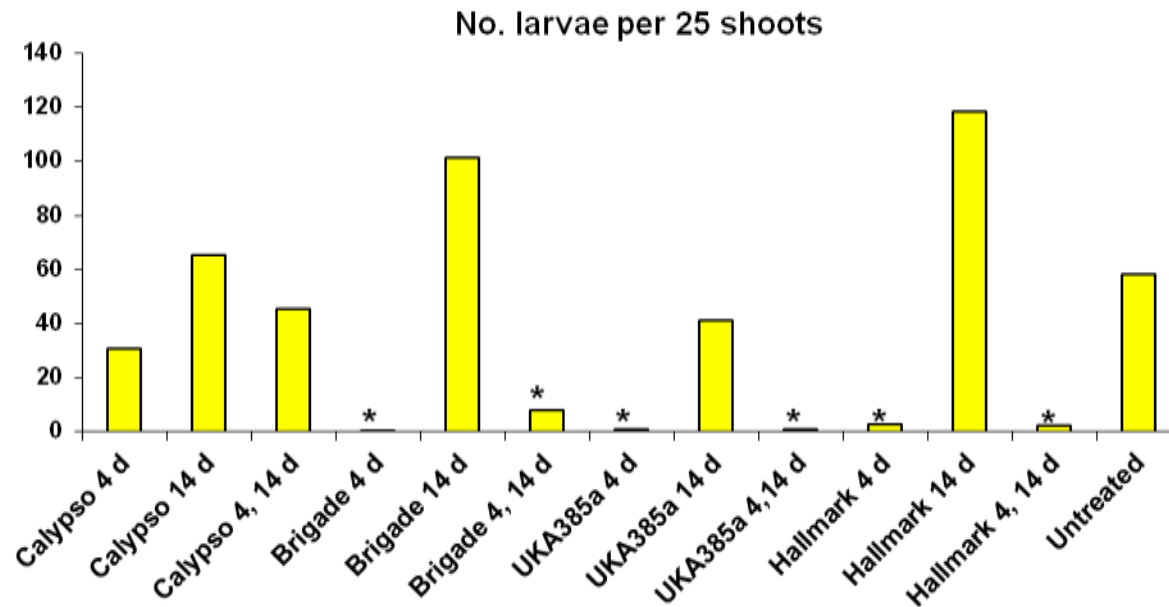
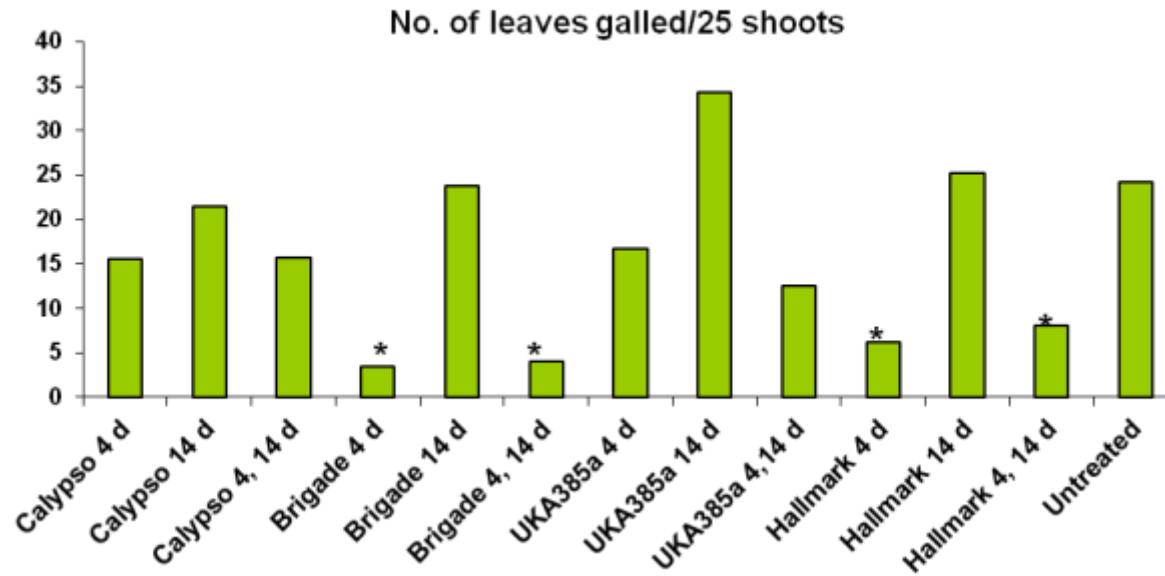


Cut down regrowth 2011





Insecticide timing & efficacy 2010



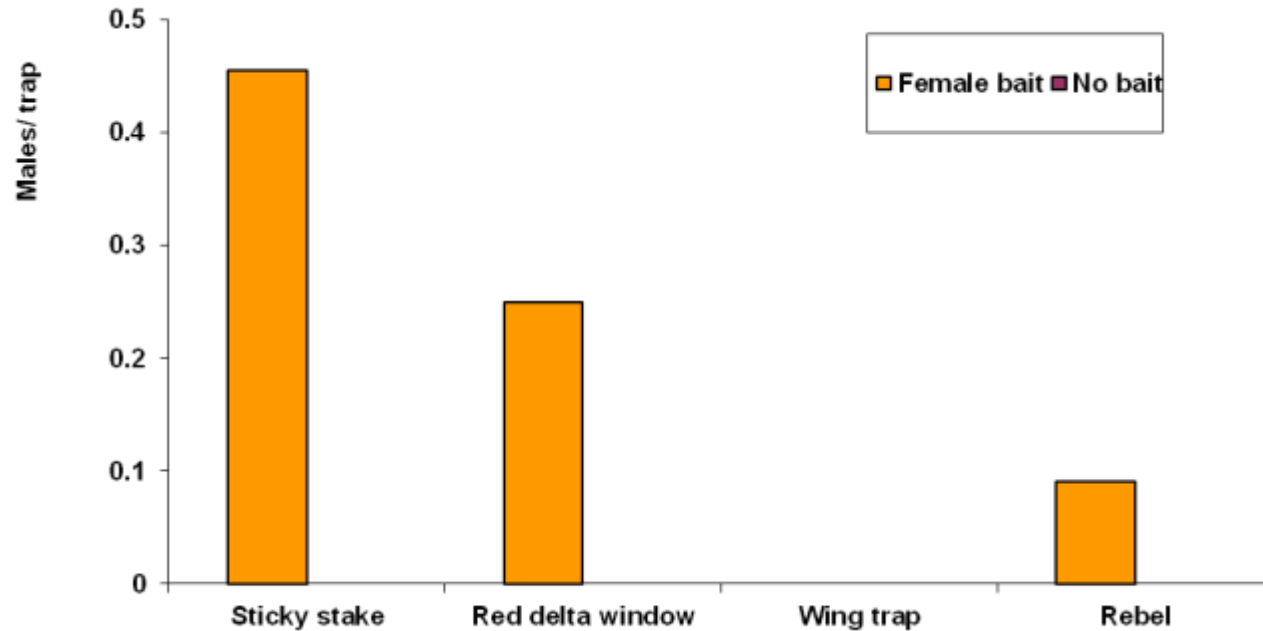
Blackcurrant sawfly (*Nematus olfaciens*)



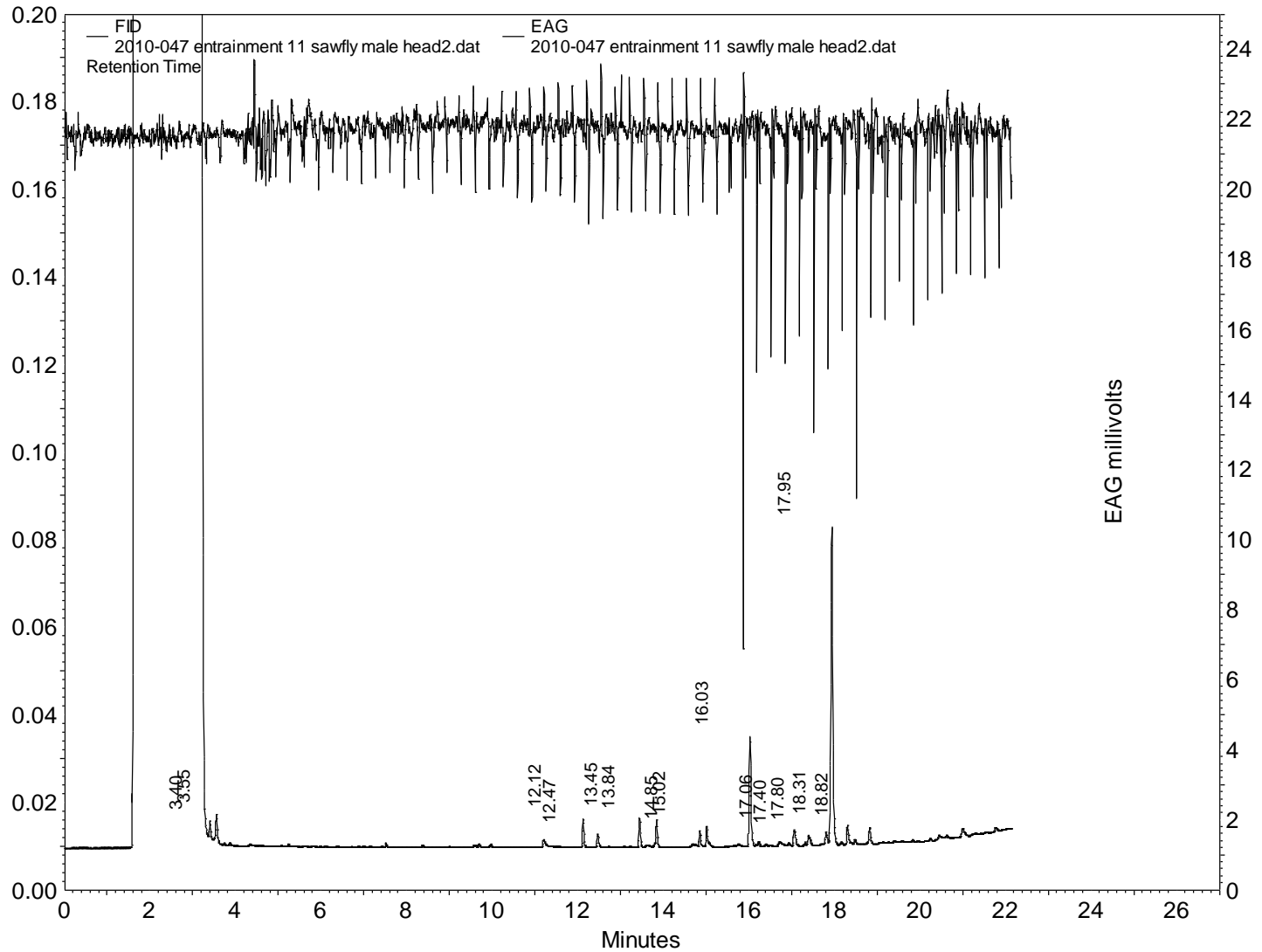
Blackcurrant sawfly

- **Demonstrate sex pheromone attraction and investigate mating behaviour**
- **Identify sex pheromone**
- **Develop lure and trapping system, and calibrate in the field**

Female attraction - Trap design



GC-EAG analysis



Summary

- **Good progress being made on all objectives**
- **Evaluate IPDM in commercial crops in last 2 yrs of project**



The Consortium

Science partners

- EMR, NRI, JHI

Industry partners

- GSK, Bayer, Fargro, Red Beehive Co
- Ian Overy farms, Wellbrook farms, R Boucher & Son, Maynards, Bradenham Hall Farms, Bradfields Fm Ltd, Corbett Fms Ltd, J Youngman & Sons, Adamston Fms Ltd

Funders

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