Progress(?) in invertebrate pest control – highlights from BCPC reviews

Dr Jon Knight
Highlights of Pests and Beneficials Reviews

- 7 years of Pest & Beneficials Review meetings
- Recurring themes
- Crop examples
- Grower perspectives
- Conclusions - Progress....
2016 - Can we continue to grow oilseed rape in the UK?
2017 - Achieving sustainable pest control – hard lessons from the pyrethroid story and implications for an IPM future
2018 - Building confidence in beneficials
2019 - Breeding to Boost IPM - Can We Rise to the Pest Control Challenge?
2020 - ‘Making Metrics Pay’
Can data-driven decision making deliver profitable IPM?
2021 - Delivering IPM - Overcoming the Regulatory and Economic Barriers to Progress
2022 - Trials, Tribulations and Successes of IPM

csfb
often
field
damage
farmers
impact
risk
provid
ed
used
need
adoption
tools
decision
use
work
management
crop
control
information
available
Any change?

Oilseed Rape
Why the interest?

Oil Seed Rape Area

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>800,000</td>
</tr>
<tr>
<td>2013</td>
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<td>2021</td>
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<td>2022</td>
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First meeting of group in 2016 on *The future of growing oilseed rape*

- Economic appraisal
- OSR and neonicotinoid loss. Discussion of evidence and best practice to determine impacts
- Farmer and Agronomist perspective
- Danish experience
- Cabbage Stem Flea Beetle management

“IPM is a need not an option”
A drive for increased in-crop biodiversity (as opposed to pollinator margins etc.) could have a significant negative impact on crop production.

There is a need for transparent farm relevant, experimental data to provide robust decision making e.g. thresholds.

Current concerns over the use of neonicotinoid insecticide seed treatments must be put into context with other factors impacting bee health.

“Limited chemistries will mean unlimited resistance”.

The economic and environmental impact of OSR must be understood.

There is an urgent need to establish a systematic and standardised monitoring programme for insect pollinators.
2018 Review (Beneficials)

- Cost Benefits of thresholds - including for pests of OSR e.g. Pollen Beetle
- Report on work on conservation biocontrol of OSR pests by beneficials

2022 Review (Trials, tribulations...)

- IPM strategies for cabbage stem flea beetle
2018 - Cost Benefits of thresholds

Economic thresholds

- Pollen beetle: 10
- Virus vectors (e.g. aphids): 8
- Cabbage seed weevil: 16

More than 0.5/plant in northern Britain
1/plant elsewhere

Ramsden et al. (2017) Crop Protection 96, 30-43
**Summary example – Pollen beetle**

<table>
<thead>
<tr>
<th>Density (plants/m²)</th>
<th>Threshold (pollen beetles per plant)</th>
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<tbody>
<tr>
<td>&lt; 30</td>
<td>25</td>
</tr>
<tr>
<td>30–50</td>
<td>18</td>
</tr>
<tr>
<td>50–70</td>
<td>11</td>
</tr>
<tr>
<td>&gt; 70</td>
<td>7</td>
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</table>

Excess pods can be lost with no impact on yield.
2018 - Cost Benefits of thresholds
Obstacles to implementing thresholds

- Calendar/insurance based insecticide application
  - Obvious results
  - Forgiving application
  - Established methods
  - Cheap
  - Quick

- Threshold based applications
  - Relative results
  - Difficult to get right
  - Complex systems
  - Investment needed
  - Often slow

- All insects gone
- Sub-optimal application still works
- Fits with existing system
- Relatively low short-term costs
- Can have immediate effect

**Farmer Focused Research**

- Pest remains in crop
- IPM solutions do not always work
- Numerous spatially variable techniques
- Establishing field margins
- Benefits accumulate over years
Conservation via habitat management: field margins

• Uncultivated field margins can act as refuges for tillage-susceptible parasitoid populations to thrive

• Flowering field margins can improve pollen beetle parasitism on neighbouring crops (by provision of pollen and nectar resources) (Thies & Tschamntke 1996; Buchi 2002)

• Brassicas needed to build-up populations of brassica-specialist parasitoids (!)

  - Insect samples & plant composition was monitored from 16 margins sown to 4 different types of semi-natural habitat: (1) wild bird cover (2) florally-enriched grassland (3) insect rich cover (4) natural regeneration

  - 50 parasitoids of OSR pests were identified; only 3 were in margins containing no brassicas
2016

Four steps to developing and delivering fully integrated pest management strategies.
1. Action thresholds - defined in the UK but essential they are understood and trusted.
3. Prevention. Pest resistant cultivars (Amalie resistance to TuYV)
4. Control can be managed using mechanical, insecticidal and biological controls.

2022

IPM is the solution to CSFB problem using 4 key steps.
1. Action thresholds – rethink threshold in terms of physiological damage to the plants.
2. Early sowing strategies to avoid adult damage require caution - monitoring
3. Prevention of damage by planting resistant cultivars is not currently available. Trap crops showing some promise, cultivations and rotations.
4. Controls using new insecticides with RNAi technology, biopesticides, entomopathogenic fungi and nematodes have been shown to work in the lab. Conservation biological control shows some promise in field experiments.
2018 Review - Application of biocontrols in outdoor crops - Horticulture

- Conservation Biocontrol
  - Pear sucker
  - Conservation biocontrol
  - Pesticide impact on biocontrols
  - Thresholds
  - Habitat required
2018 Review - Application of biocontrols in outdoor crops - Horticulture

- Augmentation biocontrol
  - Western Flower thrips in strawberry
  - Neoseiulus cucumeris predatory mite

- New Pests
  - Spotted Wing Drosophila
    - First discovered in the UK 2012
    - Development of trapping
    - i.d. of parasitoids in UK

![Spotted Wing Drosophila](https://commons.wikimedia.org/wiki/File:Spotted-wing_Drosophila_%28Drosophila_suzukii%29_male_15585238246.jpg), "Spotted-wing Drosophila (Drosophila suzukii) male (15585238246)", https://creativecommons.org/licenses/by/2.0/legalcode
OSR
- Architect
- Companion crop - beans/clover/cereal volunteers
- Trap crop - turnip rape/kale
- Home Saved Seed and prepare to be flexible
- Don not spray for pollen beetle or seed weevil

Wheat
- Skyfall/Zyatt?/Deter?
- Clover understory/keep OSR volunteers
- Not too early apply compost
- No T0 fungicide
- No autumn aphicide

Beans
- Spraying pointless or use entomopathogen
- Plant into rye/oats cover crop mulch

Backed up by
- No till
- Compost/manure
- Urea/UAN/foliar nutrients
- Countryside stewardship
- LEAF Marque
- Field specific monitoring alerts
- Patience & flexibility

A Plan... Andy Barr - Kent Farmer 2018
Insect biodiversity Lenham

Average individuals per sampling

- No companion crop: 700
- Phacelia / oats mix: 600
- Phacelia / radish mix: 500
- Beetle bank: 400

Average species per sampling

- No companion crop: 6
- Phacelia / oats mix: 5
- Phacelia / radish mix: 4
- Beetle bank: 3
Progress……

- Enabling policy is emerging  
- We know more about more
- We can change how we manage pests
- More options are available
- We better Understand Risks
- More work to be done
Integrated Pest Management (IPM) means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to ecosystems and encourages natural pest control mechanisms.

Thank You

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