Crop tolerance as a component of IPM

Steve Ellis ADAS High Mowthorpe, UK
The case for change

Limited chemical armoury + Few new actives + Insecticide resistance + Expensive alternatives to pyrethroids = IPM
Pyrethroids & their alternatives: Pollen beetle control in UK

<table>
<thead>
<tr>
<th>Standard treatment</th>
<th>Alternative products</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pymetrozine</td>
<td>Indoxacarb</td>
</tr>
<tr>
<td>Lamda-cyhalothrin @ £7.48/ha</td>
<td>£40.86/ha</td>
<td>£31.34/ha</td>
</tr>
</tbody>
</table>
What is crop tolerance?

The capacity for a plant to withstand or recover from injury without any discernible impact on yield

‘With resistance things are kind of stop right there,
But with tolerance things are more laissez-faire’
Early sown autumn tillering

WBF damage

Late sown spring tillering

WBF eggs laid

Key timings
Why is tolerance important?

• Damage does not mean yield loss
• Use tolerance to rationalise insecticide use
• Uses crop as first step in risk assessment
### Asking the right questions

<table>
<thead>
<tr>
<th>Pest</th>
<th>How many pods/shoots required for potential yield?</th>
<th>How many excess buds/shoots can the crop produce?</th>
<th>How hungry is the pest?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollen beetle</td>
<td>6000-8000 pods/m²</td>
<td>Up to 4000 pods/m²</td>
<td>Eats nine buds</td>
</tr>
<tr>
<td>Wheat bulb fly</td>
<td>500 shoots/m²</td>
<td>Up to 600 shoots/m²</td>
<td>Destroys four tillers</td>
</tr>
<tr>
<td>Slugs</td>
<td>500 shoots/m²</td>
<td>Up to 600 shoots/m²</td>
<td>Unknown</td>
</tr>
</tbody>
</table>
Are we measuring the right things?

Problems with current thresholds:
• Not user friendly
• Time consuming
• Temperature dependent
• Elusive quarry
What have the Americans ever done for us? (Litsinger, 2009)

<table>
<thead>
<tr>
<th>Insect feeding group</th>
<th>Example pests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce green leaf area</td>
<td>Slugs, flea beetles, pea and bean weevil, pollen beetle, seed weevil, slugs</td>
</tr>
<tr>
<td>Reduce plant number</td>
<td>Slugs, wireworms, leatherjackets, dipterous stem borers</td>
</tr>
<tr>
<td>Assimilate sappers</td>
<td>Aphids, saddle gall midge, orange wheat blossom midge</td>
</tr>
</tbody>
</table>
Using tolerance to develop ‘smarter’ thresholds

• Utilising the existing crop
  • Pollen beetle
  • Slugs

• Growing robust crops that can tolerate pests
  • Stem borers e.g. wheat bulb fly

Excess flower number is inversely related to plant number

![Graph showing the relationship between excess flowers per plant and plants per square meter for different varieties and years.](image)
Pollen beetle threshold varies with plant number
Seed rate experiments

![Graph showing yield vs. seed rate for two different locations: Rosemaund 2012 and Terrington 2011.](image-url)
Should I increase seed rate or apply slug pellets in OSR?

- Untreated
- Increasing seed rate
- Single dose of pellets

Diagram showing the gross margin over seed and slug pellet cost (£/ha) against the percentage of plants lost to slugs.
Preliminary wheat bulb fly threshold scheme

<table>
<thead>
<tr>
<th>Egg count (million per ha)</th>
<th>Minimum shoot number/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25</td>
<td>720</td>
</tr>
<tr>
<td>2.50</td>
<td>940</td>
</tr>
<tr>
<td>5.00</td>
<td>1380</td>
</tr>
<tr>
<td>7.50</td>
<td>1820</td>
</tr>
</tbody>
</table>

AHDB Project Report No. 598
Crop management guidelines for minimising wheat yield losses from wheat bulb fly. Storer, Ellis & Berry 2018
How will thresholds evolve?

- User friendly
- Inexpensive to use
- Based on sound science
- Take account of crop tolerance
- Combine pests in feeding groups
- Incorporate models of pest development
- Incorporate remote sensing of crop
There’s a revolution brewing, and the great thing is that to join it all you have to do is absolutely nothing.’

Tom Hodgkinson, 2004
Thank you