Managing ALS-resistant broad-leaved weeds: current research and future needs

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Background & challenge!

• Loss of herbicide actives (Legislation)
• Lack of herbicide choice with remaining actives
• Over-reliance on ALS-inhibitor products
• ALS - Greatest resistance incidence globally
• Broad-leaved weed (BLW) resistance increasing
• Biology of BLW’s - less cultural options
• Learn lessons from other resistant species
Research project aims

• Practical solutions to control ALS-resistant broad-leaved weeds (focus on *Papaver rhoeas*)
  • Identify & quantify the risks
  • Optimise strategies to manage, reduce resistance
  • Raise awareness & provide early warning
• Four year project: field, container & glasshouse

[Logos of AHDB, BASF, Dow AgroSciences, Dupont, and ADAS]
# Treatments: Field & Containers

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop rotations</th>
<th>Herbicide treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wheat</td>
<td>Untreated</td>
</tr>
<tr>
<td>2</td>
<td>Wheat/oilseed rape</td>
<td>ALS alone</td>
</tr>
<tr>
<td>3</td>
<td>Wheat</td>
<td>Non-ALS + ALS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-ALS</td>
</tr>
</tbody>
</table>

- Field populations (known resistance)
- Plot size 12m x 12m (+ buffer zones)
- 4 replicate blocks
- Herbicides vary with crop, **BUT** same active group
- *P. rhoeas* plant counts & head counts
Rotational 3 year trial plots
(one weed population)
## Herbicide treatments

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Wheat</th>
<th>Oilseed rape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ALS alone</td>
<td>Metsulfuron-methyl (20% ww)</td>
<td>Imazamox (17.5 g/l)</td>
</tr>
<tr>
<td>Non-ALS + ALS</td>
<td>Flufencet (60g/l) + pendimethalin (300g/l) fb.</td>
<td>Imazamox (17.5 g/l) + metazachlor (375g/l)</td>
</tr>
<tr>
<td></td>
<td>Metsulfuron-methyl (20% ww)</td>
<td></td>
</tr>
<tr>
<td>Non-ALS</td>
<td>Flufencet (60g/l) + pendimethalin (300g/l) fb. MCPA (500g/l)</td>
<td>Metazachlor (500g/l) fb. Propyzamide (500 g/l) + aminopyralid (5.3 g/l)</td>
</tr>
</tbody>
</table>
A non-ALS herbicide programme required to control ALS-resistant *P. rhoeas* (Year 1)
Crop and herbicide choice effect control levels of ALS-resistant *P. rhoeas* (Year 2)
Good pre-emergence control in Oilseed rape crop (Oct 2013)

Untreated

Metazachlor (pre-em)
Good pre-em control in wheat (Dec 2013)

Untreated

Pendimethalin + flufenacet (pre-em)
Differences in *P. rhoeas* growth stages (Jan 2014)

Oilseed rape  Wheat

Herbicide application & growth stage important
Clear treatment differences (July 2013)
*P. rhoeas + T. inodorum levels high*  
(July 2014)

*P. rhoeas* too large for spring post-ems- many not controlled
ALS alone in wheat – no crop visible!

ALS-alone

Non-ALS
Container-based trials

*P. rhoeas* populations (susceptible, 2 resistant)

- Results support field data
- Seed collected annually

Treatments isolated at flowering
Final project year

• Seed return high - farmer concerns
• Non-ALS field treatments only
• Container treatments as previous years
• Seed collection 2015 (field + glasshouse)
• Glasshouse seed testing programme
• Data analysis and reporting
Supporting research

12 tested, 8 resistant

7 tested, 4 resistant

7 tested, 3 resistant
Conclusion and future needs

• Broad-leaved weed resistance is increasing
• UK- Currently numbers low/manageable
• Effective non-ALS control essential:
  • Retaining herbicide actives, especially pre-ems
  • Product timing post-em critical
• Cultural control options limited
• Seed production vast (*P. rhoeas*)
• Monitor development + make local decisions
• Communication between all countries
Acknowledgements

• Funders
• ADAS research staff + statisticians
• Host farmers – very challenging trials!