Harvest Weed Seed Control – the value of chaff tramlining?

Dr Paul Fogg – Frontier
Outline

• Resistance – need for novel approaches
• Harvest Weed Seed Control
• Chaff Tramlining
• Trials
• Summary
Need for novel approaches

Current status of herbicide resistant weeds
- Black-grass – 20,000 farms in 35 Counties
- Ryegrass - >475 farms in 33 Counties
- Wild oats - >250 farms in 28 Counties

Economic Significance
- 100 black-grass plants / m2 – yield penalty
  1 t/ha + can increase lodging risk
- All crops affected not just cereals
- Herbicide costs <£100/ha – limited effectiveness

Counties (35) with herbicide resistant black-grass. Hull et al., 2014
Need for novel approaches

Source Stephen Moss & Tom Allen-Stevens
Harvest Weed Seed Control

Harvest weed seed control (HWSC) exploits the high proportions of seed retained at maturity by some weed species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Country</th>
<th>% retention at harvest</th>
<th>HWSC potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avena fatua</td>
<td>Australia</td>
<td>69-84</td>
<td>High</td>
</tr>
<tr>
<td>Avena fatua</td>
<td>USA/Canada</td>
<td>39</td>
<td>Low</td>
</tr>
<tr>
<td>Avena fatua</td>
<td>UK</td>
<td>4-20</td>
<td>Low</td>
</tr>
<tr>
<td>Bromus sp.</td>
<td>Australia</td>
<td>77</td>
<td>High</td>
</tr>
<tr>
<td>Lolium rigidum</td>
<td>Australia</td>
<td>85</td>
<td>High</td>
</tr>
<tr>
<td>Lolium multiflorum</td>
<td>USA/Canada</td>
<td>58</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Chenopodium album</td>
<td>USA/Canada</td>
<td>90</td>
<td>High</td>
</tr>
<tr>
<td>Galium sp.</td>
<td>USA/Canada</td>
<td>74</td>
<td>High</td>
</tr>
<tr>
<td>Sinapis arvensis</td>
<td>USA/Canada</td>
<td>70</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Alopecurus myosuroides</td>
<td>UK</td>
<td>10-50</td>
<td>Low</td>
</tr>
</tbody>
</table>

Walsh et al., 2018
Black-grass seed retention

- Ca. 10% per week seed shedding from early July
- 10-30% retained at wheat harvest
- More in winter barley and OSR

Neve & Hull (unpublished data)
Harvest Weed Seed Control

95% of the weed seed entering the combine exists in the chaff making HWSC and obvious area for further investigation

- Options include:
  - Chaff carts
  - Narrow windrow burning
  - Bale direct
  - Weed seed destruction
  - Chaff tramlining
Chaff Tramlining

- Placement of chaff into narrow rows 20 – 30cm wide
  - Wheel tracks – chaff tramlining
  - Single row – chaff lining
- Looking to create a “hostile” environment for germination
  - Mulch effect to prevent germination
  - More compacted soils – tramlines
  - Different micro-climate
- Suited to both CTF and non-CTF system
  - Does require consistent combine lines year on year
UK trials 2017

- **Objectives**
  - Would it physically work under UK Conditions?
  - Would it consolidate black-grass seeds?

- **Would it work under UK conditions?**
  - 1250 ha cut, wheat, OSR, barley, oats, linseed beans – No problems

- **Would it consolidate black-grass seeds?**
  - Trial field – winter barley CV. Volume
  - Average black-grass population 219 heads/m² prior to harvest
  - Crop harvested on 14th July 2017 – estimated 30-50% black-grass seed retained
  - Following crop OSR
  - Black-grass assessed early October
UK trials 2017

UK Chaff Deck evaluation Autumn 2017

- Chaff tramline: 260 Black-grass Plants/m²
- Rest of field: 44 Black-grass Plants/m²

6 fold increase
UK trials 2018

- Background black-grass population 512 plants/m²
- 77% black-grass seed shed pre-harvest – winter wheat

![Distribution of black-grass seed post harvest](image)

- Tram-line 1
- Tram-line 2
- Mean
- Infield sample

3 fold increase
UK trials 2018 – could we delay seed shed?
UK trials 2018 – could we delay seed shed?

Black-grass seed retention pre-harvest

![Bar chart showing black-grass seed retention](chart.png)

- **Non Weed surfed**
  - Black-grass seed shedding % (10 plants assessed)
  - Number of seeds remaining per ear

- **Weed Surfed**
  - Black-grass seed shedding % (10 plants assessed)
  - Number of seeds remaining per ear
UK trials 2018 – could we delay seed shed?

Distribution of black-grass seed post harvest

<table>
<thead>
<tr>
<th>% Black-grass seed</th>
<th>Tram-Line 1</th>
<th>Tram-line 2</th>
<th>Infield sample</th>
<th>Tram-line 1</th>
<th>Tram-line 2</th>
<th>Infield sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed Surfed</td>
<td>Yellow</td>
<td>Yellow</td>
<td>White</td>
<td>Green</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>Non-Weed surfaced</td>
<td>Green</td>
<td>Green</td>
<td>White</td>
<td>Green</td>
<td>Green</td>
<td>White</td>
</tr>
<tr>
<td>No Sample</td>
<td>No Sample</td>
<td>No Sample</td>
<td>No Sample</td>
<td>No Sample</td>
<td>No Sample</td>
<td>No Sample</td>
</tr>
</tbody>
</table>
Longer term benefits

- Main aim is to try and consolidate the weed seeds being returned to the field
  - 100 heads/m² = 1t/ha

- Full benefits likely to be realised across the rotation – greater weed retention depending on crop

- Subsequent management of chaff tramlines?
  - Do nothing
  - Treat separately
  - Key area for further study
Summary

• Herbicide resistance is an ever increasing problem
• New herbicide MOA are rare
• Long term integrated approaches are required
• 95% of the weed seed entering the combine exists in the chaff
• HWSC exploits the high proportions of seed retained by some weed species at maturity
• Chaff tramlining has proved to consolidate black-grass seeds – great benefits observed for brome spp.
• Full benefits from chaff tramlining will be realised across the rotation – combined with other approaches
Acknowledgments

Gary Davison – Greenend Farm
Charlie Reynolds – Courteen Hall Farm
Will Goff – Foxborough Farms