2016
Blackgrass - Keeping rotations profitable
Ben Taylor-Davies
Selective herbicide resistance
Chemical group HRAC

However………

No known resistance to Chemical Group $C_{12}H_{23} + Fe$!
When speaking to Dr Michael Owen of Iowa State University about preventing glyphosate resistance in blackgrass

“Do **not** repeat what we have done! i.e multiple applications of glyphosate with no mechanical tillage”
Post emergence applications too soon after a pre emergence herbicide can potentially result in poorer results and faster development of resistance.

Stressed weeds are harder to kill than healthy, actively-growing weeds.

Plants can be stressed and not show any distinct visual signs.

**Stress can be caused by:**

lack of moisture, dry conditions,
lack of oxygen due to waterlogging
extremes of temperature, for example, cold (frost) and heat
nutrient deficiencies
insect pests, for example aphids and wireworms
disease
mechanical damage, that is, tillage or slashing.

A sublethal dose of herbicide from previous applications or residues
Hormesis as a driver for resistance?

Year of release (highly effective on blackgrass)
Dose 100gm ai Ha

Resistance (no real effect on blackgrass)

Graminicide example: Fluazifop-P-butyl (Fusilade) (HRAC A)

Use over time

Are we creating greater pressure on follow up Clethodim (Group A) applications?

Reduced efficacy, increased rate
Dose 187.5ai Ha

years of resistant selection
(product used at 62.5ai Ha for Volunteer control)
Blackgrass often described as the ‘perfect’ weed

- Poorly structured soils
- Germinates mostly in Autumn 85%
- Grows well in very wet soils
- Thrives in disturbed soils
- Highly competitive
- Has a huge tillering capacity
- Sheds seed before harvest
- Resistant to almost all herbicides
- Shallow germinating depth…
Most obvious mutations in blackgrass

- In 2 generations potentially 144,000,000 seeds
- Rapid selection!

Herbicide resistance

Julian Oliva - University Catolica de Cordada

Weed surfer, Used on UK Organic farm

Selected for blackgrass shorter than the growing crop of clover within 3 years
Less obvious selections in blackgrass........

- Similar farm with similar issues.
- Carrier to depth of 50mm (surface tillage) Vaderstad rapid drill
- **Selected** BG germinating from >50mm mutation.
Brome grass samples (Australia)

All seeds ‘set’ on the same day

Field population

Evolving longer dormancy to avoid pre emergence herbicides!

Standard population (found along roadsides)

January 2019
What are you selecting for?
Or a simple anomaly?
Mutations to perennial blackgrass?
Crop rotations for blackgrass control

Clattercote Priory Farm cropping 1998-2018
Traditional rotations of wheat and oilseed rape selected for a very narrow blackgrass germination window

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Drilling date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>1999</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>2000</td>
<td>Winter Rape</td>
<td>November</td>
</tr>
<tr>
<td>2001</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>2002</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>2003</td>
<td>Winter Rape</td>
<td>November</td>
</tr>
<tr>
<td>2004</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>2005</td>
<td>Spring Barley</td>
<td>November</td>
</tr>
<tr>
<td>2006</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>2007</td>
<td>Winter Rape</td>
<td>November</td>
</tr>
<tr>
<td>2008</td>
<td>Winter Wheat</td>
<td>November</td>
</tr>
<tr>
<td>2009</td>
<td>Spring Linseed</td>
<td>November</td>
</tr>
<tr>
<td>2010</td>
<td>Winter Wheat</td>
<td>November</td>
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<tr>
<td>2011</td>
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<td>November</td>
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<td>2015</td>
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<tr>
<td>2016</td>
<td>Winter Wheat</td>
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</tr>
<tr>
<td>2017</td>
<td>Spring Barley</td>
<td>November</td>
</tr>
</tbody>
</table>

Clattercote Priory Farm cropping 1998-2018

- Traditional rotations of wheat and oilseed rape selected for a very narrow blackgrass germination window
- Spring cropping 88% control
Manipulating blackgrass
A whole new approach to rotation enhancing nature

### Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop block</th>
<th>Cultivation block</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Winter Wheat</td>
<td>Direct drill</td>
</tr>
<tr>
<td>2</td>
<td>Winter Oats</td>
<td>Direct drill</td>
</tr>
<tr>
<td>3</td>
<td>Winter Wheat</td>
<td>Direct drill</td>
</tr>
<tr>
<td>4</td>
<td>Winter Oats</td>
<td>Direct drill</td>
</tr>
<tr>
<td>5</td>
<td>Winter Wheat</td>
<td>Direct drill</td>
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<tr>
<td>6</td>
<td>Spring Barley</td>
<td>Surface cultivate</td>
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<tr>
<td>7</td>
<td>Spring Oats</td>
<td>Direct drill</td>
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<tr>
<td>8</td>
<td>Spring Wheat</td>
<td>Direct drill</td>
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<tr>
<td>9</td>
<td>Spring Barley</td>
<td>Direct drill</td>
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<tr>
<td>10</td>
<td>Spring Oats</td>
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<tr>
<td>11</td>
<td>Winter Oilseed rape</td>
<td>Surface cultivate</td>
</tr>
<tr>
<td>12</td>
<td>Winter Barley</td>
<td>Surface cultivate</td>
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<tr>
<td>13</td>
<td>Winter Oilseed rape</td>
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<td>14</td>
<td>Winter Barley</td>
<td>Surface cultivate</td>
</tr>
<tr>
<td>15</td>
<td>Winter Oilseed rape</td>
<td>Surface cultivate</td>
</tr>
</tbody>
</table>

**Block drill timings**
- **Mid to late October**:
  - Winter Wheat: Direct drill
  - Winter Oats: Direct drill
  - Winter Wheat: Direct drill
  - Winter Oats: Direct drill
  - Winter Wheat: Direct drill
  - Spring Barley: Surface cultivate
  - Spring Oats: Direct drill
  - Spring Wheat: Direct drill
  - Spring Barley: Direct drill
  - Spring Oats: Direct drill
  - Winter Oilseed rape: Surface cultivate
  - Winter Barley: Surface cultivate
  - Winter Oilseed rape: Surface cultivate
  - Winter Barley: Surface cultivate

**Cultivation type ‘blocks’**
- **Build**
- **Neutralise**
- **Repeat**

Inter row hoeing to maximise disturbance

**Artificial selection building blackgrass numbers**

Neutralise and start again

Neutralise and build again
Thank you