Forty years of fighting black-grass in the UK: developing effective integrated weed management strategies and knowledge transfer initiatives

Dr Stephen Moss, Visiting worker
Rothamsted Research, UK
Alopecurus myosuroides (Black-grass)

A major problem in UK for three main reasons:

- More autumn sown crops (wheat & oilseed rape)
- Earlier autumn sowing of winter cereals
- Herbicide resistance – especially to post-em herbicides
- Herbicide resistance
- Non-chemical control
- Knowledge transfer
- Future needs
- Herbicide resistance
- Non-chemical control
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- Future needs
UK counties with herbicide-resistant black-grass

• 20,000 farms have black-grass
• 20,000 farms have resistance

Resistance is present on virtually every farm where herbicides are used regularly for its control

• Resistance to ACCase herbicides widespread
• Resistance to ALS herbicides increasing fast
• Enhanced metabolism (NTSR) at least as important as target site resistance
• Pre-emergence herbicides now the main means of chemical control
Resistance to mesosulfuron+iodosulfuron (12+2.4 g/ha) (‘Atlantis’)

- Both ALS TSR (197 & 574) and E.M. common
- Enhanced metabolism builds up fast and confers high resistance
- E.M. to meso+iodo confers cross-resistance to pyroxsulam, imazamox & propoxycarbazone – but not to flufenacet

Susceptible standard  
Woburn selected 5 yrs  
Woburn parent

Sprayed 5 November at 3 lf, photo 16 weeks post-spraying
Selecting for resistance to flufenacet in black-grass in outdoor containers

Flufenacet (180 g/ha)
Selecting for resistance to flufenacet in black-grass in outdoor containers

Flufenacet (180 g/ha)
Herbicides alone are not enough
- Herbicide resistance
- Non-chemical control
- Knowledge transfer
- Future needs
Black-grass – agro-ecology is the key
Black-grass agro-ecology – 6 key elements

1. Emergence pattern – 80% in early autumn
2. Max depth of seedling emergence < 5 cm
3. Seed longevity in soil – 74% decline/year
4. Seed shedding patterns – mid June onwards (Wheat)
5. Population dynamics >95% control needed
6. A competitive weed – aim for <5 plants/m²
## Non-chemical control of black-grass in winter wheat

<table>
<thead>
<tr>
<th>Method</th>
<th>Number of experiments</th>
<th>% reduction achieved</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Ploughing</td>
<td>25</td>
<td>69%</td>
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<tr>
<td>Delayed autumn drilling</td>
<td>19</td>
<td>31%</td>
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<td>Higher seed rates</td>
<td>16</td>
<td>26%</td>
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<tr>
<td>Competitive cultivars</td>
<td>5</td>
<td>22%</td>
</tr>
<tr>
<td>Spring cropping</td>
<td>5</td>
<td>88%</td>
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<td>Fallowing/grass leys</td>
<td>-</td>
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Based on review, by Lutman, Moss, Cook & Welham, Weed Research, 2013
Modelling data from 375 field trials with flufenacet based herbicides 2001 - 2013

- <1% decline/year in performance since 2001
- Improved control at later drilling dates - 29% extra control mid Oct v mid Sept

Data supplied by Bayer, BASF, DuPont & Syngenta
- Herbicide resistance
- Non-chemical control
- Knowledge transfer
- Future needs
How effective are we at communicating advice on herbicide-resistance prevention and management to these guys?
Hopeless!

Chris Preston, University of Adelaide
(Global Herbicide Resistance Challenge, Perth 2013)

“Over the years a variety of management strategies employing mixtures, sequences and varying rates of herbicides have been promoted. However, there is no good evidence that any of these have successfully stopped herbicide resistance from evolving. At best, resistance has been delayed.”


“Uptake of IWM and non-herbicidal weed management strategies by most growers has been poor”
Is this due to farmers failing to heed good advice (farmers at fault) or due to the ‘wrong’ research (researchers at fault)?

Or where does the balance of fault lie?

Farmer
His fault?

Researcher
Or his fault?
Since 1990, we have contributed to > 334 popular articles in the farming press.

Given hundreds of talks to farmers, agronomists and company technical personnel (> 50 in last 3 years).

Formal publications too.
- Herbicide resistance
- Non-chemical control
- Knowledge transfer
- Future needs
Understanding the relationship between advice and behaviour

**Communication**
- Agronomists and advisors
- Personal contacts
- Face to face meetings
- Web
- Email/Texts
- Phone

**Willingness to change**
- Confidence of success
- Social responsibility
- Farming philosophy
- Personal ideology
- Financial incentive
- Avoid penalties
- Time/effort/‘hassle’
- Previous experience

**Ability to change**
- Understanding the relationship between advice and behaviour
- Willingness to change

**Success!**
- Farm characteristics
- Resources e.g. Labour/machinery
- Farm tenure
- Finance
- Knowledge/Skills
- Legal/regulatory constraints

**Methods of Communication**
- Demonstrations
- Farming press
- Leaflets / Adverts
- Time
- Personal contacts
- Face to face meetings
- Web
- Email/Texts
- Phone

**Other relevant factors**
- Finance
- Farm tenure
- Legal/regulatory constraints

**Factors influencing change**
- Previous experience
- Personal contacts
Ultimately, it’s the individual farmer who must recognise the need for IWM, and decide what measures to adopt
Thank you for listening!

Thanks to Bayer for the invitation to speak – and for positive collaboration over the past 40 years.