The increasing threat of Italian ryegrass.

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Italian Ryegrass is an increasing problem on farms in the UK.

Data from Monsanto/Bayer National Grassweed Survey (reported in farmer’s guardian) AND 2022 Gowan National Grassweed management Survey (in Anglian Farmer)
2021 Survey

Change in the level of Italian Ryegrass as an arable weed on farm

- Seeing a lot less
- Seeing a little less
- About the same
- Slight increase
- A big increase

Significance of Italian Ryegrass across the farm

- Rare few individual plants
- Quite a few patches in various places
- In multiple fields across the farm and relatively dense
- Some bad patches in some fields
- Very high levels in multiple fields
Italian Ryegrass competitive with high seed production
Italian Ryegrass and germination timing

Predominantly autumn germinating in a winter crop BUT with a relatively long ‘tail’.

Figure 4.2. Percentage of emergence of *L. multiflorum* plants per month, in five winter wheat fields (A) and average values of emerged plants per month (B).
Italian Ryegrass and drilling date

- Drilling date and Italian Ryegrass
- Seedlings (All Crops)
- Heads (Barley)

Crop Sowing date:
- 28-Sep
- 17-Oct
- 08-Apr
- 23-Apr
- 26-May

Seedling or head density (per m²)
- 0
- 20
- 40
- 60
- 80
- 100
- 120
- 140
- 160
- 180
- 200
- 220
- 240
- 260
- 280
- 300

Drilling date:
- 21/09/2021
- 20/11/2021
- 19/01/2022
- 20/03/2022
- 19/05/2022
Italian Ryegrass overall cultural control

Everything that is effective against black-grass also work for ryegrass … just not as well!
Italian Ryegrass – a diverse weed problem

Phenotype variation observed in the survey hints at the genetics diversity between these populations.

There are also differences in ploidy levels between populations. Although almost all problematic arable weed populations are diploid.
Italian Ryegrass – a diverse weed problem

Arable weed populations have variable vernalisation requirements.

Vernalisation requirement determines the fitness of a population in different cropping scenarios.
Italian Ryegrass – a diverse weed problem

Variation in freshly shed seed in overall dormancy and response to light/dark conditions.
Italian Ryegrass – a diverse weed problem

When comparing populations collected from two fields on the same farm well over half are significantly different in herbicide sensitivity.
This is important to understand when planning resistance testing/monitoring.
Italian Ryegrass – a diverse weed problem

Samples from 10 fields on the same farm.

Sensitivity to flufenacet varies from total sensitivity to absolute tolerance.
NIAB-BAYER Italian Ryegrass Survey: Herbicide Sensitivity

%age of samples in each R Rating category

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<thead>
<tr>
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<th>Atlantis</th>
<th>Axial</th>
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<tr>
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<td>R?</td>
<td>7.7</td>
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<th>FLUFENACET</th>
<th>PINOXADEN</th>
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<tbody>
<tr>
<td>Sensitive</td>
<td>19.2%</td>
<td>1.0%</td>
<td>6.7%</td>
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<tr>
<td>Significantly Reduced</td>
<td>14.5%</td>
<td>8.8%</td>
<td>7.25%</td>
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<tr>
<td>No control</td>
<td>7.25%</td>
<td>6.7%</td>
<td>17.6%</td>
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</table>
Italian Ryegrass versus Black-grass – flufenacet sensitivity

Sensitive
Standard

Flufenacet resistant population.
Herbicide strategies for effective ryegrass control

• Sequencing
Because of the much longer window of germination through the autumn we’ve found splitting/sequencing more effective than single applications.

• Mode of action diversity
The nature of the resistance mechanism in ryegrass to flufenacet in particular means that a mode of action diversity approach brings not just resistance management but also improved efficacy.
## Status of glyphosate resistance in Ryegrass species globally.

<table>
<thead>
<tr>
<th>Region</th>
<th>Lolium rigidum</th>
<th>Lolium multiflorum</th>
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<tbody>
<tr>
<td>North America (USA / Canada)</td>
<td>1 Case; 1 Perennial Cropping 0 Annual Crops</td>
<td>11 cases; 6 Perennial Cropping 5 Annual Crops</td>
</tr>
<tr>
<td>Australia</td>
<td>11 cases; 7 Perennial Cropping 4 Annual Crops</td>
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<tr>
<td>South America</td>
<td>10 cases; 2 Perennial Crops 8 Annual Crops</td>
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</tr>
<tr>
<td>Europe</td>
<td>5 Cases; 5 Perennial Cropping 0 Annual Crops</td>
<td>4 cases; 2 Perennial Cropping 2 Annual Crops</td>
</tr>
<tr>
<td>Japan / New Zealand</td>
<td>3 cases; 2 Perennial Cropping 1 Annual Crop</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>2 Cases; 2 Perennial Cropping 0 Annual Crops</td>
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</tr>
<tr>
<td>Israel</td>
<td>1 Case; 0 Perennial Cropping 1 Annual Crops</td>
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</tbody>
</table>
Status of glyphosate resistance in Ryegrass species globally.

Number of confirmed cases of glyphosate resistance in annual ryegrass species.

- North America: 7 cases
- Australia: 2 cases
- South America: 8 cases
- Europe: 6 cases
- Japan/NZ: 1 case
- South Africa: 2 cases
- Israel: 1 case

Legend:
- Blue: Perennial Cropping
- Orange: Annual Crops
Sustainable Glyphosate use

Relative glyphosate sensitivity at 1.5l/ha (540g a.i.) (in pot tests)

% Reduction in Fresh Weight

Population

Resistant Standard

Susceptible standard

LSD (contrast with the susceptible)
Sustainable Glyphosate use

**Black-grass (Alopecurus myosuroides)**
As part of a PhD project at Warwick Laura Davies tested 40 black-grass populations and while significant variation in glyphosate sensitivity was found between populations all were well controlled by field (label) rates. In a glasshouse study, they were able to demonstrate selection for reduced sensitivity to glyphosate BUT none of the artificially selected populations could not be controlled with field rates.

**Sterile Brome (Anisantha sterilis)**
Laura Davies and Colleagues at Rothamsted tested 35 populations (including ones where glyphosate effectiveness had been questioned in the field) and found 3 of these with significantly reduced sensitivity. While exhibiting reduced sensitivity to glyphosate none were resistant. Selection for reduced sensitivity to glyphosate was inferred from comparison of exposed and nearby un-exposed populations.

**Rat’s Tailed Fescue (Vulpia myuros)**
Reports in Germany from a Perennial Cropping situation led us to carry out initial ‘baseline’ testing on populations from the UK. We carried out dose response tests on 14 populations from semi-natural habitats and as long-term arable weeds. At low rates (0.66g a.i./ha) there is some differentiation (from 20% to 60% control) which is associated with the source of the population. At higher rates only small differences are detected.

**Italian Rye-grass (Lolium multiflorum)**
We tested 50 samples of ‘difficult’ Italian Ryegrass populations collected in 2019 and carried out dose response testing. We found nearly a 5x difference in glyphosate sensitivity.
Relative glyphosate sensitivity.

- Pot testing is not intended or useful for predicting field performance of herbicides – it is useful when considering RELATIVE effectiveness.
- There were a handful of populations from the 50 ‘difficult’ populations which showed significantly reduced sensitivity to glyphosate across a range of doses.
One example of a high-risk scenario in Italian Ryegrass

High weed seed rain in August

No mechanical or herbicide control for nearly 8 months

May survivors following multiple applications of glyphosate

Before these plants were destroyed in the field we dug-up plants for a glasshouse experiment
One example of such a high-risk scenario in Italian Ryegrass

We can show that with a UK population of Italian Ryegrass we can select for Glyphosate resistance in high risk scenarios.

**THIS IS NOT A CASE OF GLYPHOSATE RESISTANCE IN THE FIELD** it is an glasshouse experiment showing how we can select for glyphosate resistance even from UK sourced populations.
“Emerging Weeds” One Two example of a high-risk scenario in Italian Ryegrass

Untreated
recommended “Label” rate
Max label rate
2.5x Maximum authorised dose

SAZ-1 UK population
Reference resistant popln
Susceptible standard
The increasing threat of Italian ryegrass.

- Becoming more widespread and an increasing challenge on individual farms.
- More challenging to manage than black-grass from a cultural perspective especially in terms of the effectiveness of spring cropping.
- A number of herbicide resistance traits are becoming more common.
- Reduced sensitivity to pre-emergence herbicides is evolving rapidly.
- Monitoring of glyphosate sensitivity is an absolute priority; nationally and on individual farms.
- The inherent genetic diversity of the species is part of the challenge and means understanding the relatedness of individuals and populations needs to be the key focus.