

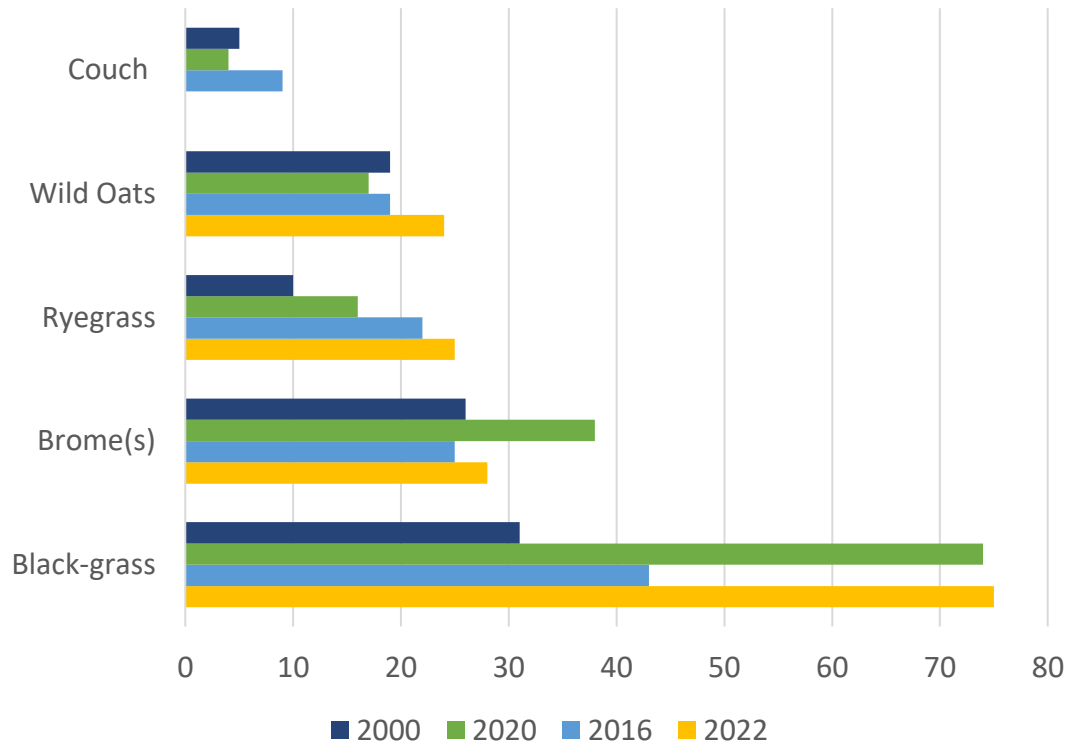


The increasing threat of Italian ryegrass.

John Cussans

Italian Ryegrass in surveys

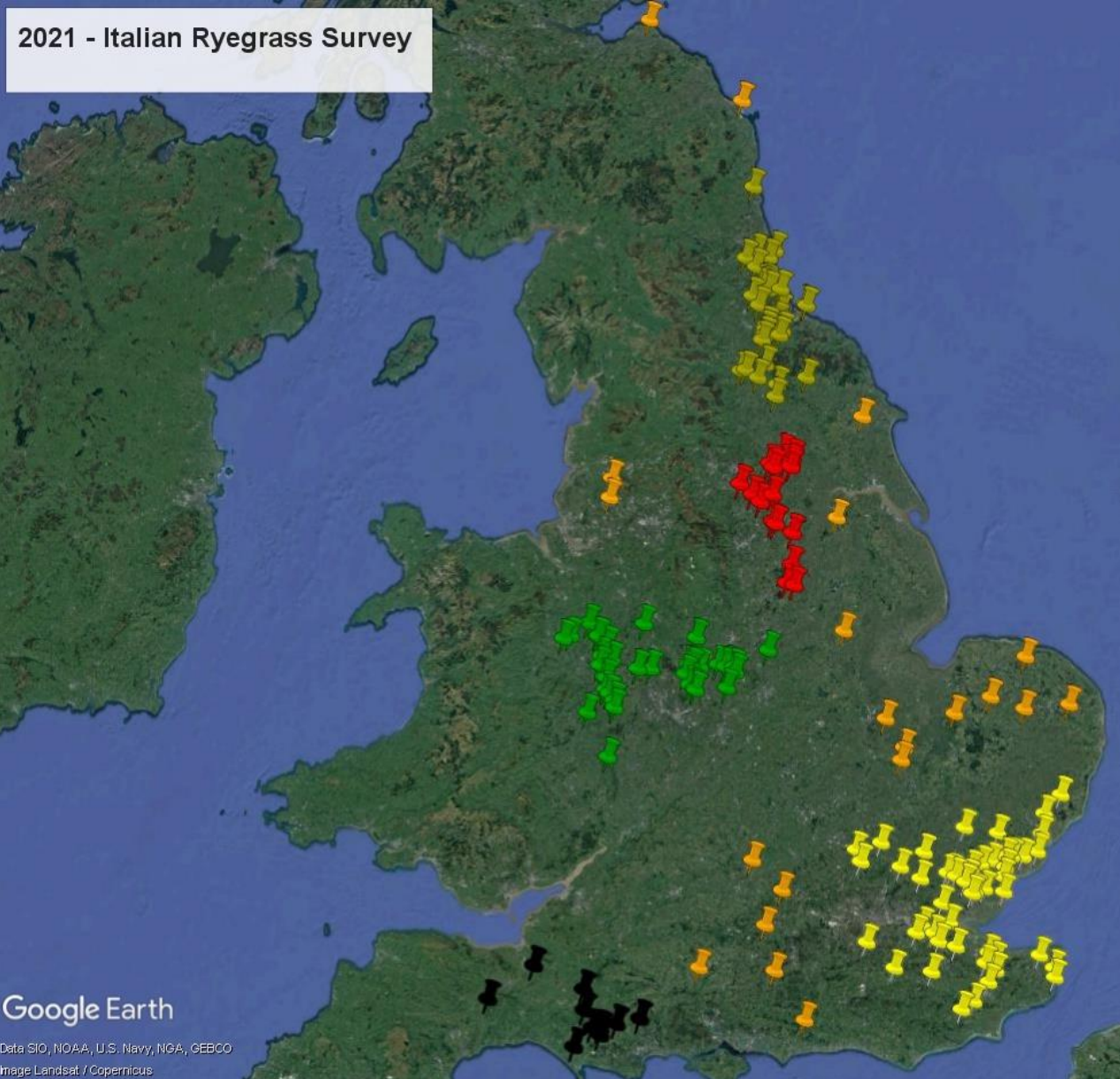
Percent of farms reporting a problem



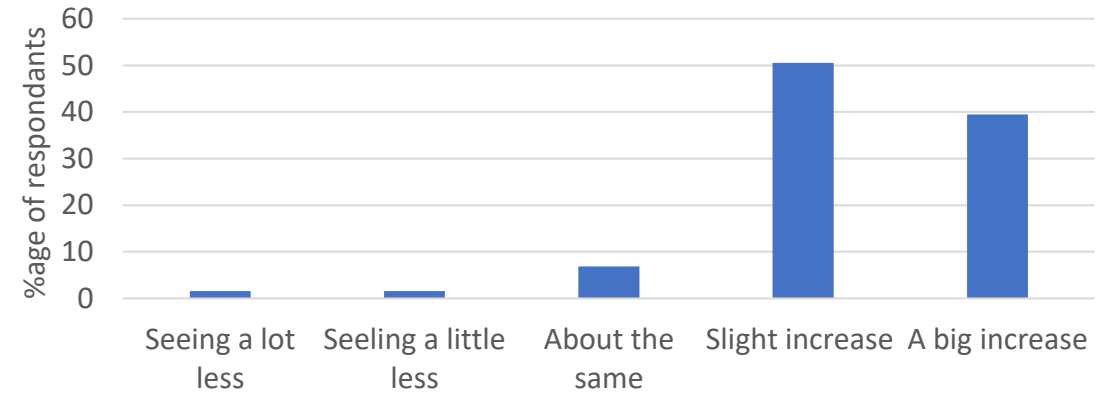
Italian Ryegrass is an increasing problems on farm in the UK.

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

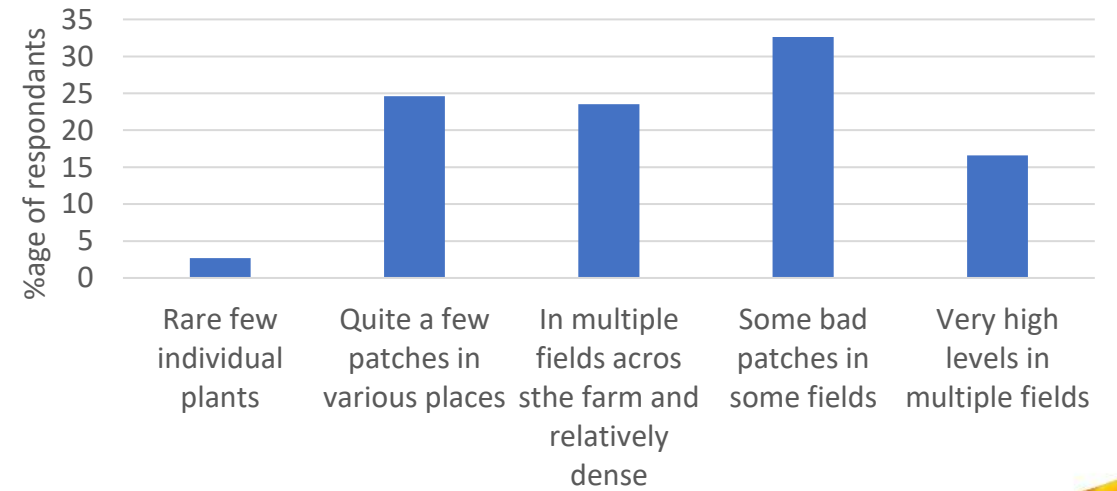
2021 Survey



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



Significance of Italian Ryegrass across the farm



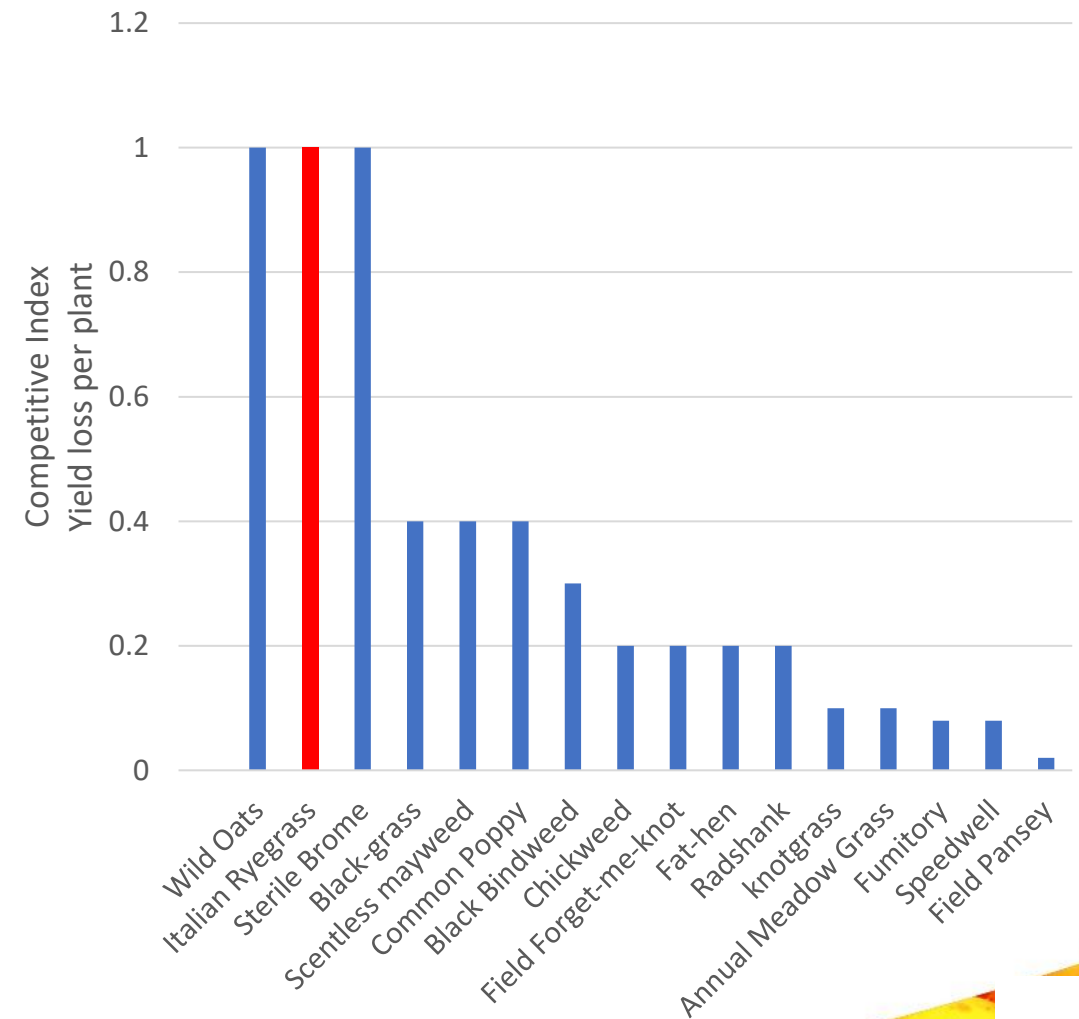
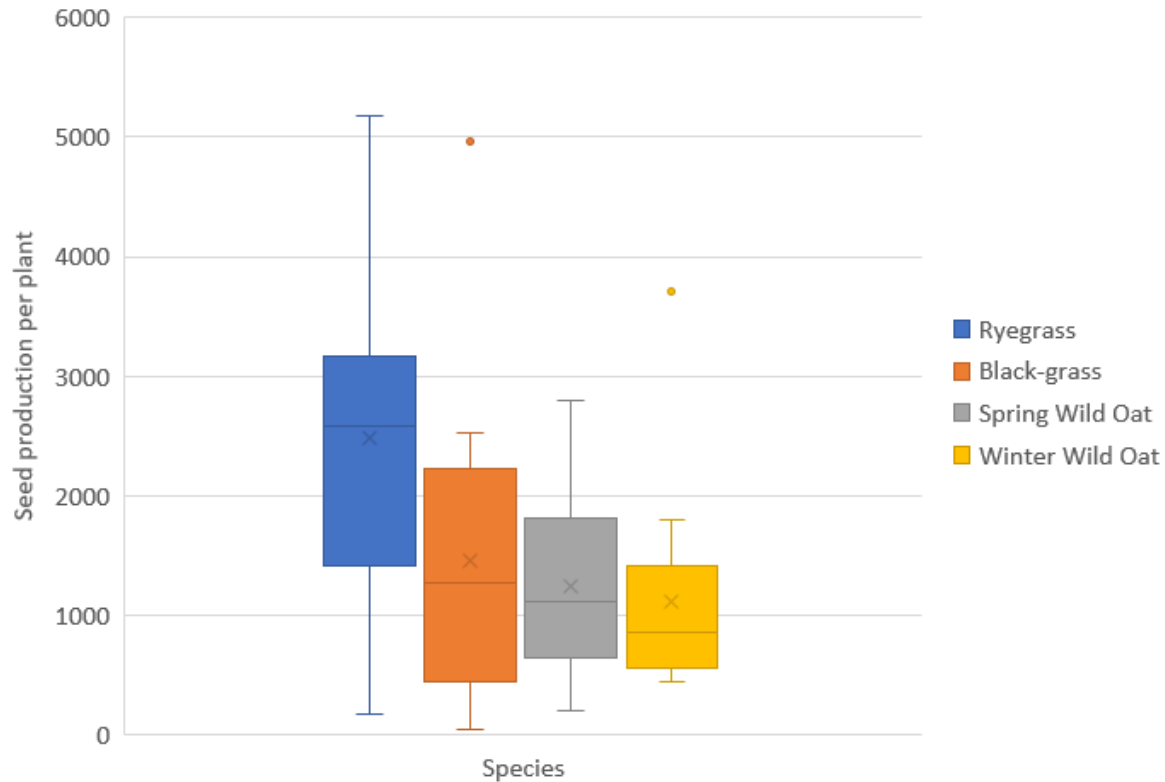
Bayer CropScience



world-class experience, skills and resources

Italian Ryegrass competitive with high seed production

Seed Production per plant
(October drilled winter wheat)



Italian Ryegrass and germination timing

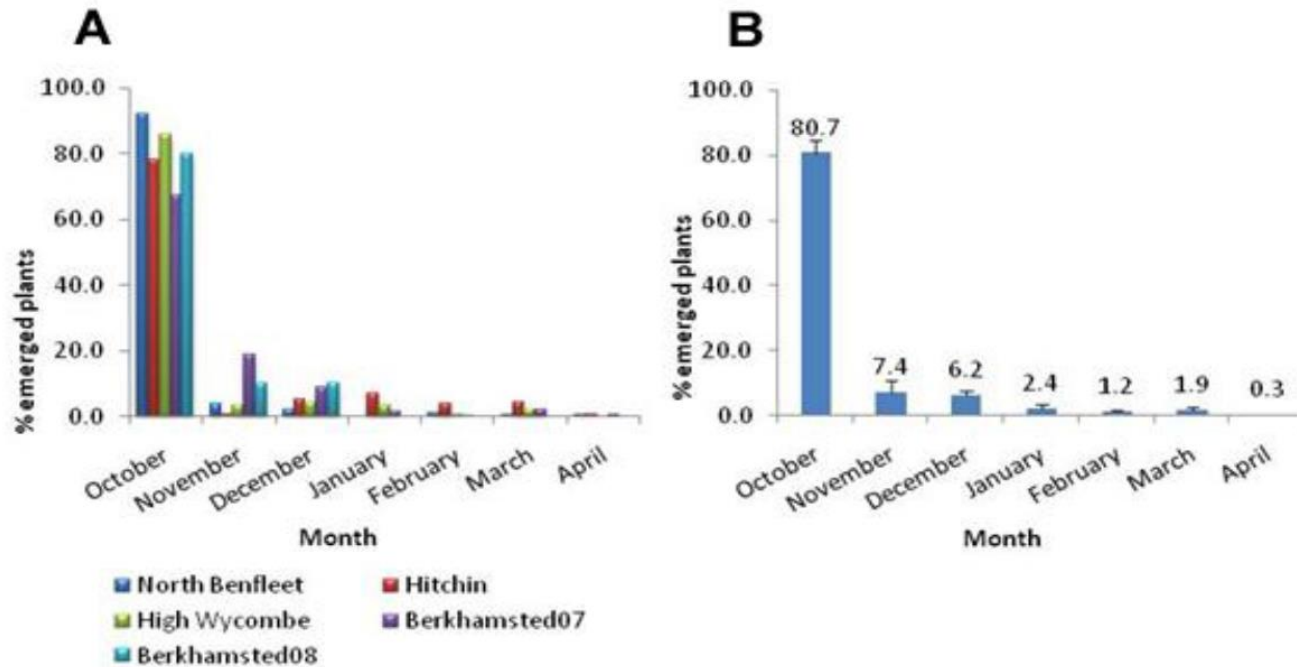
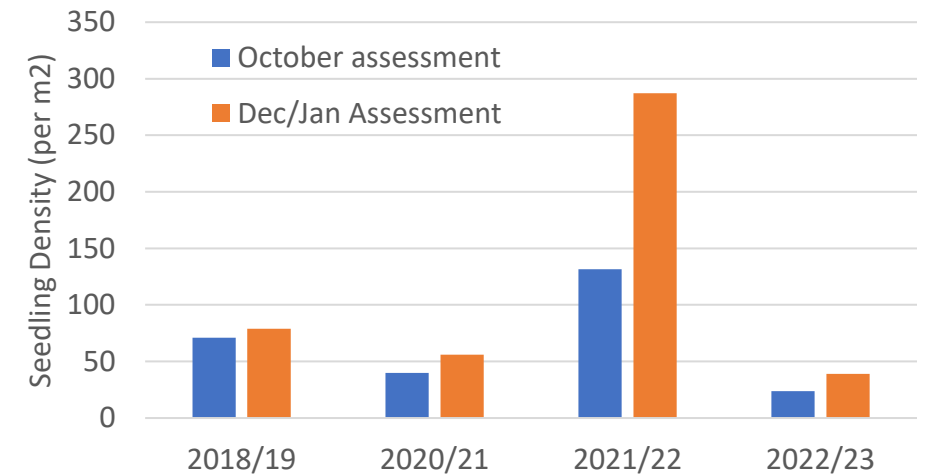
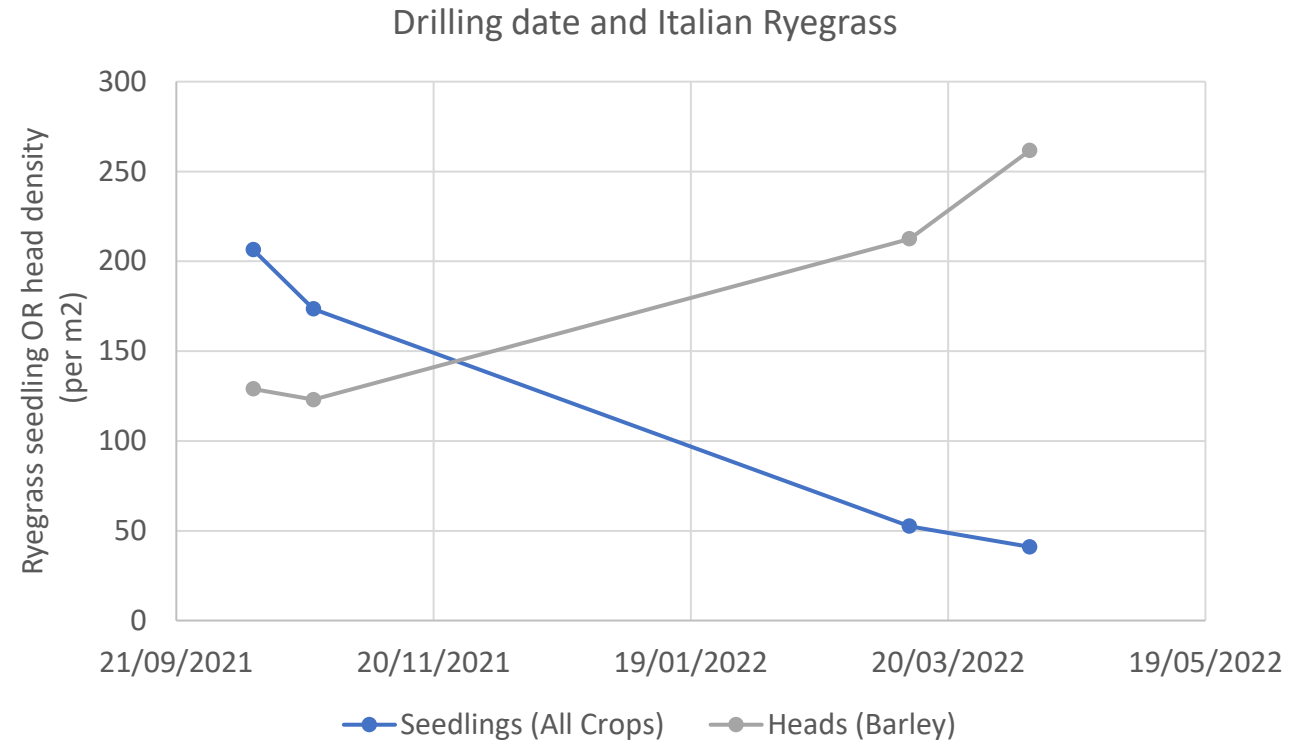
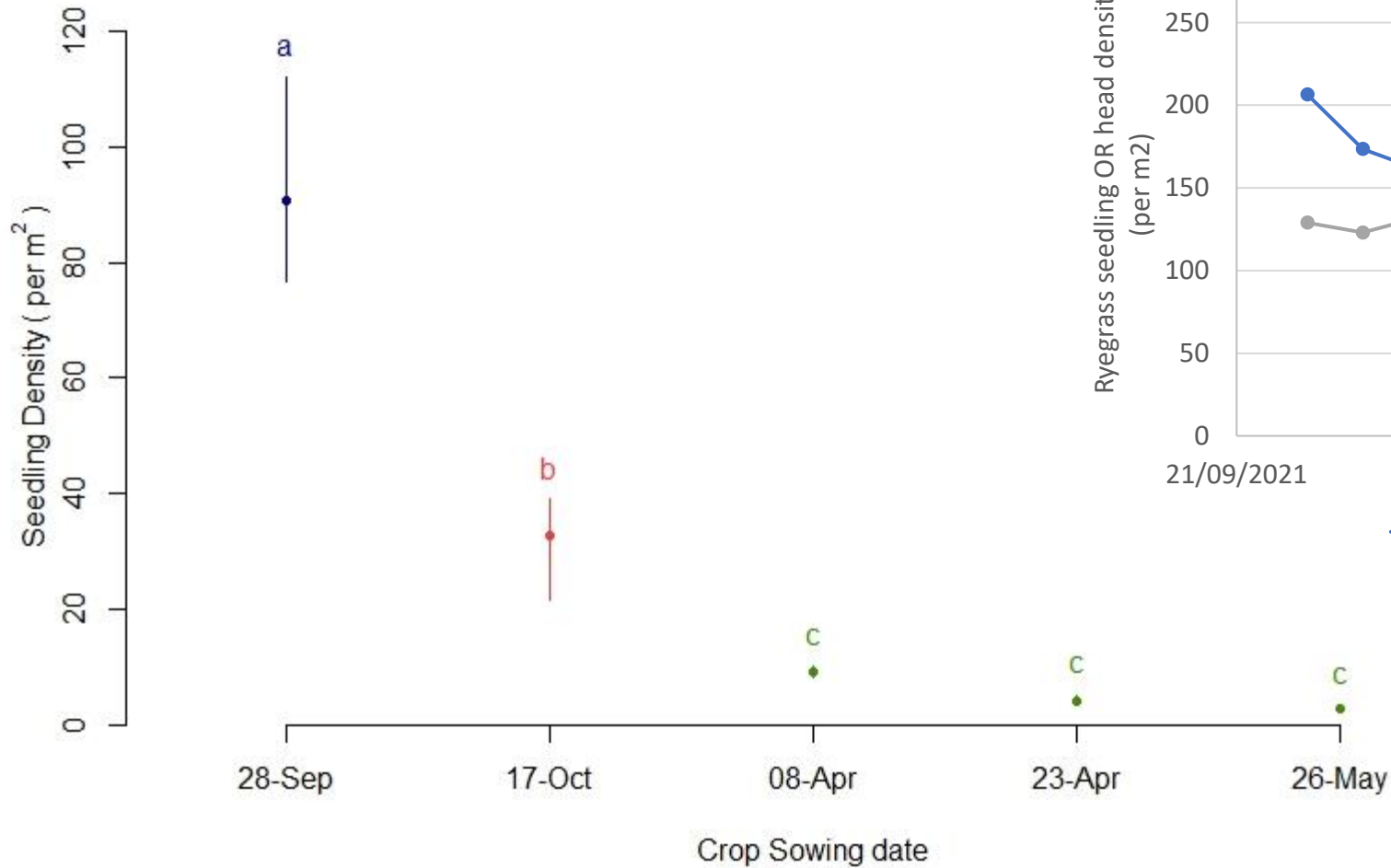


Figure 4.2. Percentage of emergence of *L. multiflorum* plants per month, in five winter wheat fields (A) and average values of emerged plants per month (B).

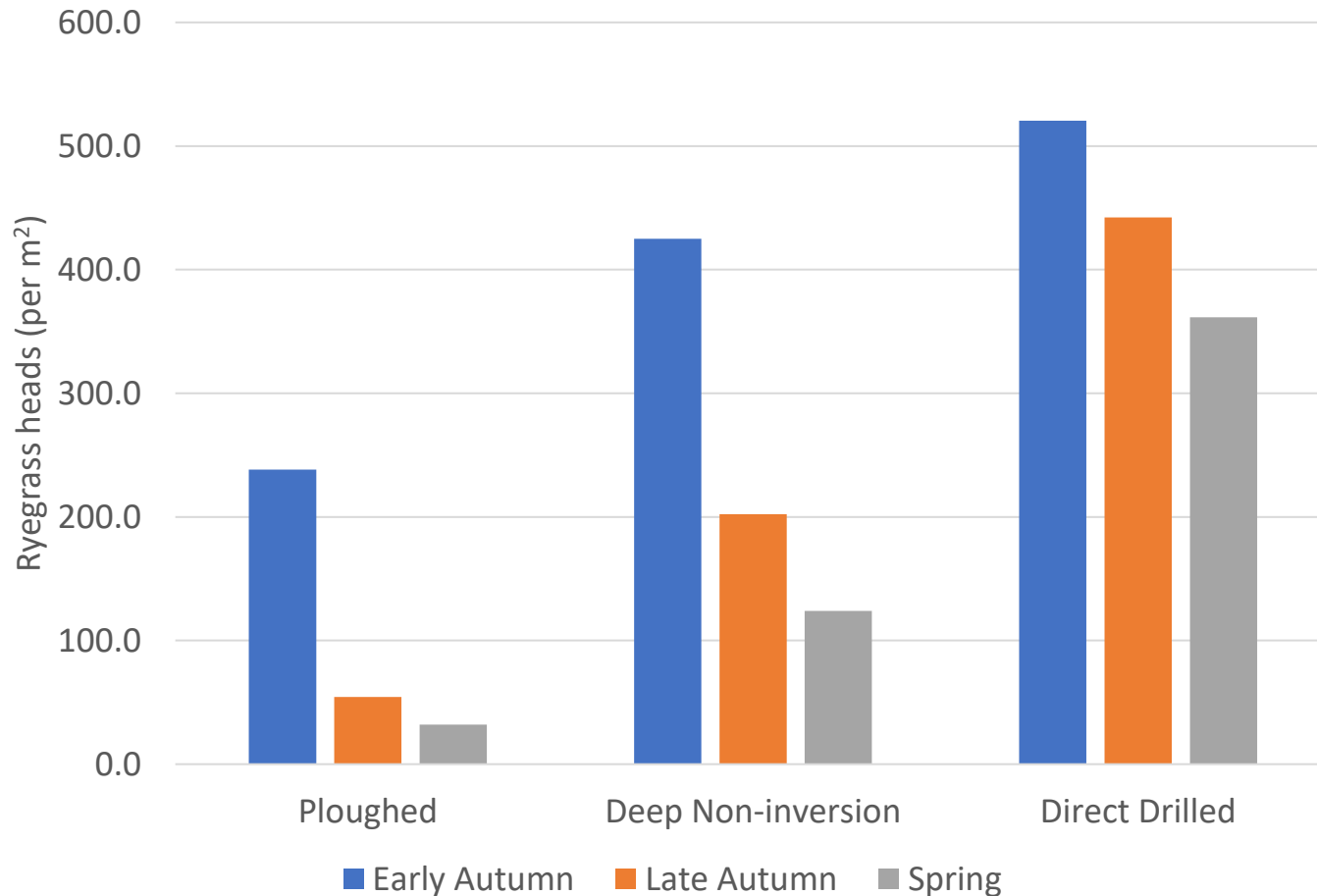
Predominantly autumn germinating in a winter crop BUT with a relatively long 'tail'.



Italian Ryegrass and drilling date



Italian Ryegrass overall cultural control



Everything that is effective against black-grass also work for ryegrass ... just not as well!

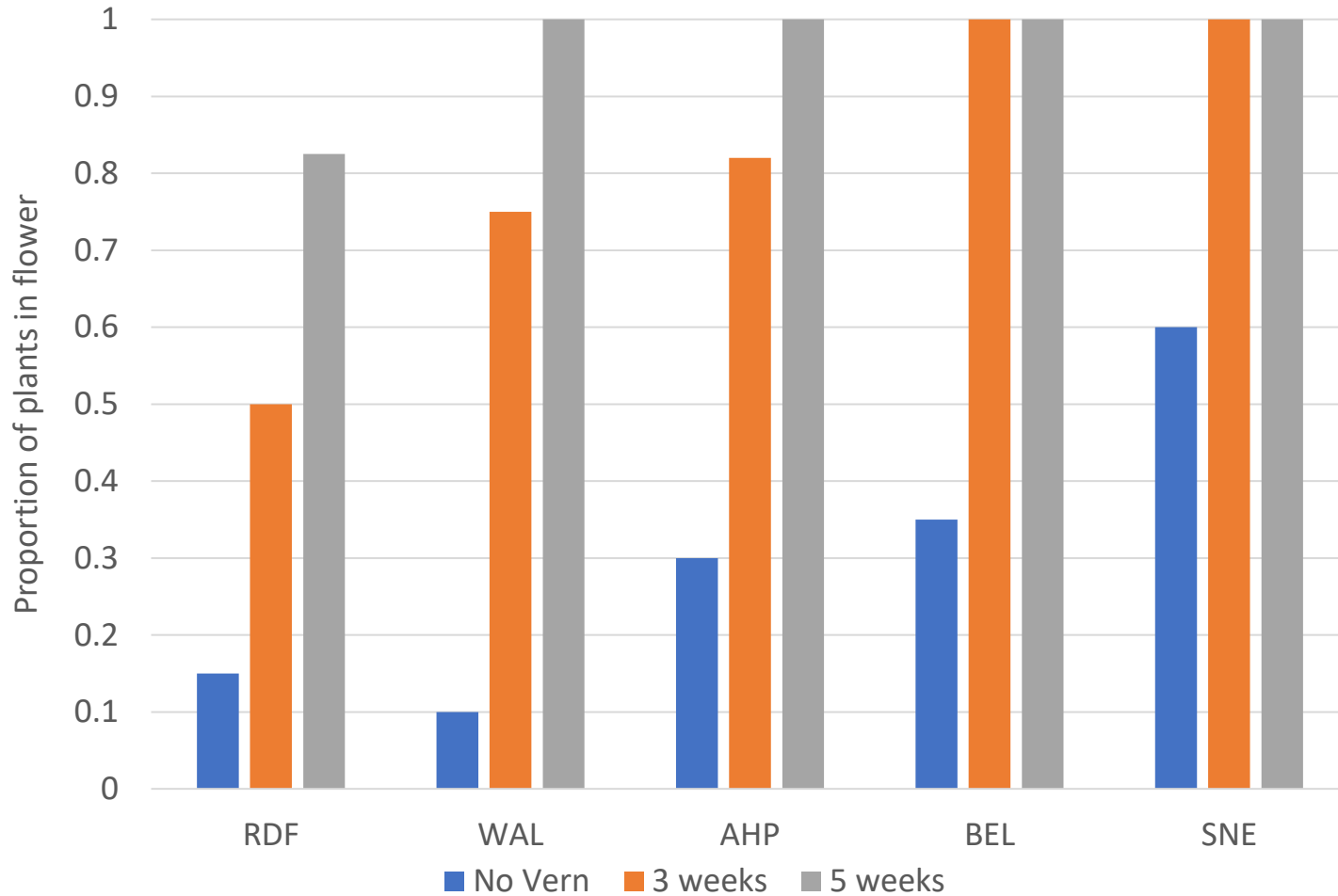
Italian Ryegrass – a diverse weed problem

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

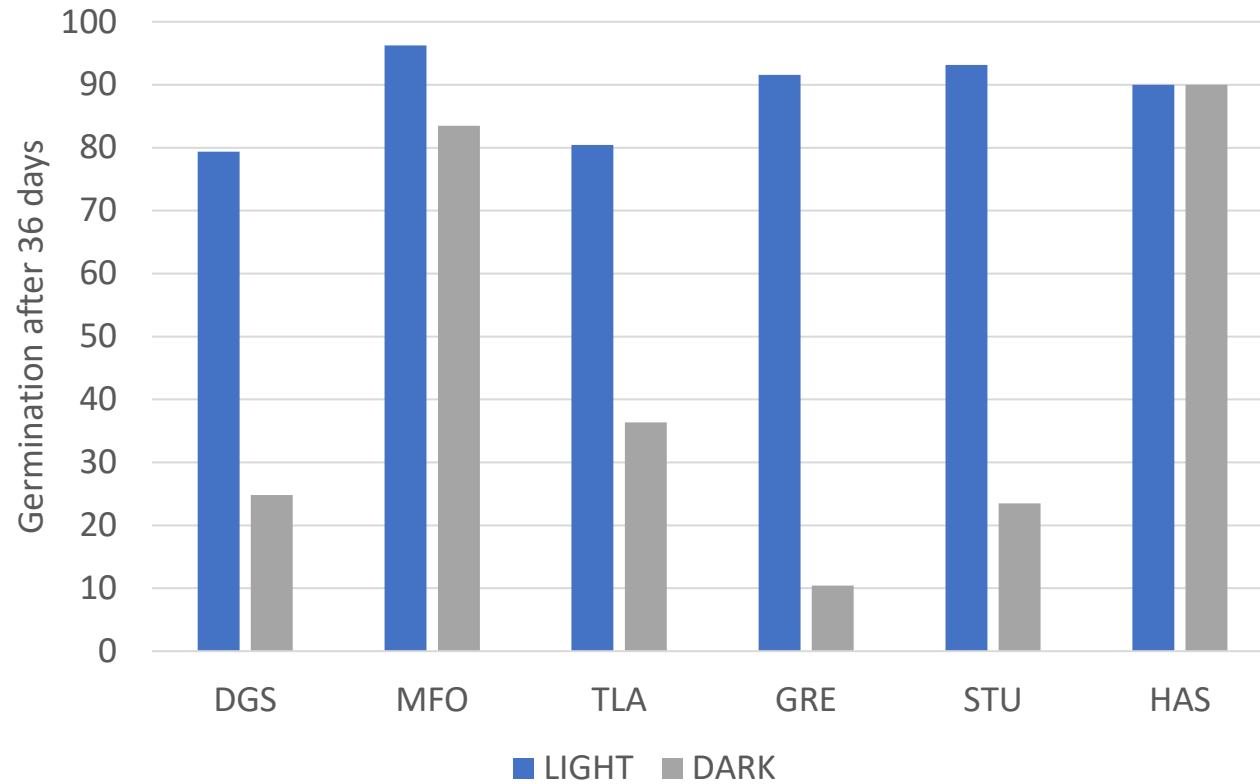


Arable weed populations have variable vernalisation requirements.

Vernalisation requirement determines the fitness of a population in different cropping scenarios.



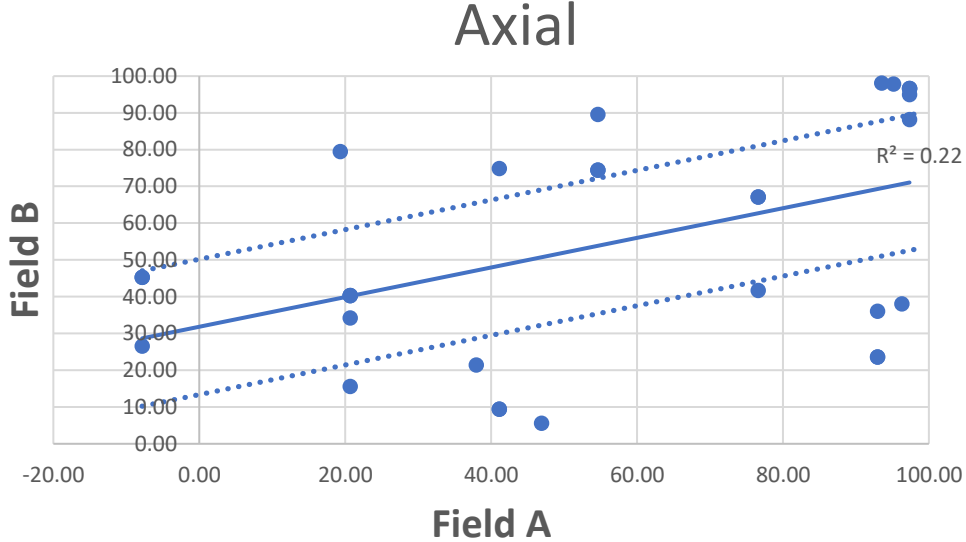
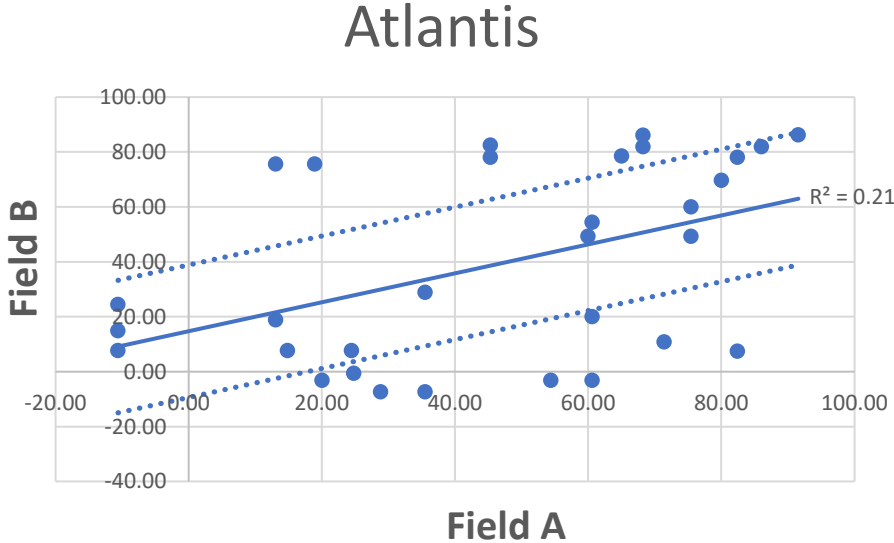
Italian Ryegrass – a diverse weed problem



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.

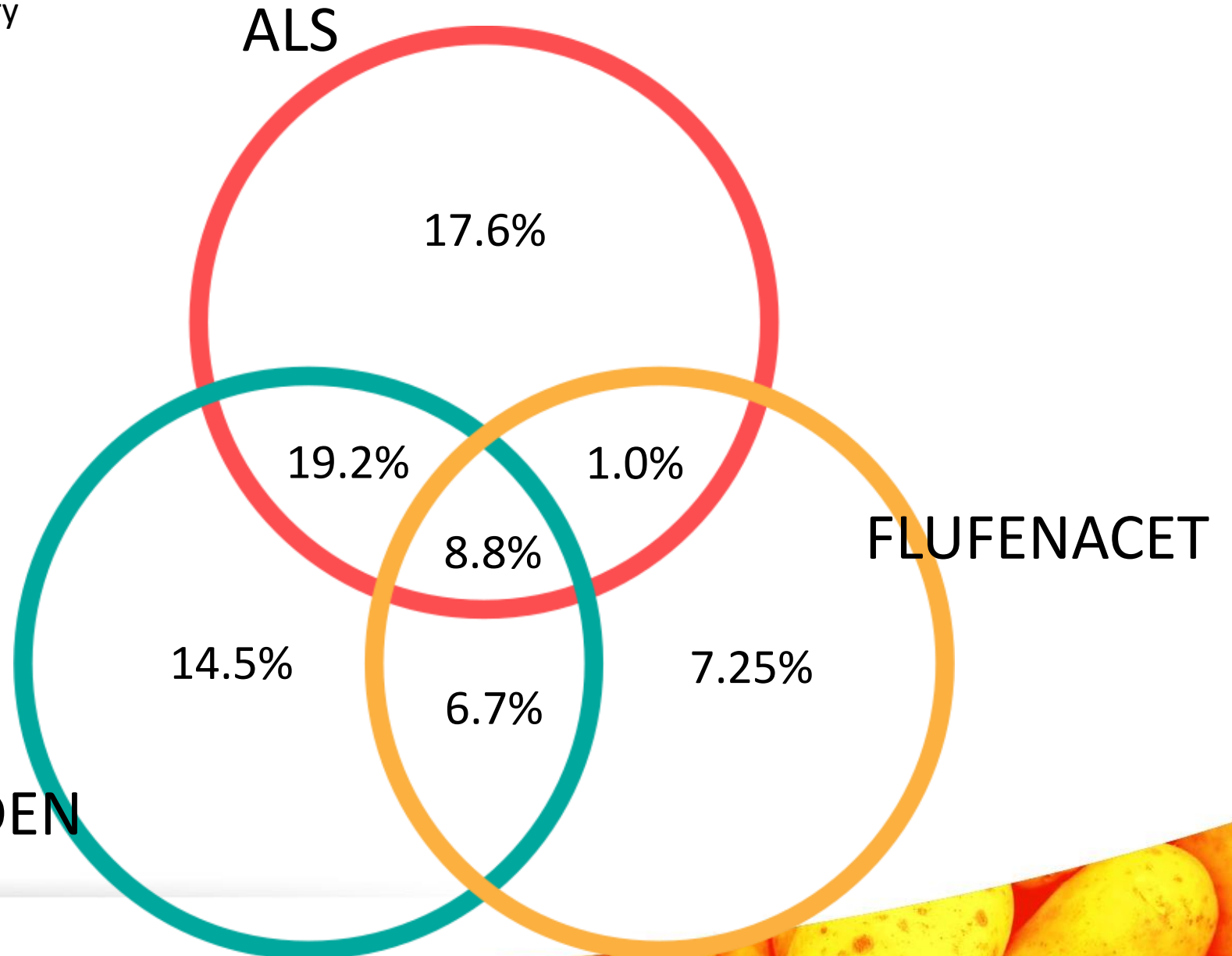


NIAB-BAYER Italian Ryegrass Survey: Herbicide Sensitivity

%age of samples in each R Rating category

	Atlantis	Axial
S	45.6	45.6
R?	7.7	6.2
RR	24.1	32.3
RRR	22.6	15.9

	Flufenacet
Sensitive	70.6
Significantly Reduced	17.3
No control	9.6

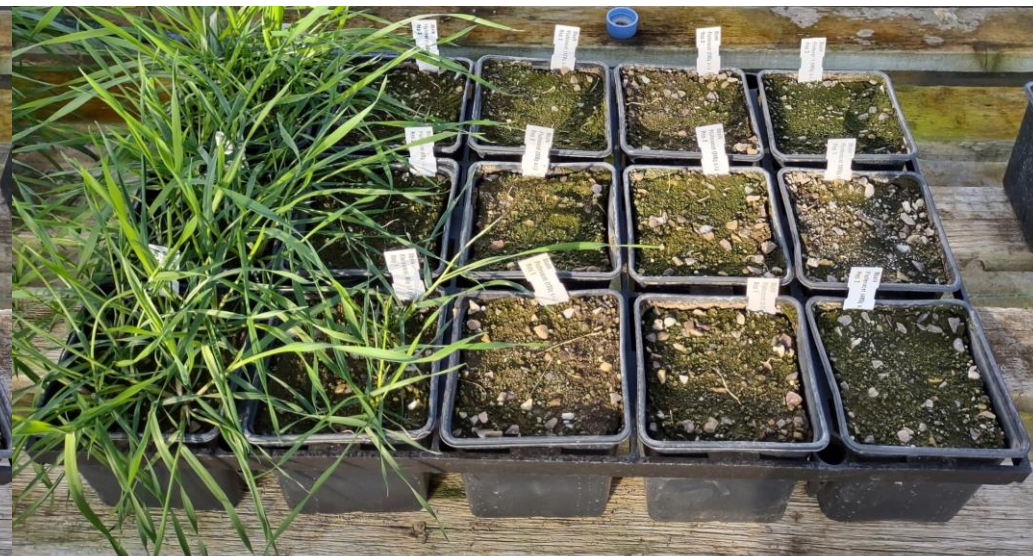


Italian Ryegrass versus Black-grass – flufenacet sensitivity

Italian Ryegrass

Black-grass

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.

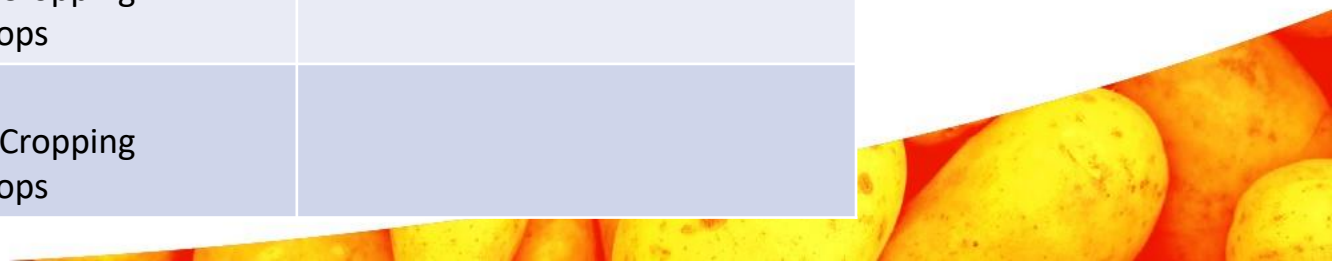
- Mode of action diversity

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.



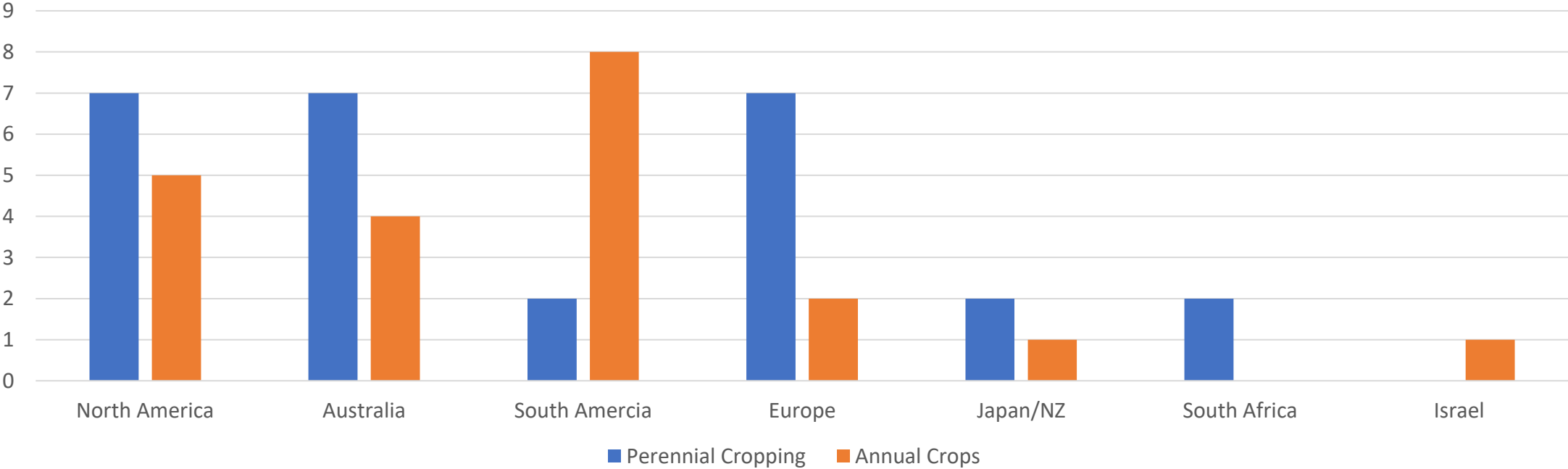
Status of glyphosate resistance in Ryegrass species globally.

	<i>Lolium rigidum</i>	<i>Lolium multiflorum</i>
North America (USA / Canada)	1 Case; 1 Perennial Cropping 0 Annual Crops	11 cases; 6 Perennial Cropping 5 Annual Crops
Australia	11 cases; 7 Perennial Cropping 4 Annual Crops	
South America		10 cases; 2 Perennial Crops 8 Annual Crops
Europe	5 Cases; 5 Perennial Cropping 0 Annual Crops	4 cases; 2 Perennial Cropping 2 Annual Crops
Japan / New Zealand		3 cases; 2 Perennial Cropping 1 Annual Crop
South Africa	2 Cases; 2 Perennial Cropping 0 Annual Crops	
Israel	1 Case; 0 Perennial Cropping 1 Annual Crops	



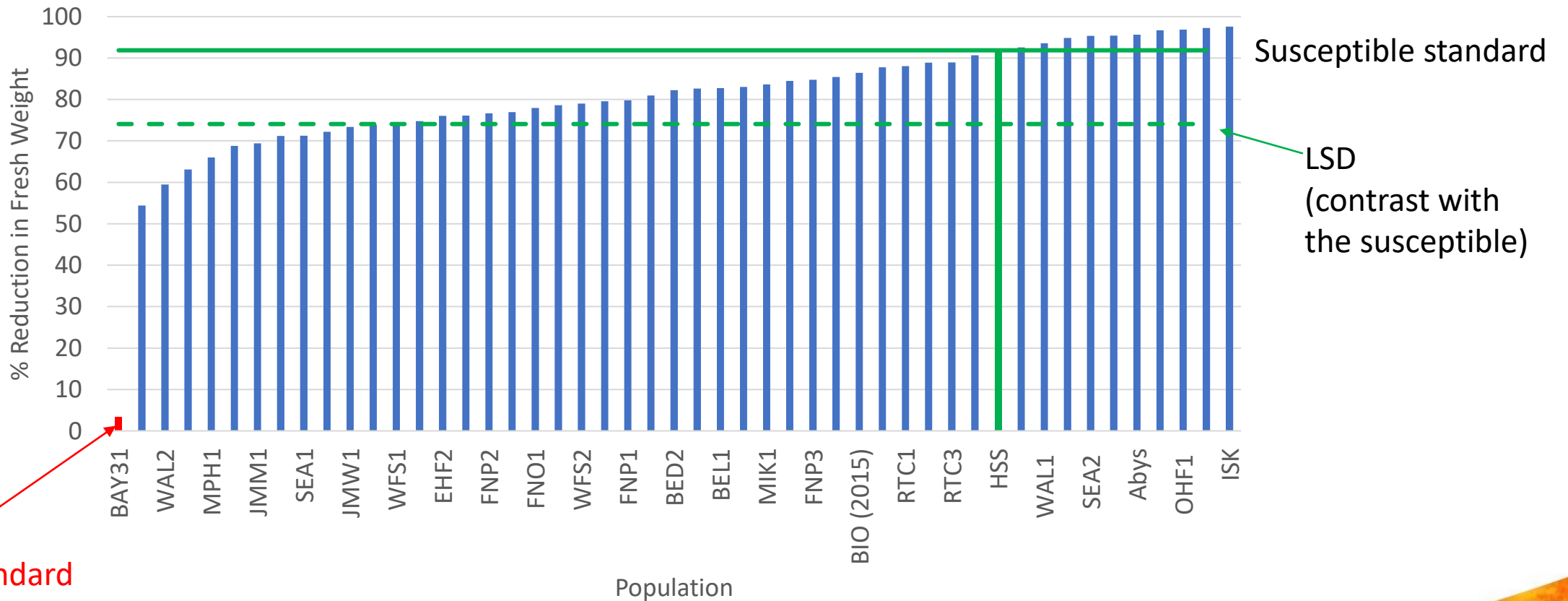
Status of glyphosate resistance in Ryegrass species globally.

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



Sustainable Glyphosate use

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



Resistant Standard

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.

x1.7

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.

x3.4

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.

x3.0

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.

x4.7



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



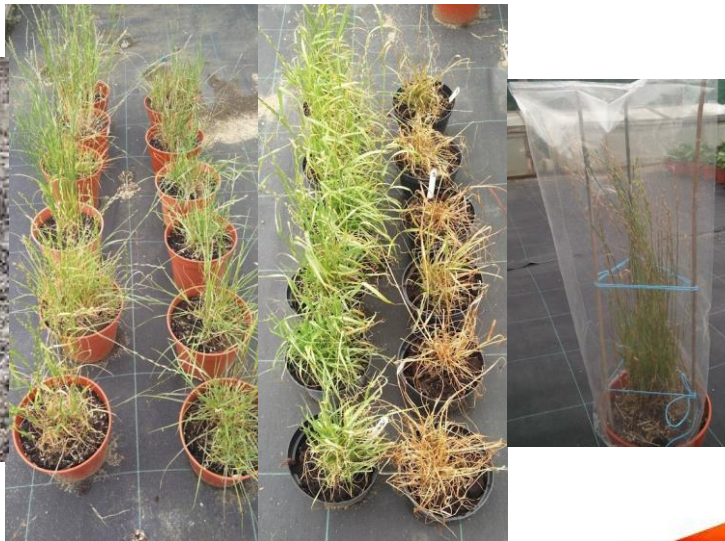
No mechanical or
herbicide control for
nearly 8 months



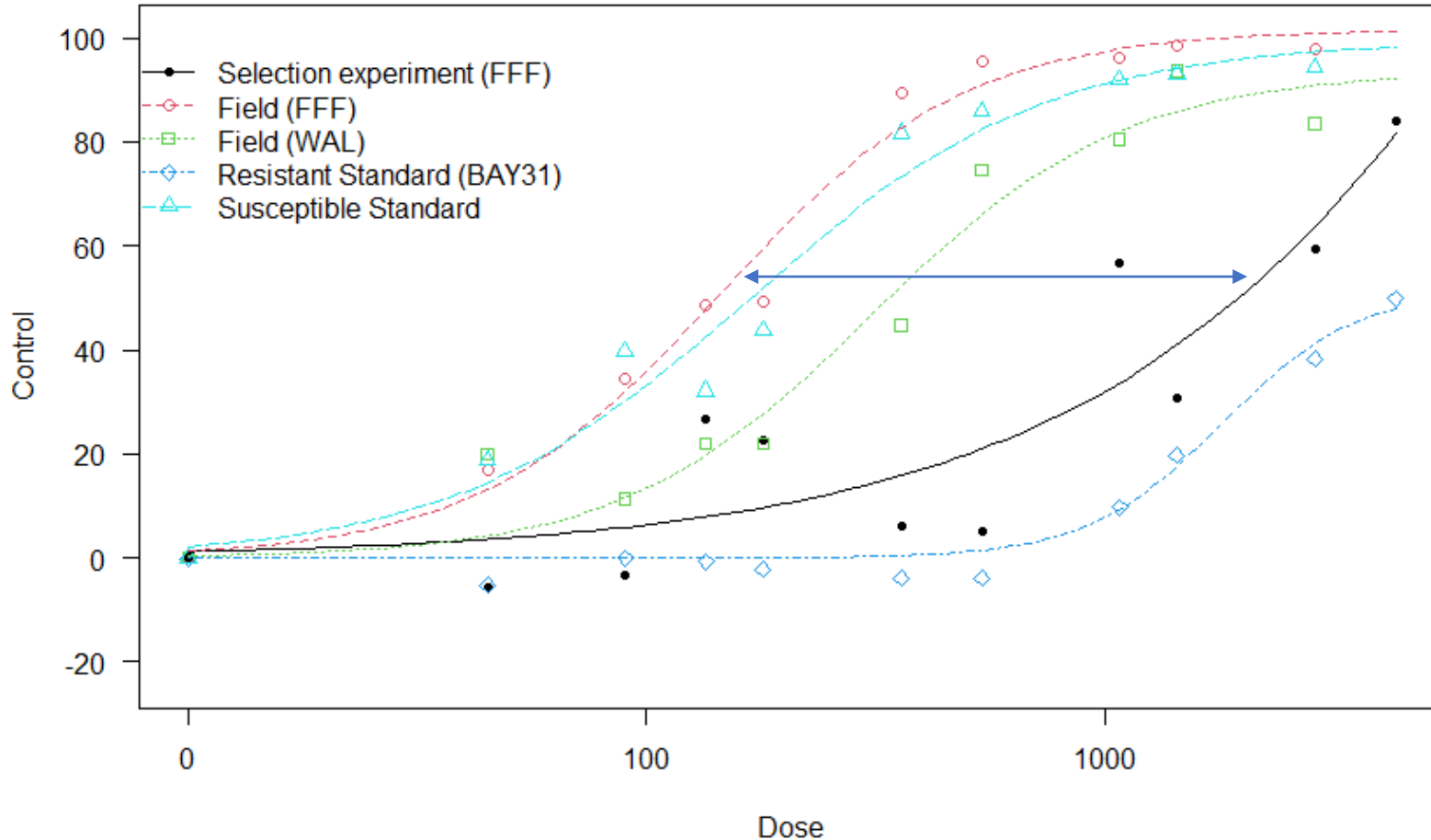
May
survivors following
multiple applications
of glyphosate



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

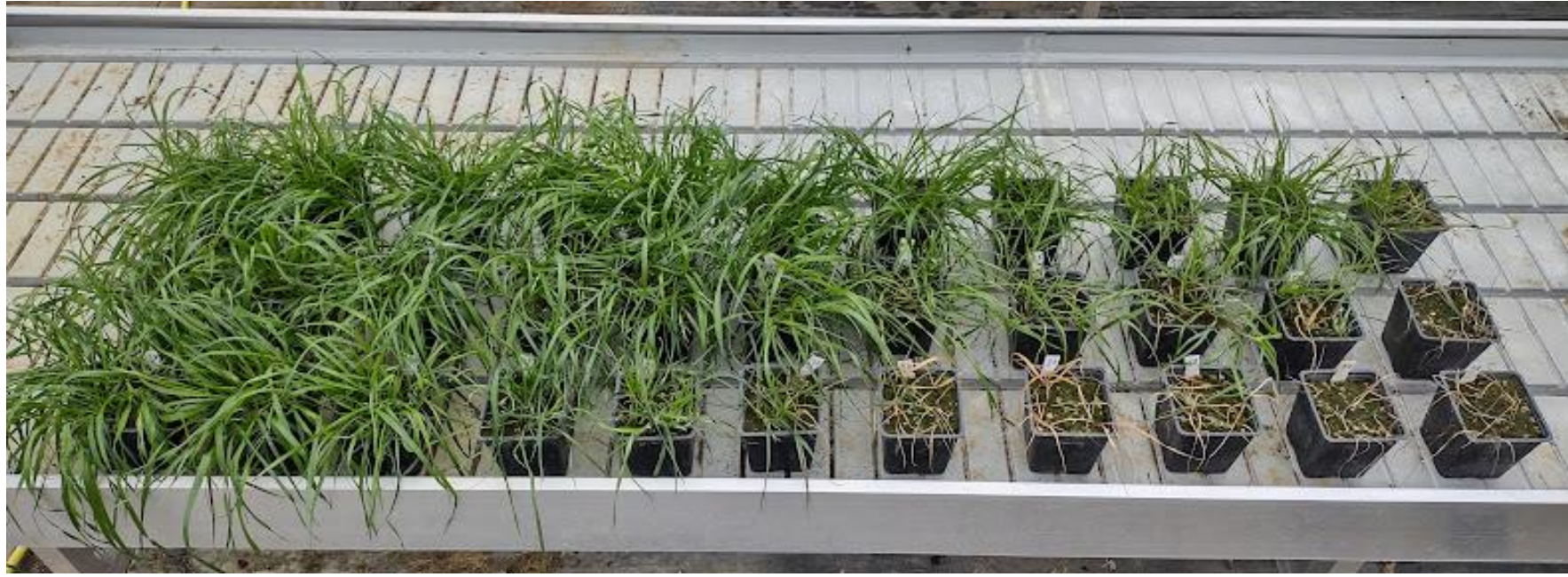


We can show that with a UK population of Italian Ryegrass we **CAN** select for Glyphosate resistance in high risk scenarios.

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.

