

Tapping into ancient sources of disease resistance to protect our modern barley cultivars – barley scald 2015

Dr Dante Adorada and Dr Andrew Milgate NSW DPI, Wagga Wagga

Key findings

- » Ancient barley germplasm from Ethiopia harbours resistance to scald and other diseases.
- » Twenty-eight out of 355 Ethiopian lines were moderately resistant to scald.
- » Careful selection for disease-resistant lines is important to retain other desirable traits.

Introduction

The aim of this work is to increase the sources of multi-disease resistant germplasm available for barley variety improvement in Australia. This is being achieved by screening and identifying possible sources of resistance to barley scald and other diseases from the centres of origin of barley cultivation.

Site details

The trial was conducted at the Wagga Wagga Agricultural Institute, which represents the medium rainfall winter cropping regions of southern NSW. This material is also being evaluated for other diseases in a number of other locations around Australia.

Varieties

A total of 335 Ethiopian lines were screened under field conditions as part of the National Barley Foliar Pathogen Varietal Improvement Program (NBFVIP). This program contains diverse barley germplasm from ancient landraces to material more adapted to modern agricultural practices.

Treatments

Scald-infected barley stubble from the previous season was spread on the buffer rows to promote an epidemic. Regular overhead sprinkler irrigation was conducted to spread the disease and ensure the epidemic developed to high levels.

Results

The decline in the number of Australian barley varieties resistant to scald in the past two years, as reported in the NSW DPI Winter crop variety sowing guide 2015, prompted plant pathologists and breeders to find alternative sources of

resistance to the disease. Of the 335 diverse set of Ethiopian lines evaluated against scald under field conditions, 28 were found to have a moderately resistant (MR) reaction to scald (Figure 1). These can now be investigated further as possible new sources of scald resistance that can be incorporated into research and breeding programs.

The material will require further development through crossing to elite Australian varieties to ensure it is adapted to Australian conditions. This is because there are often associated traits that are not desirable for modern agriculture. The Ethiopian germplasm were used because Ethiopia is proposed as the centre of origin of barley (Badr & El-Shazly 2012) and is thought to harbour desirable traits such as resistance to diseases. Careful selection is imperative to recover the best these lines have to offer, as a variety with acceptable resistance against one pathogen could lack resistance against others (Table 1).

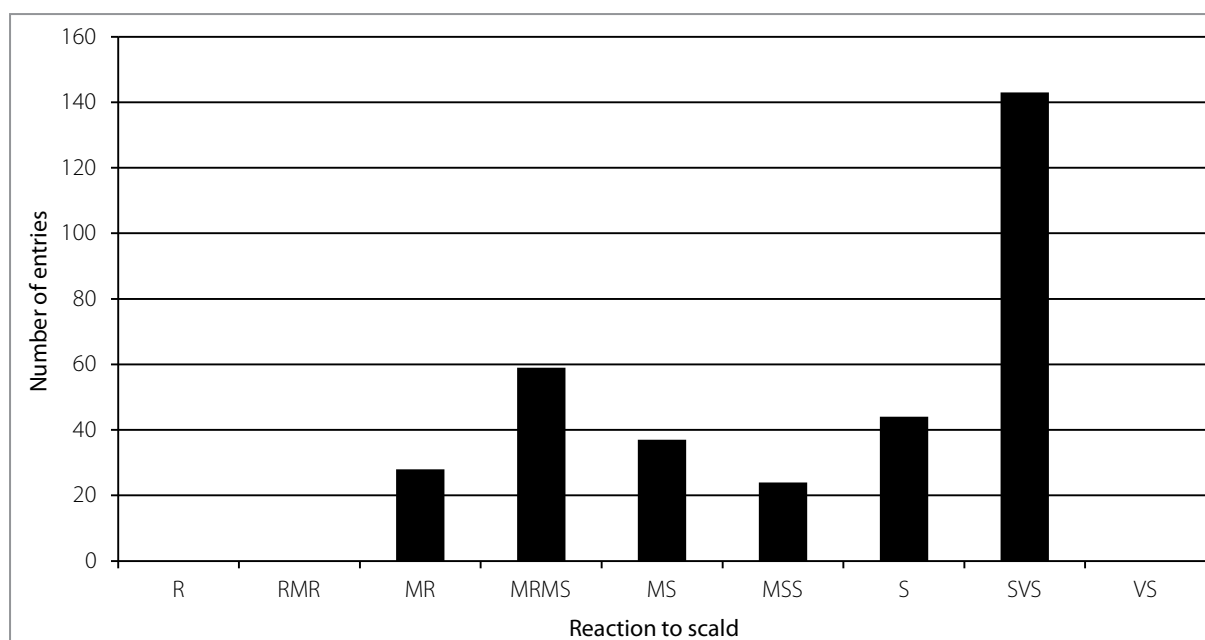


Figure 1. Frequency distribution of the 335 Ethiopian lines' reaction to scald under field conditions, 2015.

NB: R = resistant; R-MR = resistant-moderately resistant; MR = moderately resistant;

MR-MS = moderately resistant-moderately susceptible; MS = moderately susceptible;

MS-S = moderately susceptible-susceptible; S = susceptible; S-VS = susceptible-very susceptible; VS = very susceptible.

Table 1. Example list of Ethiopian lines that are possible sources of resistance (MR) to barley scald, spot form of net blotch (SFNB), net form of net blotch (NFNB) and leaf rust (LR), plus some other attributes.*

Name	Grain colour	Row No.	Scald	SFNB	NFNB	LR
AUS400105	White	6	MR	S	R	VS
AUS400107	White	6	MR	MS	R	R
AUS400110	White	6	MR	MS	R	MS
AUS400112	White	4	MR	MS	R	MS
AUS400115	White	6	MR	S	R	S
AUS400210	White	6	MR	VS	R	MS
AUS400213	Blue	6	MR	MS	R	MS
AUS400216	Blue	6	MR	VS	R	VS
AUS400217	White	2	MR	VS	R	R
AUS400411	White	6	MR	MS	R	R
AUS402784	White	6	MR	MR-MS	R	VS
AUS403034	Blue	4	MR	MR	R	MS
AUS403071	Black	6	MR	MS	R	MS
AUS403223	Black	6	MR	VS	R	R
AUS403839	White	2	MR	VS	R	R
AUS403850	White	6	MR	MR-MS	R	R
AUS403864	Pink-Blue	6	MR	S	R	R
AUS403884	White	2	MR	MS	R	MS
AUS403888	Black	6	MR	S	R	R
AUS403896	Pink (Brown)	4	MR	MR-MS	R	MS
AUS403920	White	6	MR	S	R	R
AUS403932	White	6	MR	VS	R	R
AUS403946	White	6	MR	MR-MS	R	R
AUS405821	White	6	MR	S	R	MS
AUS407177	White	6	MR	MR	R	S-VS
AUS407337	White	6 & 2	MR	S	R	R
AUS408654	Blue	4	MR	S	R	R
AUS409392	Brown	6	MR	VS	R	VS

*Attributes and reaction to barley diseases provided by Ryan Fowler, Department of Agriculture and Fisheries Queensland.

Summary

Screening for sources of barley scald and other disease resistances plays a vital role in improving the performance of barley varieties for NSW. Identified sources of resistance are provided to breeders for incorporation in their breeding program to develop improved varieties with resistance to scald. By tapping into ancient germplasm collections from where the crop originated, researchers hope to discover resistance that will provide protection to the barley industry into the future.

Note: This is an industry summary provided pre-publication. Further information and analysis will be published in due course.

Acknowledgements

This experiment is part of 'The National Barley Foliar Pathogen Variety Improvement Program (NBFVIP)', DAQ187, 2013–17, jointly funded by GRDC and NSW DPI.

Thank you to Joel Gray, Michael McCaig and Sujeewa Rathnayake for technical assistance.

Reference

Badr, A & El-Shazly, H 2012, 'Molecular approaches to origin, ancestry and domestication history of crop plants: Barley and clover as examples', *Journal of Genetic Engineering and Biotechnology*, vol. 10, no. 1, pp. 1–12.