Final Project Summary

Project title	Introgressing resilience and resource-use efficiency traits from Scots Bere to elite barley lines		
Project number	2140011109	**Final Project Report**	SR49
Start date	September 2015	**End date**	March 2019
AHDB Cereals & Oilseeds funding	£54,000	**Total cost**	£93,000

What was the challenge/demand for the work?

Landraces, and specifically Bere barley, are a large untapped potential resource of tolerance to multiple stresses. Such sources could be used by breeders to increase the durability of the elite barley crop. In particular, developing crops that are protected against climate change, due to robust defence to increased stress, is critical for future agricultural sustainability.

How did the project address this?

The JHI spring barley collection, consisting of a number of Bere lines, was screened for biotic stress resistance to *Rhynchosporium commune* and abiotic stress resistance to the conditions of manganese (Mn) deficiency and salt stress. Additionally, the interaction of these stresses was assessed.

What outputs has the project delivered?

The results identify a number of Bere lines that show an increased resistance/tolerance to Mn-use efficiency, salt tolerance, and rhynchosporium resistance, compared to elite cultivars. The Bere population, as a whole, showed an inherent enhanced Mn-use efficiency, correlating to increased accumulation of Mn in shoots. These results suggest that Bere landraces have unique abilities to cope with stress. Interaction studies revealed complex line-specific interactions, along with an overall adverse effect of salt on rhynchosporium symptoms.

Several genomic regions for traits of each of the three stresses originating from the Bere lines were identified, along with potential candidate genes. Further examination and validation of these regions should be undertaken for future breeding for marginal lands. By introgression into elite cultivar backgrounds, they may contribute biotic and abiotic stress-tolerance genes. This could create novel cultivars to efficiently and resiliently yield under low input and marginal environments.

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Who will benefit from this project and why?
The identification of genomic regions and potential candidate genes will allow breeders to select for robust cultivars able to thrive on marginal land. This will boost yields on such land and protect crops against increases in stresses associated with climate change.

If the challenge has not been specifically met, state why and how this could be overcome
These studies identify that, in all three of the stresses tested, the Bere group, as a whole or individual Bere lines, have a superior resistance/tolerance. However, due to the diversity of the environments where Bere lines grow and have become adapted, and the diverse range in the levels of stress adaption shown in the Bere lines for the stresses tested, such germplasm resource potentially holds resistant traits to a number of other different stresses that could be tested for.

How have you benefited from this studentship?
I have acquired skills in: • The development and adaptation of methodology, along with experimental design. • Phenotyping of a barley landrace collection for biotic and abiotic stresses, individually and in conjunction, by assessing different indicator traits. • Genotyping of said collection, to perform Genome Wide Association Studies.

Lead partner	James Hutton Institute
Scientific partners	University of Aberdeen
Industry partners	KWS-UK
Government sponsor	N/A