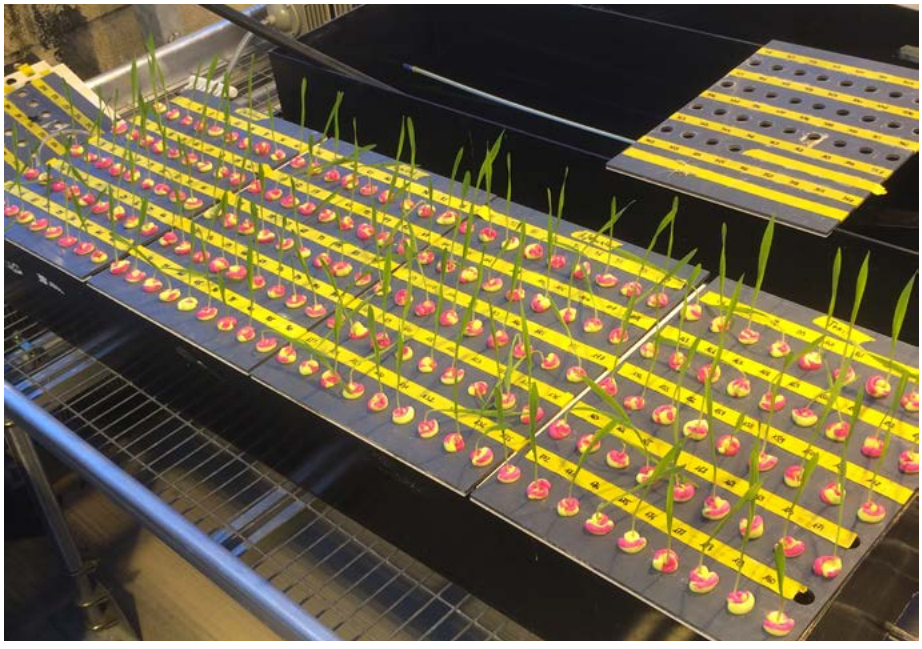
Students' Union: **Barley to better bear (Bere) climate stress**

PhD taps into natural genetic resilience



Weather-fuelled stresses often shape the success of a growing season. With extreme events becoming the norm, a recently completed AHDB-funded PhD project looked towards close relatives of barley (*Hordeum vulgare*) to locate and tap into natural genetic resilience.

The obvious place to look for genetic solutions is in marginal lands, where crops are adapted for a tough life. It is no surprise that a key area to host such plants is the Highlands and Islands of Scotland. Here, the weather is frequently wet, dark and windy. Many Scots would use the term 'dreich' to describe this type of unpleasant weather.

Student Jonathan Cope turned to Scots Bere, from Bere barley, for inspiration during his four-year study at the James Hutton Institute (JHI). Packed full of resource-use efficiency traits, this deeply historically rooted barley landrace has grown on marginal land for the last half millennia. Indeed, it can probably lay claim to being Britain's oldest cultivated cereal.

JHI curates a precious heritage spring barley collection, which captures a wide range of genetic diversity and includes Bere lines. Jonathan screened such lines for biotic stress resistance to *Rhynchosporium commune* and abiotic stress resistance to manganese (Mn) deficiency and salt (Na) stress.

Field trials revealed a large variation in rhynchosporium resistance. In fact, Bere touched the extremes, with some lines featuring in the 'most'- and other lines in the 'least'-resistant camps. The result shows why this landrace could provide valuable clues to locate promising sources of resistance to this disease.

Although field trials remain essential for varietal development, there are numerous tools at researchers' disposal these days to screen more lines, more efficiently, with a far greater degree of control. An example is contained within the main image of this article. Each square of this hydroponic system has five rows of nine lines. As part of his PhD, Jonathan fine-tuned the experimental protocols, which included holding each seedling in place with an earbud. With the plants secured, his system allows precise control of the amount of nutrients/salts delivered to each plant.

Compared to elite cultivars, the Bere lines showed increased resistance/tolerance to each of the abiotic stresses. In fact, the population, as a whole, had enhanced Mn-use efficiency, which correlated to an increased accumulation of Mn in the shoots.

Genetic analyses also identified several genomic regions in Bere lines associated with Mn-use efficiency, salt tolerance and rhynchosporium resistance. Specific genes associated with these traits, called 'candidates', were also identified. Such genes and regions are a target for breeding programmes, with resilience traits moved from such landraces to breeding lines (via a process called 'introgression').

Jonathan's report – *Characterising resilience and resource-use efficiency traits from Scots Bere and additional landraces for development of stress tolerant barley (PhD)* – can be accessed via **ahdb.org.uk/research**