High-throughput phenotyping of the core European Heritage Collection (ExHIBiT) under waterlogging

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Barley is the most produced crop in Ireland; it is essential as a fodder crop and a key ingredient for the malting industry, contributing to Irish national identity. In Ireland, climate change is bringing more extreme rain; leading to an increase in flooding and waterlogging events. Barley is particularly sensitive to waterlogging urging the need to harness genetic diversity and breed barley with increased waterlogging tolerance to maintain current agricultural production. One of the limiting factors in breeding is the drawbacks of traditional phenotyping. This project relies on modern high-throughput phenotyping, which allow non-destructive, continuous and quantitative data collection.

Using imaging sensors in controlled conditions, we phenotyped a collection of barley accessions under controlled and waterlogged conditions using RGB, fluorescent and hyperspectral cameras (VNIR and SWIR). We used the core European Barley Heritage collection (ExHIBiT); made up of 230 diverse 2-row spring barley accessions. This collection was assembled, genotyped, agronomically characterized and its application for association mapping has been established by our team.

We observed that 14 days of waterlogging lead to a significant reduction in pixel count (Project Shoot Area) and Quantum yield, showing a large impact on several hyperspectral indices. We also observed that 7 days of recovery after stress are fundamental for differentiate stress resilience. Work is ongoing to optimize hyperspectral image analysis, and establish parameters to distinguish plant performance, enabling to discriminate between resilient and sensitive accessions. These data will be used for association mapping to identify genetic regions contributing to waterlogging tolerance in spring barley.