Targeted Project / AY 2023 -2024

Computational modelling enabled research to understand the senescence process in wheat

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Research area: Wheat senescence

Project outline:

Wheat is the UK's most important crop, with production reaching 16.3 million tonnes in 2019. In the face of climatic change, human population growth and geo-political changes, securing resilient wheat production is a key component underpinning global food security. Senescence is a key process in plant development, and impacts directly on crop yield. The photosynthetic capability of an organ declines sharply with the onset of senescence. Despite its biological importance in crop performance, the molecular mechanisms that mediate senescence and control yield are largely unknown. Computer models can contribute to the understanding senescence in wheat by allowing the simulation of perturbations due to natural or experimental reasons and the prediction of responses because of GxE interactions. This PhD will 1) leverage the rich sources of omics data currently available to reconstruct the core network of molecular components, and mechanisms underlying leaf senescence, based on computational models. Then, 2) state-of-the-art breeding methodologies will be used to confirm the role of candidate genes with the core network of senescence. 3) The senescence model will be fine-tuned based on the wet-lab results and a dynamic model senescence will be generated, and iteratively improved. This model will in silico simulate the development of senescence across the plant's life cycle, enabling prediction of gene targets within the modelled networks to manipulate senescence. These approaches are only now possible due to the recent availability of the gold-standard wheat genome sequence, high-quality genetics and breeding facilities, and advances in computational modelling techniques.

BBSRC DTP main strategic theme: Bioscience for sustainable agriculture and food

BBSRC DTP secondary strategic theme: Transformative technologies