

Optimising diversity capture and maximising genetic gain within pre-breeding wheat programs

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Department/Institute: Pre-Breeding Department / NIAB

Industrial Partner: KWS UK Ltd

Research area: Crop breeding and quantitative genetics

Project outline:

Incorporating and maintaining novel genetic diversity into wheat breeding pools is a necessary step in the future proofing of our food systems. Current breeding approaches for capturing diversity (termed 'pre-breeding') are resource intensive. Large quantities of material must be generated to capture beneficial alleles/trait combinations while maintaining the genetic components prerequisite for adaptation to target environments. Advances in genotyping and computer simulation have facilitated genomic and cross prediction that could be explored to improve the efficiency of diversity capture. The proposed PhD project would focus on the following areas:

- (1) Form wheat backcross populations using the current elite wheat breeding pool in Western Europe and a selection of diverse wheat genetic resources. Identify elite varieties with a high general combining ability for traits related to adaptation. In parallel, through genomic prediction and simulation, generate populations in silico; simulations will then be validated with in vivo comparisons.
- (2) Use further in silico simulation, actual validation crosses, and key traits (plant height, heading date, and potentially yellow rust resistance), to explore how segregation patterns can be optimised at the BC1F1 generation.
- (3) Explore recombination patterns of novel introgressions during backcrossing and generation advancement in elite backgrounds. Explore different methods for incorporating pre-breeding diversity into elite backgrounds while minimising linkage-drag.

Using wheat germplasm of NIAB and KWS UK, the project will develop breeding community relevant approaches and databases to aid faster and more efficient incorporation of novel genetics and enrichment of underrepresented genetics that have the potential to improve modern wheat cultivars.

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