

Boosting Wheat Yield with Genes from the Wild

Photosynthesis in crops requires urgent improvement if we are to drive greater radiation use efficiency (RUE), biomass production and associated increases in grain yields. This boost is unlikely to be met using current modern day wheat varieties and therefore novel genetic variation from other sources needs to be identified and deployed. An IWYP research project led by Erik Murchie at the University of Nottingham, in collaboration with other researchers in the UK, “**Wider and Faster: High-Throughput Phenotypic Exploration of Novel Genetic Variation for Breeding High Biomass and Yield in Wheat**”, aims to do just this. Hundreds of wheat wild relatives, crosses between wheat and wild relatives and landraces have been screened for genetic variation in photosynthetic traits, using custom-made tools, to identify those that contain gene variants associated with higher rates of photosynthesis than available in elite wheat varieties. The goal is to apply this genetic variation in wheat breeding programs across the world.



King et al. (2019). <https://doi.org/10.3389/fpls.2019.00034>

What Solutions have been Identified?

- From screening hundreds of lines derived from modern wheat crossed with wild relatives, landrace wheats and wild wheat progenitors, several lines containing genomic segments from wheat wild relatives have been found to display 10% greater photosynthetic efficiency than the bread wheat parents. A number of wheat wild relative species were found to have photosynthetic rates up to a third greater than any of the modern wheat varieties.
- A survey of the genes involved in photosynthesis has identified significant levels of genetic variation that is correlated to phenotypes of selected lines and which could be exploited in breeding.

What has been Transferred to the Wheat Improvement Pipelines?

- 21 lines with different chromosomal segments from wild relatives and displaying high rates of photosynthesis were evaluated in the field at the IWYP Hub at CIMMYT (see below) to confirm the effects in the field that were observed in glasshouse studies.
- The best 4 introgressed segments are being introduced into IWYP lines with high biomass and harvest index to evaluate the effect in elite spring wheat lines for use in breeding programs around the world.

Enhanced biomass, grain number and spike number was observed in lines with introduced chromosome segments from wild relatives. Plants were grown in the field at the IWYP Hub at CIMMYT in 2019 and compared to Borlaug-100, a locally adapted high yielding variety as a control. The key trait to measure for enhanced photosynthesis is total biomass (dry weight) and the most important trait overall is grain number per area (yield).

