IWYP International Wheat Yield Partnership
Research to Deliver Wheat for the Future

IWYP SCIENCE BRIEF

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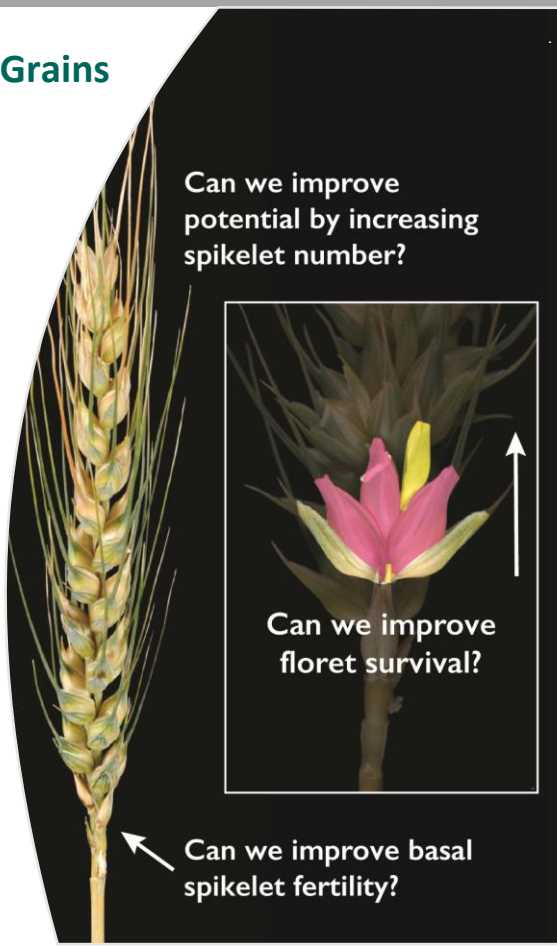
Tuning the Interaction of Genes Affecting the Number of Grains per Spike to Increase Yield



Recent discoveries of genes affecting fertility of spikelets and architecture, many featured in IWYP research projects, have opened the opportunity to create new alleles and explore their ability to supercharge yield improvement. The number of fertile spikelets and florets produced by an inflorescence are major determinants of yield in wheat. The number of grains produced per spikelet is influenced by floret fertility, a trait defined by the number of floret primordia that survive to form grain-producing florets. Typically, a wheat spikelet will form 8-12 floret primordia, but only 2-4 usually survive to produce grain. Improving the survival of floret primordia has the potential to increase grain production and overall yield, and recent literature has identified genetic variation that enhances the viability of these primordia. An IWYP Aligned Project "**Increasing Cereal Yield Potential through Reduced Floret Abortion**" led by Scott Boden at the University of Adelaide with other colleagues in Australia, the UK, USA and Germany will build upon recent discoveries (e.g., IWYP Science Briefs 11 and 13) to examine genetic variation for floret fertility in elite Australian backgrounds and investigate the potential of variant alleles to improve genetic yield potential that can then be used by breeders worldwide.

Key Objectives and Outputs

- Identify allelic diversity for the genes *GRAIN NUMBER INCREASE-A1* (*GNI1*), *FLOWERING LOCUS T2* (*FT2*), *FLOWERING LOCUS T3* (*FT3*), *TEOSINTE BRANCHED1* (*TB1*), *PHOTOPERIOD-1* (*Ppd-1*), *VEGETATIVE TO REPRODUCTIVE TRANSITION2* (*VRT-2*), and *SHORT VEGETATIVE PHASE-1* (*SVP-1*) in Australian and international germplasm
- Develop near-isogenic lines (NILs) to test the effect of variant alleles of these genes on floret and spikelet fertility, including development of lines with genetic variation for *Ppd-1*
- Generate gene-edited alleles of *GNI1*, *FT2*, *FT3*, *TB1*, and *VRT-2* that contain novel mutations relative to natural and induced alleles
- Characterize the effects of variant *GNI1*, *FT2*, *FT3*, *TB1*, *Ppd-1*, *VRT-2*, and *SVP-1* alleles, including gene-edited alleles, on floret and spikelet fertility related traits.
- Analyze biological processes that contribute to modified floret fertility, including the interaction with environmental signals such as photoperiod.
- Write a review about the current understanding of the genes and biological processes that influence floret fertility in wheat and other cereals.

Anticipated Impact of this Research

- An estimation of the breeding values of each allele and ranking of their effect on floret fertility
- A breeders decision tool to define/recommend the allelic combinations of genes that balance phenology requirements with improved floret fertility for different environments
- Gene-specific marker information, germplasm, and phenotypic data delivered to breeders to facilitate allele selection and their adoption in breeding programs to improve yields

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