

## FROM POT TO PLOT: THE ROLE FOR PHYSIOLOGY IN FACILITATING GENETIC GAIN IN COMMERCIAL WHEAT BREEDING PROGRAMS

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Grain yield should be a strong integrator of those favourable alleles underpinning adaptation in commercial breeding programs. In turn, phenotypic selection should alter allelic frequency to fix favourable gene combinations contributing to improved performance. However, reduced genetic variance and large genotype  $\times$  environment interaction lower heritability to slow genetic progress of complex traits particularly in challenging environments. Reducing the noise-to-signal in breeding programs will improve confidence in selection and delivery of new varieties.

Development of a sound physiological framework has contributed to delivery of improved wheat varieties. This will continue but there needs to be more effective integration into commercial breeding programs. Physiology will complement empirical selection to increase genetic gain for yield through: improved understanding of genotype responsiveness to environment through environmental characterisation; implementation of physiological-based crop models in the identification of traits and trait combinations; identification and use of germplasm containing new alleles for targeted traits; deployment of tools for high-throughput phenotypic screening in early generations; use of managed environments to understand genotype response to environmental challenges; and interpretation and prediction of synergies afforded with genotype  $\times$  management interactions. Together, these should compliment new genetic and breeding tools but add value in better targeting and incorporation of new alleles, and understanding of genotype responsiveness to changing environments. We will provide examples where improved physiological understanding has contributed to development of improved germplasm, and improved trait understanding for those traits important in enriching populations for adaptation to Australian environments.