

Harnessing the Knowledge of Effects from Genes in Other Crops to Boost Wheat Yields

A wealth of scientific knowledge exists for other crops that can be used to frame hypotheses to test for the genetic improvement of wheat. Results from other species open new avenues to explore untapped genetic variation for increasing genetic yield potential. A research project led by Stuart Roy at the University of Adelaide, in collaboration with other researchers in Australia and the USA, “**AVP1, PSTOL1 and NAS – Three High Value Genes for Higher Wheat Yield**” has applied knowledge of the function of three specific genes described in other cereal species and evaluated their value in wheat, using a transgenic approach. This tactic permitted a full characterization of the mode of action of these genes in wheat. Overall, the project has demonstrated the utility of exploiting research results in other species to identify novel alleles in wheat that might never have been previously selected in breeding.

What Solutions have been Identified?

- Field trials of transgenic wheat lines revealed lines with up to 30% more grain than non-transgenic controls. The best performing plants either expressed higher levels of *AVP1* or *PSTOL1* individually or a combination of the three genes (10-24% for *AVP1*; 8-21% for *PSTOL1*; and 5-30% for *AVP1*, *NAS2* and *PSTOL1*)
- The genes boosted growth by enhancing the ability of the plant to take up soil nutrients and/or remobilize carbon from leaves to roots or grain
- Analogous *AVP1*, *PSTOL1* and *NAS2* genes in wheat were identified. Screening diverse bread wheat cultivars and landraces identified those with higher expression of these genes. The favorable alleles are now being transferred into elite wheat varieties to produce non-GM wheat with enhanced yield for further testing and breeding

What has been Transferred to Wheat Improvement Pipelines?

- Transgenic lines with various combinations of the three genes field tested to confirm their effect on the target phenotype
- All sequence and phenotype data from this program have been delivered to the IWYP Hub and made available to all researchers
- Germplasm with novel naturally occurring alleles of wheat *AVP1*, *PSTOL1* and *NAS2* genes are being sent to the IWYP Hub at CIMMYT for incorporation into the validation and pre-breeding pipeline

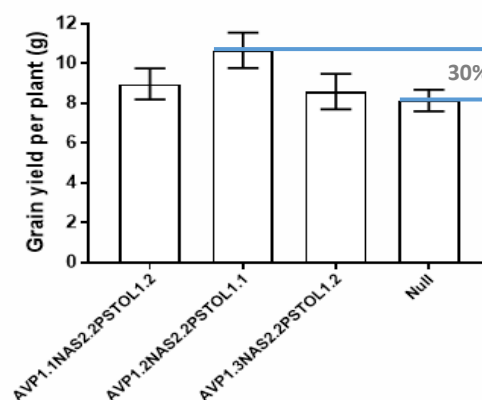


Figure 1. Enhanced grain yield per plant in the field for transgenic plants containing combinations of AVP1+NAS2+PSTOL1. The transgenic lines were compared to null segregant control plants. Results are the mean \pm standard error of the mean.

