The Interaction of Light and Gibberellin in the Control of Wheat Architecture

Bethany Ellis [1,2], Peter Hedden[1], Steve Thomas[1], Andy Phillips[1] and Matthew Terry[2]
[1] *Rothamsted Research,* [2] *Centre for Biological Sciences, University of Southampton*

DELLA proteins are repressors of plant height that act in the gibberellin-response pathway. The green revolution saw DELLA mutations introduced into wheat, causing a dwarf phenotype that reduced lodging and increased grain biomass, greatly improving yields. Phytochrome Interacting Factors (PIFs) are transcription factors that mediate light responses in plants, including promotion of hypocotyl elongation. In Arabidopsis, DELLAs repress the transcriptional activity of PIFs through a direct physical interaction. This highlights a role for PIFs in regulating growth in response to gibberellin. Furthermore, a recent paper indicated that a rice PIF homologue, OsPIL1, is an important regulator of stem elongation[1]. This suggests that *PIF* expression is a target for modifying stem height in wheat, with the potential benefit of increasing yields.

Wheat contains one DELLA, RHT-1, whereas three OsPIL1 orthologues were identified using bioinformatics; we have named these TaPIL1, TaPIL2 and TaPIL3. TaPIL1 is the most closely related to OsPIL1 and TaPIL2 the least, with a protein sequence-identity of 69% and 32.3% respectively. The interaction between RHT---1 and TaPIL1 was investigated using a yeast two-hybrid assay, revealing a possible interaction between these proteins. A yeast two-hybrid library is being used to screen for RHT-1 interactors in the wheat stem, the latest screen identified many clones encoding potential interactors which are being characterised. The role of the TaPILs in regulating stem elongation and light response is being analysed by altering expression levels. RNAi and TILLING lines are being produced to assess the effect of reduction or knockout of TaPIL1 expression. Overexpression of both TaPIL1 and the rice OsPIL1 will be used to assess effect on plant stature. Through investigating the interaction of RHT-1 and wheat PIFs, and their implications for architecture and light responses, we aim to increase our understanding of gibberellin signalling and identify new potential targets for improving wheat yields.

1. Todaka D, Nakashima K, Maruyama K, Kidokoro S, Osakabe Y, Ito Y, Matsukura S, Fujita Y, Yoshiwara K, Ohme---Takagi M, Kojima M, Sakakibara H, Shinozaki K, Yamaguchi---Shinozaki K (2012) *Proc. Natl. Acad. Sci. USA*, 109, 15947---15952.