Gibberellin Signalling: A Target For Improving Wheat Architecture

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Gibberellins (GAs) are plant hormones which control many aspects of plant growth and development, including stem elongation. The potential to improve crop traits by altering the GA signalling pathway is now well established. In wheat, the *Rht-1* semi-dwarfing mutations, which were instrumental in increasing yields during the Green Revolution, produce plants which are partially insensitive to GAs. This phenotype has a positive yield effect by reducing excessive stem elongation in response to the application of fertilizer and promoting increased partitioning of assimilate into the grain. DELLA proteins repress stem elongation and GAs relieve this repression by promoting the rapid degradation of DELLAs. The *Rht-1* semi-dwarfing mutations in wheat have been demonstrated to encode abnormal DELLAs. In work aimed at gaining a better understanding of how these alleles confer beneficial effects on wheat development, we have identified the mutations in multiple *Rht-1* dwarfing alleles and provided evidence that they enhance the stability of the protein by blocking binding to the GA receptor, GID1, leading to GA-insensitivity. We have recently devised a targeted strategy for identifying novel GA-insensitivity *Rht-1* mutations that potentially have improved traits compared to known alleles. This approach involved screening an EMS mutagenized wheat population by TILLING to identify missense mutations that alter conserved residues within the GID1 binding domain. A yeast-based interaction screen is being used to assess whether these mutations block binding to a GA-GID1 complex. In addition to identifying novel *Rht-1* semi-dwarfing alleles, this screen provides a potential explanation for the lack of *Rht-A1* dwarfing alleles being identified in wheat breeding programmes. In an attempt to identify other novel dwarfing genes, we are also targeting other phytohormone signalling components using a TILLING-based approach. These screens have resulted in the generation of a novel wheat GA biosynthetic mutant which has a semi- dwarf stature.