

IDENTIFYING GENES CONTROLLING PLANT HEIGHT IN WHEAT



THE CHALLENGE

Plant height is an important trait in wheat. Taller plants are susceptible to lodging under high winds or heavy rain, resulting in loss of yield and quality.

Semi-dwarf cultivars of wheat were introduced to breeding programmes worldwide during the "Green revolution" of the 1960s-1980s leading to improved lodging resistance.

Most wheat cultivars carry mutations in a gene called *REDUCED HEIGHT 1 (RHT1)*, a growth regulator.

Despite the benefits for lodging resistance, the mutations in *RHT1* cause additional negative effects that impact yield in certain environments.

About

70%
wheat
cultivars



carry semi-dwarf
traits discovered
in the 1930s

OUR RESEARCH



ROTHAMSTED
RESEARCH

In wheat (*Triticum aestivum*) two semi-dwarfing alleles, *Rht-B1b* and *Rht-D1b* were sourced from the Japanese variety 'Norin 10', released in 1935. These alleles make the wheat plant unresponsive to the plant growth promoting hormone gibberellin. While *Rht-B1b* and *Rht-D1b* reduce stem growth, there is generally an increase in grain number and yield due to reduced lodging, and a greater proportion of the plant's photosynthate being partitioned into spike and grain development, compared with taller lines.



Image credit: Pearce et al. (2011) Plant Physiology, 157, 4, 1820–1831

Gibberellin is a universal growth hormone, and use of *Rht-B1b* and *Rht-D1b* semi-dwarf alleles has some downsides. These include the production of shorter coleoptiles which impacts seedling emergence under dry conditions, and despite an increase in grain number, grain size is often reduced.

We are identifying alternative semi-dwarfing genes for wheat that confer resistance to lodging, while maintaining grain yield and avoiding some of the negative effects of the *Rht-B1b* and *Rht-D1b* alleles. These include *BRI1*, *GA 3-oxidases*, *GA 20-oxidases*, and *IDD5*. Many of these alternative semi-dwarfing genes have entered our Breeder Toolkit pipeline, making them available to wheat breeders.

SCAN FOR MORE INFO



The Delivering Sustainable Wheat research programme aims to address critical challenges in wheat health, yield, and production in order to safeguard the future of this vital crop.

It is a collaboration between the John Innes Centre, Rothamsted Research, Quadram Institute, and Earlham Institute, with the universities of Bristol, Lancaster, Leeds, Imperial College London, and Nottingham, NIAB, and NISD-UEA.

Follow us on BlueSky @dsw-isp.bsky.social