Fonds de Soutien à l'Obtention Végétale

Blé tendre | Blé dur | Orge | Seigle | Avoine | Triticale | Riz | Épautre

Genes to reduce plant height without increasing disease

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Introduction

Recent research has highlighted the negative relationship between reduced plant height in wheat conferred by the 'Green Revolution' semi-dwarfing (*Rht*) genes and resistance to some diseases, in particular Fusarium head blight (FHB).

This project used parallel approaches to identify new alleles controlling plant height (PH) and establish their effect on major wheat diseases such as FHB.

Project

1) The effect of five plant height (PH) loci (chromosomes 2A, 2D, 3A, 3B and 6B) on FHB were assessed in multiple field trials in France and the UK.
2) Height mutants of cv. Paragon were screened for resistance against FHB and other diseases in multiple field trials.
3) Populations with parents differing for FHB resistance but with the same *Rht* alleles (*Rht1* or *Rht2*) were screened to identify quantitative trait loci (QTL) for resistance to FHB.

Results

1) All five PH loci showed increased FHB susceptibility with decreased height. The effect was least for the 2D locus (Table 1)
2) Height and FHB susceptibility are pleiotropically associated (Figure 1). Shorter lines are generally more resistant than taller ones. Other factors, however, also contribute to FHB resistance.
3) Many FHB QTL of small effect segregated in the Barok x Bermude population (*Rht2* fixed) but some stable QTL were detected (Table 2). Few FHB QTL segregated in the Oakley x Sokal population (*Rht1* fixed) and these were of major effect (Table 3)

QTL	Height differential	AUDPC differential	AUDPC per cm
2A	-3.0	5.5	-1.81
2D	12.7	-216.2	-17.0
3A	-5.2	223.3	-43.1
3B	6.0	-207.8	-34.6
6A	3.6	-35.6	-10.0

Table 1. Effect of five plant height QTL on FHB disease (AUDPC)

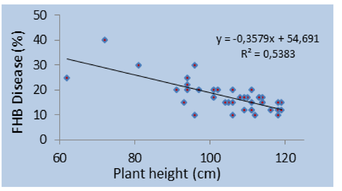

Fig 1. Relationship between plant height and FHB in Paragon mutants

Marker	Chrom. Position (cM)	Log(10)	Max. % Expl.	High Allele
AX-94758722_1BL	1B (3.2 cM)	4.19	11.75	Barok
AX-95160899_2BS	2B (278 cM)	6.07	16.99	Bermude
AX-95024486_2DL	2B (16 cM)	3.25	14.50	Bermude
AX-94574405_5AL	5A (129 cM)	4.6	10.33	Bermude
AX-95008466_7AL	7A (66 cM)	5.58	13.11	Bermude

Table 2. FHB QTL in Barok x Bermude population (*Rht2*)

Marker	Chrom. Position (cM)	Log(10)	Max. % Expl.	High Allele
AX-94433044_3AS	3A (113cM)	8.66	41.91	Oakley
AX-94540502_3DL	3A (117 cM)	4.75	20.69	Oakley
AX-94571885_1DL	6D (20 cM)	6.03	21.36	Oakley
AX-94465240_7BL	7B/5B (139 cM)	5.12	23.69	Oakley

Table 3. FHB QTL in Oakley x Sokal population (*Rht1*)

Discussion

Overall the data from this project indicate a pleiotropic effect of plant height (PH) on susceptibility to FHB (shorter plants are more susceptible). The effect of some PH QTL, however, is less than that of others (2D has less effect on FHB than 3A QTL).

Many FHB QTL of small effect segregated in the Barok x Bermude population (data no shown) but some stable QTL of moderate effect were detected. This reflects the situation in most European winter wheat varieties where FHB QTL are of generally small effect. In contrast the FHB QTL in the Oakley x Sokal population (*Rht1* fixed) were of major effect making them of considerable interest for future efforts to increase FHB resistance.

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