Austrian wheat varieties: Influence of plant height and warfing genes on susceptibility to Fusarium head blight

Michael Oberforster (AGES, Wien)

Introduction

In recent decades, one important breeding goal has been to reduce plant height in wheat. This goal went hand in hand with a reduced tendency toward lodging, an improved response to the nitrogen provided, and an altered harvest index.

Examples include 'Activus', 'Advokat', 'Artimus', 'Fidelius', 'Findus', 'Monaco', 'Spontan', and 'SU Mangold'. Some varieties that contain the semi-dwarfing alleles *Rht-B1b* or *Rht-D1b* (Chevalier, Renan, Toras) are even only slightly or slightly to moderately susceptible to FHB. For these reasons, it is not advisable to largely abandon the use of these alleles.

Materials and Methods

The presentation is based on results of Austrian VCU tests conducted with winter wheat from 1985 to 2021. The incidence and severity of Fusarium head blight (FHB) are summarised on a scale from 1 to 9 (1 = no blight, 9 = very severe blight). The data were mainly collected from natural or semi-natural environments (maize stubble method). The information on the presence or absence of the alleles *Rht-B1b* and *Rht-D1b* was taken from the publications of Knopf et al. [1] and Würschum et al. [2].

Figure 1: Symptoms of Fusarium head blight (FHB) on wheat spikes

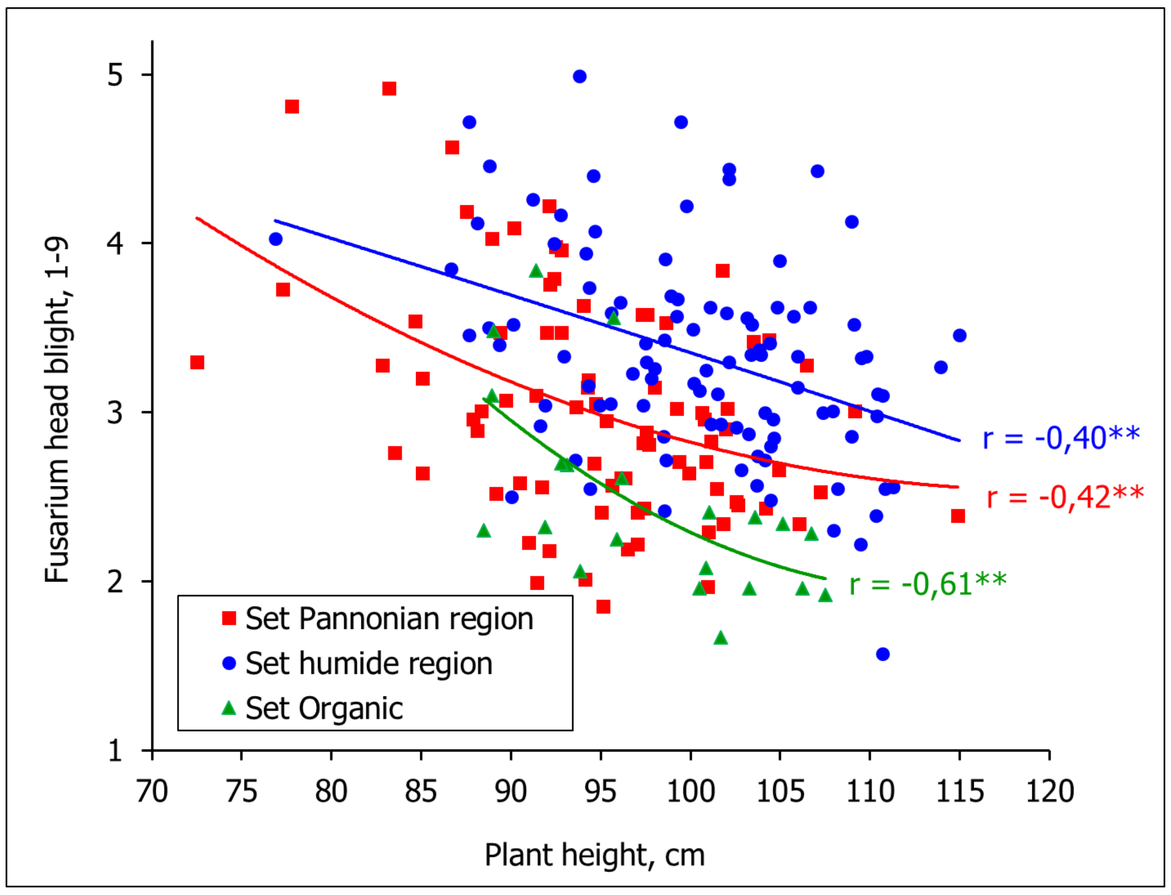

Figure 2: Winter wheat varieties – Correlation between plant height and the extent of FHB (adjusted means, trials conducted 1985-2021)

Table 1: Plant height and FHB in winter wheat varieties with and without dwarfing alleles (adjusted means, trials conducted 1985-2021)

Parameter	*Rht-B1*	*Rht-D1*	No
Pannonian region			
n	1	1	16
Plant height, cm	83,5	89,2	99,6
FHB, 1-9	2,76	2,52	2,83
Humide region			
n	1	5	27
Plant height, cm	76,9	93,0	104,0
FHB, 1-9	4,03	3,52	3,33

Results and Discussion

The negative effect of the *Rht-B1b* and *Rht-D1b* alleles on Fusarium resistance has been clearly documented. This effect is also associated with the extent of anther retention during flowering [3]. Out of 51 winter wheat varieties currently or formerly registered in Austria, two (Renan, Tulsa) contain the dwarfing allele *Rht-B1b*, and six (Chevalier, Contra, Dean, Jenga, Tambor, Toras) contain *Rht-D1b*. The two gene variants are also believed to be less frequent in the current selection than in Germany, France, Great Britain, or Denmark. In any case, this is true for wheat varieties that are mainly cultivated in the Pannonian region and on organic farms. In the series of three trials (Figure 1), plant height could be negatively correlated with susceptibility to FHB (r = -0.40** to -0.61**). This susceptibility does not present a fundamental obstacle to breeding varieties with shorter or quite short plant heights and average to above-average resistance to FHB.

References

[1] Knopf C, Becker H, Ebmeyer E, Korzun V (2008): Occurrence of three dwarfing *Rht* genes in German winter wheat varieties. Cer Res Comm 36, 553-560.

[2] Würschum T, Langer SM, Longin CFH, Tucker MR, Leiser WI (2017): A modern Green Revolution gene for reduced height in wheat. Plant J 92, 892-903.

[3] Buerstmayr M, Buerstmayr H (2016): The semidwarfing alleles *Rht-D1b* and *Rht-B1b* show marked differences in their associations with anther-retention in wheat heads and with Fusarium head blight susceptibility. Phytopathology 106, 1544-1552.

Contact: **Michael Oberforster** l Sustainable Plant Production l Spargelfeldstraße 191, 1220 Vienna l michael.oberforster@ages.at
Austrian Agency for Health and Food Safety