



Impact of Fusarium infections on β -glucans in barley grains

Charlotte Martin¹, Torsten Schirdewahn², Susanne Vogelgsang², Brigitte Mauch-Mani³ and Fabio Mascher¹

¹Institute for Plant Production Sciences, Agroscope

²Institute for Sustainability Sciences, Agroscope

³Institute of Biology, University of Neuchâtel

Barley grains can provide elevated quantities of β -glucans, a soluble fibre recognized to provide benefits for human health, and products containing these of β -glucans are now receiving an increasing interest from consumers. Barley plants are also hosts for *Fusarium* pathogens, causing Fusarium head blight (FHB) and accumulating mycotoxins in grains. *Fusarium graminearum* is the most prevalent *Fusarium* species found in barley, associated with the DON toxin. As these *Fusarium* pathogens affect properties of the grains, this study aims at investigating modifications of the β -glucan content in grains in case of infections.

Materials and methods

Six winter barley varieties have been sown in Changins (VD), Vouvry (VS) and Reckenholz (ZH) with 3 repetitions and have been infected artificially with DON producing strains of *Fusarium graminearum*. Success of these infections was controlled by observations of FHB symptoms on spikes (Figure 1). After harvest, Thousand Kernel Weight (TKW) was compared between infected and non-infected grains (Figure 2). DON toxin accumulation and β -glucan content were measured in all samples.

Results

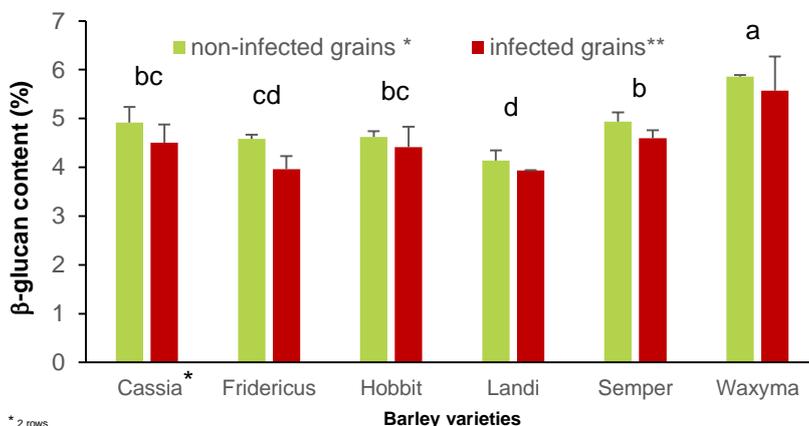


Fig 3: Comparison of β -glucan contents in infected and non infected grains, for six barley varieties. Different letters indicate significant differences in mean β -glucan contents in all environments between varieties (p-value<0.05). The error bars represent Pearson standard deviation. For all varieties β -glucan contents were significantly weaker in infected grains over all environments.

Table 1: Pearson correlation coefficients between the studied characteristics of infected grains for all varieties in the three environments.

	TKW losses (%)	DON content	β -glucan content
DON content (ppm)	0.52***		
β -glucan content (%)	-0.14 ns	-0.37**	
decrease in β -glucan (%)	0.32*	0.27 ns	-0.73***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

- β -glucan contents in grains have significantly decreased with the infection in all varieties over all environments (p-value<0.05)(Figure 3).
- Decreases in β -glucan content were linked with the loss of TKW and correlated with symptoms on spikes (r=0.40, p-value<0.05) (Table 1).
- Decreases in the β -glucan were lower for varieties providing high β -glucan contents (Table 1)
- Lower DON accumulations were detected in grains with elevated contents in β -glucans (Table 1).



Fig 1: Typical symptoms of FHB as observed and scored in field with scalding on barley spikes.

Fig 2: Comparison of infected (b) and non infected (a) grains. Infections caused changes in morphological properties of grains measured here by the decreases of TKW in infected grains.

- β -glucan content in barley grains decreased with high *Fusarium* infection pressure.
- These decreases were lower for barley varieties with higher FHB resistance level.
- Interactions between β -glucan and DON accumulation in barley grains will be further studied by testing additional barley varieties with a wide range of β -glucan concentration in grains.
- β -glucan may contribute to resistance of barley grains against *Fusarium* pathogens and their toxins.

Photo : Schirdewahn AGROSCOPE

Photo : Martin AGROSCOPE