Impact of *Fusarium* infections on ß- glucans in barley grains

Charlotte Martin[1], Torsten Schirdewahn[2], Susanne Vogelgsang[2], Brigitte Mauch-Mani[3] and Fabio Mascher[1]
[1]Institute for Plant Production Sciences, Agroscope
[2]Institute for Sustainability Sciences, Agroscope
[3]Institute of Biology, University of Neuchâtel

Barley grains can provide elevated quantities of ß- glucan, a soluble fibre recognized to provide benefits for human health. Products containing ß- glucan are now receiving increasing interest by consumers and the food industry. 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 ß- glucan content in grains with 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 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 ß- glucan content were measured in all samples.

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Fig 1: Typical symptoms of FHB as observed and scored in field with scalding on barley spikes.
Fig 2: Comparison of control (a) and infected grains (b). Infections caused changes in morphological properties of grains measured here by the decreases of TKW in infected grains.

Results

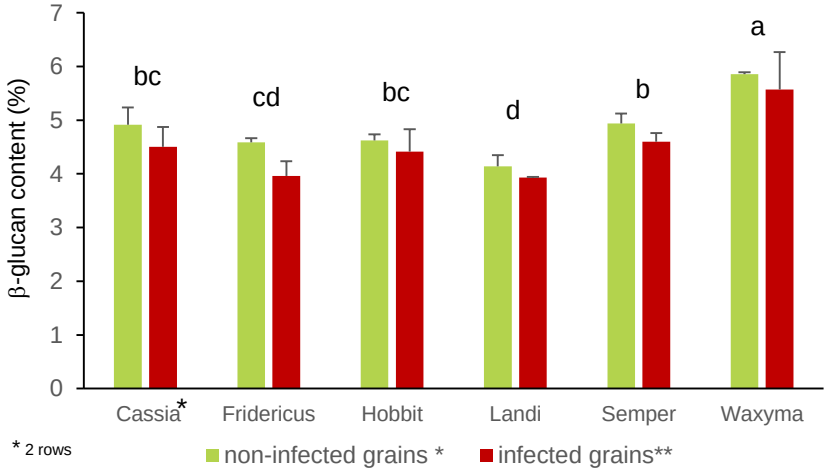

Fig 3: Comparison of β-glucan contents in infected and non infected grains, for six barley varieties. Different letters indicate significant differences in mean β-glucan contents in all environments between varieties (p-value<0.05). The error bars represent Pearson standard deviation. For all varieties β-glucan contents were significantly lower 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) (Fig.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) (Tab.1).
- Decreases in the β-glucan were proportionally lower in varieties with higher initial β-glucan content (Tab.1)
- Grains with elevated contents in β-glucans showed lower DON accumulations (Tab.1).

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

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