## Genotype X environment interactions underline the need for multilocation trials for Fusarium head blight resistance assessment

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Fusarium head blight (FHB) is a major disease of wheat worldwide. *Fusarium graminearum*, the most prominent FHB pathogen, causes yield losses but also deoxynivalenol (DON) mycotoxin accumulation in the grains. Fungicide application has proven to be unreliable to control the disease. FHB control is usually based on cultural methods such as crop rotation and deep ploughing. Choosing a resistant variety is an easy way for the farmer to limit damages to the crop by FHB. In spite of the progress in marker assisted selection, resistance trials remain essential in assessing the resistance of new candidate cultivars. In order to assess the need for multi-location trials, resistance parameters of Swiss varieties were assessed at two locations.



Fig. 1: A spike of wheat infected with FHB.

## Materials and methods

11 Swiss wheat varieties were grown at 2 locations, Changins (VD) and Cadenazzo (TI) in 2009, 2010, 2012 and 2014. The flowering wheat plants have been inoculated by spraying a macroconidia suspension of a mixture of virulent Fusarium strains. Overhead irrigation was applied in order to ensure infection. Resistance against primary infection and resistance against the spread the disease has been visually assessed. The disease severity was visually scored at 3-5 days intervals and 6-7 times in total. The relative area under disease progress curve (rel. AUDPC) was calculated with the disease scores. Sympotms of FHB infection are visible in Fig. 1. Deoxynivalenol (DON) mycotoxin accumulation was measured on 8 varieties in 2009, 2012 and 2012. Measurements were performed with quantitative ELISA Ridascreen® Fast DON test kits (R-Biopharm, Darmstadt, Germany).

## Results

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**Rel. AUDPC**: Disease severity varied significantly among the varieties. Highly significant GxE interactions have been detected for the rel. AUDPC (p<0.001). 3 varieties were consistently the most resistant in the 2 locations. One variety, Zinal, was moderately resistant in Changins but was the most susceptible in Cadenazzo. The mean rel. AUDPC of the 11 varieties in the two location is displayed in Fig. 2. The impact of year (p<0.001) and genotype x year interactions (p<0.001) were both highly significant.

**DON accumulation:** DON accumulation in the grains varied significantly among the varieties. Highly significant GxE interactions have been detected (p<0.001). There was a large variation in resistance against mycotoxin accumulation among the varieties. For some varieties, the resistance was however strongly influenced by the environment. For instance, DON accumulation of Cambrena and Simano was comparatively higher in Changins. DON contamination of the 8 varieties in the two location is displayed in Fig. 3. The impact of year (p<0.001) and genotype x year interactions (p=0.005) were both highly significant.



Fig. 2: Mean relative AUDPC of 11 Swiss wheat varieties in Changins (VD)

Fig. 2: Mean relative AUDPC of 11 Swiss wheat varieties in Changins (VD and Cadenazzo (TI). Error bars show standard error.





## Conclusions

- The results highlight the need for multi-location trials for Fusarium head blight resistance assessment.
- The observed year x genotype interaction confirm that resistance trials must be performed over several years.
- The selection of varieties showing enhanced levels of resistance in all locations is recommended.

