Phenotypic and genetic determinants of winter wheat adaptation to increasing CO_2 concentrations using ear fusarium as an example

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Since the beginning of industrialization, the concentration of CO_2 in the atmosphere has steadily increased to currently 410ppm and a further increase is to be expected. On wheat, elevated atmospheric CO_2 concentrations (eCO_2) have positive effects through stimulation of photosynthesis and a resulting increase in above-ground biomass. However, this offers a larger potential attack surface for pathogens.

Fusarium graminearum and *Fusarium culmorum* cause fusarium head blight in wheat, and in addition to yield losses, infection with these fungi can lead to the formation of mycotoxins that pose a health hazard to humans and animals. At eCO_2, increased levels of the mycotoxin deoxynivalenol and more severe symptom expression has already been measured in some wheat varieties after inoculation with *Fusarium culmorum*. However, only a small set of wheat cultivars has been tested so far, so that there is a need for clarification of the eCO_2 influence on ear infestation and toxin contamination, especially in the case of quantitative differences in *Fusarium* infestation.

In this part of the WheatFACE project, new insights into the influence of eCO_2 on the pathogenicity and virulence of *Fusarium graminearum* will be investigated in different winter wheat varieties.

In vitro laboratory studies will test the influence of eCO_2 on the biology of *Fusarium graminearum*. For this purpose, mycelial growth, spores and toxin formation of different isolates will be investigated at different CO_2 concentrations. In greenhouse experiments, a set of more than 200 winter wheat genotypes will be examined with regard to their infestation with *Fusarium graminearum* at different CO_2 concentrations. A selection of divergent genotypes will be tested in the Free Air Carbon dioxide Enrichment (FACE) facility under field conditions.

To assess disease infestation, the infestation frequency and severity will be recorded and the *Fusarium* head blight index will be calculated. Furthermore, the number of *Fusarium*-damaged kernels and presence of *Fusarium*-DNA in the grain will be determined and toxin analyses will be performed.