Effect of elevated CO_2 concentrations on morphological traits of different winter wheat varieties

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Global concentrations of CO_2 are projected to increase to 650 ppm (RCP4.5) by the end of the 21st century. Considering this steadily increasing CO_2 concentration since the industrial revolution and the associated climate changes, it becomes more and more relevant how wheat and its pathogens cope with these future climate conditions. As winter wheat (*Triticum aestivum* L.*)* is one of the most important crops in terms of human nutrition, it is particularly important to maintain its productivity. Elevated CO_2 concentrations have the potential to increase yields and to buffer the negative effects of climate change like drought and heat stress.

At Institute PB we are investigating the response of different winter wheat cultivars to elevated CO_2 concentrations (e[CO_2]) within the project WheatFACE[1]. Using a free air carbon dioxide enrichment (FACE) facility, we adjust the CO_2 concentration to 600 ppm in our experimental plots and compare them to plots with ambient CO_2 (a[CO_2]) concentrations. We are investigating the influence of e[CO_2] on the development, physiology, and agronomic characteristics of the wheat varieties. Special attention is paid to plant traits that influence the infestation of leaf rust (*Puccinia triticina)* and fusarium (*Fusarium graminearum*), such as stomata number and density, stomatal conductance or leaf area.

In 2022, we conducted a preliminary FACE-trial with 12 genotypes. We investigated traits such as the phenological development (BBCH), leaf area, leaf area index (LAI), and stomatal conductance. Furthermore, we conducted a partial harvest at mid flowering (BBCH 65) and complete harvest at maturity (BBCH 89) to determine agronomic data such as grain yield and aboveground biomass. We got the first promising results, such as a significant CO_2 fertilization effect, changes in the stomatal conductivity and changes in leaf area compared to the control group.

In 2023 and 2024, we will perform further field trials with the FACE-facility which will also feature the inoculation of plots with leaf rust and fusarium. We want to address the question if the adaption to e[CO_2] lead to changes in quality and yield of the wheat varieties and which of these adaptations may alter the infestation with leaf rust or fusarium.

[1] Phenotypic and genetic determinants for adaptation of winter wheat to increasing CO_2 concentrations using leaf rust and ear fusarium resistance as examples.