PROJECT TITLE

The Influence of Elevated [CO2] on physiology and yield of wheat cultivars accounting for 60 years of northern-European breeding.

CONSORTIUM

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SUMMARY OF THE REPORT

Atmospheric CO_2 concentration ([CO_2]) is predicted to rise significantly in the next decades leading to changes in wheat (*Triticum aestivum* L.) physiology and productivity. Evidence suggests that important physiological traits linked to wheat yield such as stomatal conductance (*gs*) and photosynthetic capacity will be influenced by elevated [CO_2]. Although it has been shown that wheat yield will benefit from the elevated [CO_2] fertilization, the influence on stomatal behaviour, transpiration and leaf temperature needs further characterization (Osborne 2016; Gray et al. 2016)

Breeding for genetic gain and assessment of physiological traits for wheat improvement have been predominantly carried out at ambient [CO_2]. Therefore, the aim of the proposed work is evaluate key physiological traits and yield components of winter bread wheat accounting for 60 years of breeding subjected to ambient and elevated [CO_2]. A significant increase in *gs* was shown due to breeding efforts in the last fifty years for Central American spring bread wheat that resulted in increased transpiration and water use. However, to date this trend has not been established in European and/or northern-European cultivars with the exception of some work carried out in a panel of Italian durum wheat. Therefore, we hypothesize that different sensitivity to the increasing [CO_2] in north European wheat is dependent on the year of release. In addition, due to the emerging potential source limitation for both grain number and grain weight determination recently highlighted, a significant diversity for leaf and spike photosynthetic stimulation, yield and yield components increase under elevated [CO_2] is hypothesized, which will also be assessed. The proposed physiological assessment will cover a range of traits including leaf photosynthesis and transpiration, leaf-to-canopy temperature, stomatal density, biomass accumulation and other remote-sensing techniques.

The work will set the basis for exploring potential novel physiological targets for inclusion in future wheat breeding programmes focusing on the yield optimization under the predicted future elevated [CO_2]. In addition, the experiment will provide a comprehensive physiological basis of bread wheat in relation to the breeding history and elevated [CO_2] conditions thus linking yield components, physiology and potential occurring interactive trade-offs.