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Phenotyping at plant and cellular level

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Phenotyping soybean and common bean for better growth and nutrition under elevated CO_2

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Today climate changes are of major concern, and increasing atmospheric CO_2 (hCO_2) level is one of the most important and worldwide events. Currently the global CO_2 concentration is about 400 ppm, but it will rise to about 550 ppm by 2050. Elevated CO_2 affects plant growth, crop yield and nutritional status of agricultural products. Although hCO_2 has been previously associated with increased yields, recent studies found a significant negative effect in protein and mineral concentrations in several crops. Parallel to hCO_2, restricted soil Fe supply will also affect legume nutrition. On one hand, Fe has low solubility and on the other hand, about 30% of the arable land in the world is calcareous. The combination of these factors results in reduced Fe availability leading to reduced yields and possible lower nutritional quality. Here, we grew 18 soybean (*Glycine max*) and 18 common bean (*Phaseolus vulgaris*) cultivars under hCO_2 or ambient CO_2 with or without Fe restriction, and we conducted three experiments. The major goal was to harvest the grain and pod material and to look at the effect of hCO2 on the nutritional composition (minerals, protein phytonutrients) of the different lines of both legume species, chasing genetic variability for the nutritional traits. We hypothesize that the nutritional variability will surely be due to several factors, amongst which changes in photosynthesis and respiration. Photosynthetic rate and morphological changes will indirectly affect sink-source relationships within the plant, and impact photo assimilate redistribution during grain fill. The first experiment (experiment 1) was a short-term study and it aimed at understanding the combined effect of iron deficiency and hCO2. In the second and third studies the aim was to select cultivars with contrasting behaviors in the presence of different atmospheric CO2 levels in growth chamber (experiment 2) or field (experiment 3) conditions. We phenotyped the cultivars of both species looking at biomass, nutrition, metabolomics and yield parameters. Preliminary data from these three experiments will be presented, including data generated in frame of a recently approved STSM. We believe that the combined information from these three studies conducted in growth chamber and field conditions will allow identifying the most CO2-responsive genotypes and provide starting lines for future breeding programs.

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