40 - Impact of elevated CO2 and restricted iron supply on soybean (Glycine max) and common bean (Phaseolus vulgaris) growth and nutrition.

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Elevated atmospheric CO2 (eCO2) is known to affect plant growth and nutrition leading to reduced mineral or protein concentrations in several crop species, and these losses will worsen in the near coming future. Soil iron (Fe) deficiency in calcareous soils, which represent about 30% of the arable land in the world, highly affects plant growth leading to reduced yields and nutritional quality. Legume crops provide a large share of the global population's diet and will be affected by eCO2 and Fe deficiency, but there are no studies linking the effect of these two stresses. Aiming at understanding the interaction of these effects in two legume species - soybean (Glycine max) and common bean (Phaseolus vulgaris) - we conducted a short-term study where plants grew under ambient CO2 (400 ppm) and eCO2 (800 ppm) in hydroponics using nutrient solution with (20 uM) and without Fe. At the end of the experiment chlorophyll levels, photosynthetic rates, ferric chelate reductase (FCR) activity, dry weight of roots, shoots and leaves, mineral composition and organic acids concentrations of roots and leaves were measured. Plants of both species grown under Fe deficiency showed symptoms of Fe deficiency chlorosis, with 40-65% lower chlorophyll levels. Also, in both species, FCR activity was generally higher in plants grown under eCO2 but for soybean the difference was significant in the presence of Fe (four-fold higher) whereas for bean it was significant in the absence of Fe (ten-fold higher). Leaf and root biomass were also affected by these stresses with eCO2 combined with Fe deficiency resulting in significantly lower leaf and root biomass in the plants of both species. Nutrient composition and organic acid analysis allowed us to further understand the underlying impact of these combined stresses. Our results clearly show an interaction of both factors leading to different plant behaviors which may be plant species dependent.