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Influence of pCO_2 on carbon allocation in nodulated Medicago sativa L.

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Atmospheric CO_2 concentrations (pCO_2) have been related to changes in plant carbon (C) availability and photosynthetic capacity, yet there is no clear consensus as to the effect of pCO_2 on the plant C balance and on nitrogen fixation in symbiotic systems. We investigated how different pCO_2 (Pleistocene: 170 ppm, ambient: 400 ppm and projected future: 700 ppm) influence C allocation in nodulated Medicago sativa L.
We labeled 17 week old plants with depleted ^{13}C (-34.7$\pm$1.2‰ and traced the label over a 9-day period, to assess the redistribution of newly assimilated C across different sinks, including nodules. We analyzed N concentrations in plant tissues and found no significant differences in leaves and roots across treatments. However, growth and C fixation rates increased with pCO_2, and differences were greatest between 170 ppm and 700 ppm. Across pCO_2 treatments we observed a ^{13}C-enrichment in roots compared to leaves. We further observed the highest ^{13}C depletion of non-structural carbohydrates (NSCs) and respired CO_2 in tissues of plants grown at 700 ppm, especially in leaves and nodules.
Our preliminary results suggest that sink organs like roots and nodules are fed with newly-assimilated NSCs from leaves to support respiration, and especially in 170 ppm plants represented a major respiratory loss of newly assimilated C ($\approx$ 35% of the total plant respiration). Our results suggest that although plant metabolic processes like photosynthesis and respiration are affected by changes in pCO_2, nitrogen acquisition in such a symbiotic system is not.