THE EFFECT OF PHOSPHORUS SUPPLY ON WHITE CLOVER (*TRIFOLIUM REPENS* L.) RESPONSE TO ELEVATED P_{CO2}.
I. SYMBIOTIC NITROGEN FIXATION

EFEITO DA DISPONIBILIDADE EM FÓSFORO NA REACÇÃO DO TREVO BRANCO (*TRIFOLIUM REPENS* L.) AO AUMENTO DA P_{CO2} .
I. FIXAÇÃO SIMBIÓTICA DO AZOTO

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Phosphorus is a basic nutrient for plant growth and it becomes determinant of yield and persistence of pasture legumes under conditions of poor and acid soils, a common situation observed in Portugal. P deficiency leads to low nodule mass per plant and lower quantities of symbiotic fixed nitrogen. The nitrogen demand from the plant has an effect over *Rhizobium* activity. However in low P, *Rhizobium* activity might be impaired. This situation leads possible to a limitation of white clover growth by phosphorus and nitrogen deficiency.

Human activities like industrialisation, burning of fossil energy, intensification of agriculture, deforestation and land use, lead to an increase in atmospheric CO_2 partial pressure (p_{CO2}). The actual values of aprox. 35 Pa are expected to double within the next century. The basic effects of enhanced p_{CO2} on plant growth are an increase in biomass due to higher rates of photosynthesis, decreased stomatal conductance and increased water use efficiency. This advantage for plant growth is only possible when plants are able to increase sink growth that is dependent on nutrient availability. Therefore we assumed that P deficiency affects the response of white clover to elevated p_{CO2} due to a negative effect in the *Rhizobium*-legume symbiosis causing a nitrogen limitation of plant growth.

In a growth-chamber experiment white clover cuttings were established in sand; then during 4 weeks, exposed to four levels of P supply and two p_{CO2} (35 Pa and 70 Pa). The increase of whole plant biomass at elevated p_{CO2} depended on P supply (p_{CO2} x P interaction $p<0.0238$). Nodule mass and N derived from symbiosis responded positively to the increase of P uptake. The ratio N in root/N in shoot decreased with the increase of P supply. The ratio N/P, in the whole plant material decreased from 30 at 0.0027 mM P to 17 at 0.075 mM P. These results suggest that at the lowest P levels white clover plants were co-limited by P and N. Therefore, these plants were not able to profit from the increased carbon availability. Under high levels of P supply with no apparent nutrient limitation, white clover showed a positive response of biomass to elevated p_{CO2}. We assume that in a future scenario of higher atmospheric p_{CO2}, the high levels of symbiotic nitrogen fixation allow white clover to increase yield if P is not limiting.