THE EFFECT OF PHOSPHORUS SUPPLY ON WHITE CLOVER (*TRIFOLIUM REPENS* L.) RESPONSE TO ELEVATED P_{CO2}. II. TRANSPIRATION RATE, P PARTITIONING AND ROOT PHOSPHATASE ACTIVITY

EFEITO DA DISPONIBILIDADE EM FÓSFORO NA REACÇÃO DO TREVO BRANCO (*TRIFOLIUM REPENS* L.) AO AUMENTO DA P_{CO2} . II. TAXA DE TRANSPIRAÇÃO, REPARTIÇÃO DO P E ACTIVIDADE DA FOSFATASE RADICULAR

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Phosphorus is a basic nutrient for plant growth. P uptake by white clover is the result of a passive and an active process: the first a mass flow effect and the second called as a "proton motor force" mechanism. The passive process, is dependent from the external nutrient concentration, permeability of root tissues and plant transpiration rate. Plants possess mechanisms that act in a well-co-ordinated way towards withstanding the disadvantageous of P deficient situations. As an overall consequence of them, photoassimilates and nutrients are priority allocated to the roots assuring its growth and survival. Also other additional reactions might be developed under P deficiency, at the plant-soil interface level: release of root exudates, i.e. organic acids, phosphatases and phytosiderophores, that are involved in the solubilization of ester-P macromolecules from soil, and therefore increasing P-availability.

The predicted increase in atmospheric CO_2 partial pressure (p_{CO2}) is expected to influence plant growth (see part I) through increased

rates of photosynthesis, decreased stomatal conductance and increased water use efficiency. These advantages for plant growth might result in a yield increase if nutrient uptake allows the increase of sink growth. Contrasting with this condition, the decrease in transpiration and water flow might cause then a lower mass flow and as a consequence lower P availability at the root surface. Therefore we assumed that under elevated p_{CO2} the uptake of P might be impaired and thus the response of white clover might be dependent on higher external P concentration that compensate the reduction of mass flow.

In a growth-chamber experiment we established white clover cuttings 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 $p<0.0238$). Stomatal conductance and transpiration rate reduced significantly under elevated p_{CO2}. Pi concentration in the roots increased and induced a partially inhibition of root acid phosphatase activity. Older leaves, under elevated p_{CO2}, showed a decreased concentration of Pi corresponding to an apparent increase in nutrient recycling, for matching this way the demand for sink growth. At very high P supply, plants could offset this negative effect because the high external P concentration might compensate for the lower flow rate.

We assume that under field conditions, where the role of acid phosphatases for P acquisition is more important than in our experimental system, the impair of P uptake under elevated p_{CO2} might be stronger, and therefore the CO_2 response smaller than expected.