THE EFFECT OF PHOSPHORUS NUTRITION ON THE RESPONSE OF WHITE CLOVER (*Trifolium repens* L.) TO ELEVATED pCO_2.

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The first results from the Swiss FACE experiment showed a sink-limitation in the response of *Lolium perenne* to elevated pCO_2 related to an apparent low availability of mineral nitrogen (1). In contrast, the nitrogen fixing *Trifolium repens* plants showed no N-limitation and a positive response to elevated pCO_2 (2). Therefore we speculate that nutrient availability could be an important factor in the response of plants to elevated pCO_2 through an influence on the source-sink relations. Considering the role of phosphorus (P) in basic mechanisms of plant growth (e.g. photosynthesis and leaf cell expansion) we asked whether and how P nutrition would limit white clover response to elevated pCO_2. We suggest that a limitation in the response would operate by (*i*) inadequate symbiotic N_2 fixation and (*ii*) reduced sink for assimilates.

In a growth-chamber experiment white clover cuttings were established in sand; then during 4 weeks, exposed to four levels of P nutrition and two pCO_2 (35Pa and 70Pa). The whole plant growth increased with elevated pCO_2 was strongly dependent on P nutrition (pCO_2 x P interaction $p<0.0238$). Nitrogen (N) concentration in plant tissues was higher in the lowest level of phosphorus nutrition despite the lower percentage of N derived from symbiosis. Phosphorus concentration in plant tissues increased with increasing P nutrition level.

The results suggest that P deficient white clover plants did not respond to elevated pCO_2 due to a direct and exclusive effect of this nutrient, without co-limitation by N. At the medium P the decrease in the specific leaf area (SLA) under elevated pCO_2 and the lack of a significant increase in plant biomass, suggests an imbalance between net photosynthesis and utilisation of carbon assimilates (sink-limitation). Under ambient pCO_2 and high P nutrition, SLA decreased significantly (to similar values as elevated pCO_2 plants) due to a similar effect. At high level of P under elevated pCO_2 plants had the highest increase in biomass, showing apparently no limitation for growth.

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2. Hebeisen, T., Lüscher A., Zanetti, S., Fischer, B.U., Hartwig, U.A., Frehner, M., Hendrey, G.R., Blum, H. & Nösberger, J. (1997). Growth response of *Trifolium repens* L. and *Lolium perenne* L. as monocultures and bi-species mixture to free air CO_2 enrichtment and management. Global Change Biology **2**, 149-160.