EFFECT OF PHOSPHORUS NUTRITION ON GROWTH AND PHYSIOLOGY OF COTTON GROWN UNDER AMBIENT AND ELEVATED ATMOSPHERIC CARBON DIOXIDE CONCENTRATIONS

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Abstract

Cotton (cultivar deltapine 555) plants were grown in six growth chambers with three levels of phosphate (Pi) supply (0.2 (optimum), 0.05 and 0.01 mM) under ambient (400 µmol mol^{-1}) and elevated (800 µmol mol^{-1}) CO_2 concentration for 95 days. Several growth and physiological measurements were made during and at the end of experiment. Irrespective of the growth CO_2, Pi deficient plants exhibited highly reduced leaf photosynthesis (P_{net}) and were significantly shorter with decreased node numbers, reduced leaf area and total biomass (75-80%) as compared to the plants grown under optimum Pi supply. The decreases in rate of stem elongation, leaf area expansion were the main cause of smaller size of the plants in Pi deficiency. The stimulatory effect of elevated CO_2 on P_{net} was negligible under 0.01 mM Pi nutrition. In general, CO_2 enrichment failed to alleviate the negative effect of Pi deficiency on photosynthesis and reproductive structure (flower, square and boll).However, small stimulatory effects of elevated CO_2 on plant height and total biomass were observed at all Pi nutrition. Irrespective of the Pi supply, photosynthetic acclimations of cotton plants to CO_2 enriched environments were evident from the reduced carboxylation efficiency of the photosynthetic processes. The results from this study indicated that the amount of available soil Pi will affect cotton growth and development independent of atmospheric CO_2concentration. Particularly, processes such as photosynthesis and reproductive structures will be negatively affected by Pi deficiency even under high CO_2 environments of the future.