

Changes in growth and photosynthetic patterns of oil palm (*Elaeis guineensis* Jacq.) seedlings exposed to short-term CO₂ enrichment in a closed top chamber

ABSTRACT

Three varieties of oil palm seedlings (Deli Yangambi, Deli Urt, Deli AVROS) were exposed to three levels of CO₂ (400, 800, 1,200 $\mu\text{mol/mol}$) in split plot design to determine growth (net assimilation rate, NAR; relative growth rate, RGR) and photosynthetic patterns of the seedlings under short-term CO₂ exposure of 15 weeks. Increasing CO₂ from 400 to 800 and 1,200 $\mu\text{mol/mol}$ significantly enhanced total biomass and leaf area, net photosynthesis (A) and water use efficiency (WUE) especially from weeks 9 to 15. By the end of week 15, total biomass increased by 113%, and A and WUE by one- and fivefold, respectively, while specific leaf area decreased by 37%. Both enhanced biomass and A under elevated CO₂ were effective in modifying NAR and RGR as shown by high correlation coefficient values ($r^2 = 0.68$ and 0.72 ; $r^2 = 0.63$ and 0.67 , respectively), although WUE seemed to have more influence over the NAR ($r^2 = 0.97$) and RGR ($r^2 = 0.93$). Neither interspecific preference nor its interaction with CO₂ imposed any significant effect on parameters observed. Growth improvement with CO₂ seemed able to produce healthy, bigger and vigorous oil palm seedlings, and the technique may have potential to be developed for use to reduce nursery period.

Keyword: Oil palm seedling; Growth; Development; Net assimilation rate; Relative growth rate; Net photosynthesis; Water use efficiency