

Title Gas exchange in litchi under controlled and field conditions
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Abstract

Gas exchange of 3-year-old potted '73-S-20' litchi (*Litchi chinensis* Sonn.) plants were measured under controlled conditions. At 28.8 ± 0.3 °C, dark respiration (R_d) was estimated at $0.6 \text{ CO}_2 \mu\text{mol m}^{-2} \text{ s}^{-1}$, quantum yield (Φ) was $0.024 \text{ mol CO}_2 \text{ mol}^{-1}$, and light compensation point ($\text{PPFD}_{\text{comp}}$) was $24 \mu\text{mol m}^{-2} \text{ s}^{-1}$ photosynthetic photo flux density (PPFD). Maximum net CO₂ assimilation (A_{CO_2}) ($6.5\text{--}8 \mu\text{mol m}^{-2} \text{ s}^{-1}$), stomatal conductance (g_s) ($0.07\text{--}0.09 \text{ mol m}^{-2} \text{ s}^{-1}$) and transpiration (E) ($0.7 \text{ mmol m}^{-2} \text{ s}^{-1}$) were recorded at $\text{PPFD} > 800 \mu\text{mol m}^{-2} \text{ s}^{-1}$, leaf temperature (T_L) between 27 and 32 °C, and vapor pressure deficit (VPD) < 0.7 kPa. When VPD and T_L simultaneously increased maximum A_{CO_2} was obtained between 25 and 28 °C. CO₂ compensation point (C_{comp}) was recorded between 90 and 100 ppm. A_{CO_2} saturated at external CO₂ concentration > 800 ppm. A_{CO_2} responses to light, and VPD were mainly regulated by stomata. On the other hand, A_{CO_2} response to internal CO₂ was mainly through leaf photochemistry. At $T_L < 28$ °C leaf photochemistry dominated A_{CO_2} responses, while at $T_L > 28$ °C stomatal regulated A_{CO_2} responses. Effects of leaf age and location as well as cropping on gas exchange were also studied on 9-year-old in the field trees. Leaf A_{CO_2} , g_s and E on the well-exposed, younger flushes and adjacent to fruit were greater than those on shaded older flushes and woods or those on de-fruiting shoots. Our findings indicated that potential depression of leaf photosynthetic efficiency in litchi might occur due to low temperature in bloom season and early fruit set, as well as due to hot and dry mid-day in early summer.