

Boonthida Kositsup 2009: Photosynthesis of Rubber (*Hevea brasiliensis* Muell. Arg.) - Effect of Temperature, Leaf Age and Season. Doctor of Philosophy (Tropical Agriculture), Major Field: Tropical Agriculture, Interdisciplinary Graduate Program. Thesis Advisor: Associate Professor Poonpipope Kasemsap, Ph.D. 78 pages.

The aim of this study was to assess effect of temperature, leaf age, and season on single leaf photosynthesis rates in rubber trees (*Hevea brasiliensis* Muell.Arg.). Net CO₂ assimilation rate (A) was measured in rubber saplings grown in a nursery and in growth chambers at 18 °C and 28 °C. The temperature response of A was measured from 9 to 45 °C and the data were fitted by an empirical model. The photosynthetic capacity (maximum carboxylation rate, V_{cmax} , and maximum electron transport rate, J_{max}) of plants acclimated to 18 °C and 28 °C were estimated by fitting a biochemical photosynthesis model to the CO₂ response curves (A/C_i curves) at 15, 22, 28, 32, 36 and 40 °C. The optimum temperature (T_{opt}) for A was lower in plants grown at lower temperature (18 °C) than plants grown at higher temperature (28 °C) in growth chambers. Net CO₂ assimilation at optimum temperature (A_{opt}), V_{cmax} and J_{max} at a reference temperature of 25 °C ($V_{\text{cmax}25}$ and $J_{\text{max}25}$) as well as activation energy of V_{cmax} and J_{max} (E_{aV} and E_{aJ}) decreased at 18 °C growth temperature as compared to 28 °C growth temperature. The optimum temperature for V_{cmax} and J_{max} was not defined for certain value, but they were above 36 °C and not far from 40 °C. The average ratio of $J_{\text{max}25}/V_{\text{cmax}25}$ was higher in plants grown at lower temperature (18 °C). Variations in A , V_{cmax} and J_{max} were partly explained by leaf nitrogen content. These results indicate that rubber leaves are able to change their photosynthetic characteristics in response to growth temperature.

Finally, leaf age and seasonal effects on photosynthesis were studied in 2-year-old rubber trees grown in rubber plantation. Maximum net CO₂ assimilation (A_{max}), $V_{\text{cmax}25}$, $J_{\text{max}25}$, and nitrogen use efficiency (A_{max}/N_a) decreased significantly with increasing leaf age. Lower temperature and drier season also decreased photosynthesis of 2-year-old rubber trees in the field. These results indicate that not only temperature, but also age and season-related effect must to be taken into account in photosynthetic study in rubber trees.

Student's signature

Thesis Advisor's signature

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