73. Extension of oil palm in altitude under global change in North Sumatra: ecophysiological responses and yield

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Global change effect in North Sumatra has provoked an increase of minimum temperatures (climatic recordings – 1971 until nowadays – station of Bah Butong, 850m; 1971-1990: T°Cmin from 16°C to 18°C; 1990-2008: until 19°C) in some highlands devoted traditionally to tea plantation. This increase has potentiality to benefit to oil palm which has replaced tea since 2006. Today, total area of oil palm in Sumatran Highlands is reaching 4700 ha from 500 to 1000 m. Because oil palm planters have placed a bet on new extension, conditions are still far to reach maximum productivity. There is a need for fine physiological studies to quantify main constraint factor for yield metabolism. Early in 90', some oil palm trials were planted from 250 to 850 m: our main goal was to evaluate this elevation effect on leaf gas exchanges, phenology and yield. Climatic data series have been recorded (1971-2013); photosynthesis and transpiration were measured on 12-year old trees (origin DeliXYangambi), with a portable photosynthesis system (LI-COR 6400[1]) at 3 different altitudes (1)550-580m-(2)650-680m-(3)815-820m completed by individual vegetative and yield observations. Altitude effect was observed on trunk height (34 cm more until 700 m), on petiole thickness (3 times more from 250 to 1000 m). 40 % loss for maximal photosynthesis was observed by elevation of 400 m and 50 % for WUE between 600 and 800 m. Concerning FFB (yield) 25 % loss was observed for 4- to 7-year old trees at 800 m, 40 % for 7- to 10-year old and until 60% (with 10 t FFB) for older trees. Late bunch abortions seem responsible for yield loss. In order to improve sustainable yield in Sumatra highlands, new adapted material, tolerant to low temperature, presenting faster metabolism has to be produced. Innovated and adapted cropping practices (ecofriendly: adapted fertilizer input, new density planting, special pruning, biological control for Marasmius, pollination improvement with elaeidobius) must be applied during new land extensions.

[1] The LI-COR 6400 (LI-6400) utilizes gas exchange principles to measure the photosynthesis rates of plants.