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"Development on the margin"

Photosynthesis of three Dessert Banana Cultivars along an Altitudinal Gradient

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Abstract

Bananas are grown by small holder farmers in agro-forestry systems in a wide range of climatic conditions throughout mid and high altitude zones of Latin America and the Caribbean. However, few studies have measured the photosynthesis of different banana cultivars in these conditions, an effect primarily of temperature on banana photosynthesis (An). In this study the leaf photosynthesis of three cultivars was measured at intermediate (1000 m asl) and high altitude (m asl). Gros Michel (AAA) is the preferred cultivar for national dessert banana markets, but is susceptible to Fusarium wilt. The two hybrids FHIA 17 and FHIA 23 (AAAA) are dessert bananas reported to be resistant to Fusarium wilt and are potential substitutes in Fusarium infested fields. Gas exchange measurements of light and CO_2 response curves on the third leaf of plants were conducted to estimate the parameters of a biochemical model of An (Farquhar *et al.*, 1980) - maximum carboxylation rate (Vcmax), potential light-saturated electron transport rate (Jmax) and day respiration (Rd). The results showed higher rates of An at mid altitude. The estimated parameters Vcmax, Jmax and Rd were dependent on leaf temperature. For the cultivar Gros Michel, Vcmax varied from 145 μmol m^{-2} s^{-1} at 1000 m asl (29°C) to 52 μmol m^{-2} s^{-1} at 1400 masl (23.5°C), while Jmax varied from 153 μmol m^{-2} s^{-1} at intermediate altitude to 79 μmol m^{-2} s^{-1} at high altitude. Values of Vcmax, Jmax and Rd standardised at 25°C also differed between locations suggesting an additional effect of site factors such as soil fertility and water availability. FHIA 17 and FHIA 23 had higher rates of An than Gros Michel. Vcmax and Jmax standardised at 25°C were highly correlated with leaf specific area. The FHIA cultivars with a thicker leaf blade presented higher photosynthesis capacity. Understanding changes in photosynthetic parameters for banana are crucial for modelling long-term photosynthesis and productivity in these agroforestry systems, an important tool for improving their productive and economic viability.

Keywords: Altitude, banana, biochemical model, light, photosynthesis

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