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"Resilience of agricultural systems against crises"

Effects of Induced Drought and Different Shade Levels on Leaf Gas Exchange of *Musa* spp.

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Abstract

Several climate scenarios predict that extreme weather events like droughts are likely to become more frequent and severe. Moreover, average precipitation may decrease or at least rainfall patterns could change and become less predictable. To face the impact of such weather events it may be necessary for the rural population to adapt land use practices concerning production techniques and adequate varieties. Agroforests tend to offer better resilience to reduced precipitation compared to monocultures and annual crops. Hence, agroforestry may play a decisive role in reducing the vulnerability of the rural poor to extreme weather events. In general agroforestry systems present a more balanced humidity regime. Additionally, advantages result from the existence of different shade levels and the reduction of soil and air temperature peaks. Thus the evaluation of water budgets and changes in plant water use under prolonged drought conditions is essential to predict responses of ecosystems to climate change. In a banana (*Musa* spp.) agroforest with coffee (*Coffea arabica*) plants associated with *Erythrina* spp. shade trees, we studied the effect of soil moisture depletion and different shade levels on leaf gas exchange and chlorophyll fluorescence of two *Musa* varieties: 'Gros Michel' (*Musa* AAA) and 'Bluggoe' (*Musa* AAB). The study was conducted at two experimental sites: one at CATIE, Turrialba, Costa Rica consisting of an agroforest with different shade levels and the other one near Matagalpa, Nicaragua where the induced drought conditions were established. In order to achieve a reduced soil moisture content in a fraction of the experimental field in Nicaragua, roofs were constructed over individual plants. In addition to the measurements of soil moisture content, leaf gas exchange and chlorophyll fluorescence, we collected meteorological data such as diurnal precipitation, temperature and relative humidity. The preliminary results show clear trends regarding the responses of the two varieties. 'Bluggoe' shows a higher drought tolerance than 'Gros Michel'. Both varieties performed best at a shade level of 50 %, although 'Gros Michel' is better adapted to high irradiance. An in depth analysis is currently being conducted.

Keywords: Agroforestry, Central America, chlorophyll fluorescence, drought, leaf gas exchange, *Musa* spp., shading

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