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“Development on the margin”

Water Use Characteristics of Cocoa and two Shade Tree Species in Different Production Systems

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Abstract

Cocoa production in the humid tropics is practised by smallholders in different production systems ranging from full sun to shaded agroforestry systems under conventional and organic management. While the water use characteristics of cocoa trees (*Theobroma cocoa*) under dry conditions are well studied, little is known about the difference in the water use characteristics of cocoa in full sun versus shaded production systems and of shade trees in conventionally and organically managed agroforestry systems. Furthermore, there is a lack of knowledge regarding the impact of the management practices on the water availability for the cocoa trees in the dry season.

The objective of this study is to assess the influence of different production systems – organic and conventional, full sun and shaded – on the water use and availability of the cocoa trees, and to analyse and compare the water use characteristics of two shading tree species, Achiote (*Bixa orellana*) and Huasicucho (*Centrolobium ochroxylum*).

The measurements were conducted in experimental cocoa plantations in Alto Beni, Bolivia, during the transition period and in the dry season at a local cocoa variety and the two tree species Achiote and Huasicucho, widely used in cocoa agroforestry systems for soil fertility improvement, and additional products. The five studied treatments were: mono culture full sun conventional, mono culture full sun organic, agroforestry conventional, agroforestry organic, and successional agroforestry organic. The transpiration rate and the leaf water potential were measured with a steady state porometer and a scholander pressure chamber, respectively, and the obtained data evaluated by relating them to the potential evaporation of the research area, the humidity, evapotranspiration, and soil water content at the plots as well as the leaf temperature.

The results of this study will allow a comparison of the water use characteristics of cocoa in different production systems. Furthermore, this study will lead to management recommendations regarding the selection of the appropriate shade tree species and the improvement of water availability for cocoa trees in the dry season.

Keywords: Achiote, agroforestry, *Bixa orellana*, *Centrolobium ochroxylum*, cocoa, Huasicucho, organic, shade trees, *Theobroma cocoa*, water use characteristics