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Comparison of Canopy Openness in Different Cocoa (*Theobroma cacao*) Production Systems in Alto Beni, Bolivia

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Abstract

Cocoa (*Theobroma cacao* L.) grows naturally as an understory tree in tropical forests and produces well under shaded and non-shaded conditions. It is cultivated by small scale farmers in South America under various conditions, ranging from monocultures to different kinds of agroforestry systems. While in monocultures it is exposed to direct sunlight, one or various tree species shade the cocoa in agroforestry systems. Also organic cocoa cultivation is becoming more and more popular due to premium prices and increasing ecological consciousness. In Alto Beni, Bolivia, the Research Institute of Organic Agriculture (FiBL) and local partners have established a long-term field trial to compare cocoa production systems. The bi-factorial randomised block design includes management and biodiversity factors combined to the following five cocoa treatments: monoculture and agroforestry systems both under organic and conventional management, and successional agroforestry system (high plant species diversity) under organic management and for further comparison fallow plots of same age as the cocoa plots. Research is done in all fields of agronomic, economic and environmental interest.

This study focuses on the comparison of the canopy openness of the different cocoa production systems and fallow plots. Knowledge about the canopy openness enables the estimation of light entering the production system, especially on the cocoa layer (photosynthesis relevant) and also on the soil as canopy openness influences the microclimate in the plantation. Another aspect of the canopy is the impact on the throughfall within the plot. Over the time, variations in the canopy structure indicate the production of biomass, of nutrient enrichment by throughfall (rain-wash and nutrient leaf leaching in the canopy) and may indicate pruning necessities when the plant cover above the cocoa exceeds critical values.

To estimate the canopy openness, in the years 2012 and 2013 hemispherical photography was taken with fisheye lenses in the different cocoa production systems and in the fallow plots. The photos were analysed with the programme Gap Light Analyser. First results of canopy openness between the cocoa systems will be shown and discussed for leave area index and potential microclimate differences.

Keywords: Agroforestry, canopy openness, cocoa, system comparison

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