

Infiltration and soil water repellency in Theobroma cacao plantations: Stand and Seasonal effects

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July 1, 2022

Abstract

Our understanding of the hydrological processes in cocoa agroforests is extremely limited. Most work has focused on characterising throughfall and transpiration processes under various management approaches and climate change scenarios. However, little is currently understood about the soil hydrological processes which serve as a link to throughfall and transpiration. We monitored the soil properties, soil water repellency and hydraulic conductivity in a 5, 12 and >30 year old cocoa plantation in the wet and dry seasons. During the wet season repellent conditions were absent in all stands while the hydraulic conductivity showed no significant differences among them. This suggests that stand age has little effect on water movement during the wet period. During the dry season, the soil at the 5 and 12 year old stands became extremely repellent and was twice as severe as that of the >30 year old plantation. It was expected that the extreme repellency in the younger stands would reduce infiltration rates; however, higher rates were recorded in the 5 and 12 year old stands. This was likely due to the combination of a repellent soil matrix and the presence of large, deep soil cracks which enhanced preferential flow. As the repellency was not significantly correlated with soil properties, we hypothesised that the high grass/sedge cover and temperatures in the 5 and 12 year old stands enhanced it. While further research is needed to investigate the role that grass and sedges play in developing repellent conditions, managing their cover may prove beneficial for the growth and survival of young cocoa trees.

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