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## Effect of Shade Trees in Cocoa Agroforestry Systems on Water and Light Availability During Dry Seasons

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### Abstract

The objective of this paper was to assess the influence of single standing shade trees in cocoa agroforestry systems on soil moisture and light availability for cocoa in the dry seasons and how these environmental factors affect potential pod yields of cocoa. The research was conducted in a moist semi-deciduous forest zone of Ghana. Seven different shade trees that were commonly found in cocoa systems were selected. An effect ratio was used to compare tree sub-canopy effects to the open area effects. Data were analysed as one-way analysis of variance (ANOVA) using the R Statistical Package. For each variable, normal distribution was tested using the Shapiro-Wilk normality test for homogeneity of variances. Significant ANOVAs were subsequently assessed using Tukey's Honestly Significant Difference (HSD) test and probability was set at 0.05 for the statistical tests. *Morinda lucida* (0.19), *Spathodea campanulata* (0.16) and *Ficus capensis* (0.13) showed favourable soil moisture conditions, however *Citrus sinensis* (-0.28) revealed a lower soil moisture content in the sub-canopy. *Entandrophragma angolense* and *Terminalia superba* had the highest transmitted percentage light of 69.2 % and 67.1 %, respectively and the lowest being *Mangifera indica* (3 %). The potential pod yields of cocoa were higher under *Morinda lucida* (0.40), *Terminalia superba* (0.40) and *Entandrophragma angolense* (0.34) but lowest under *Mangifera indica* (-0.55). *Morinda lucida*, *Spathodea campanulata*, *Entandrophragma angolense* and *Terminalia superba* in cocoa agroforestry systems potentially ensure higher soil moisture content and light availability in the sub-canopy, especially during the dry seasons, which could translate into higher cocoa pod yields. Because *Mangifera indica* and *Citrus sinensis* are fruit trees and farmers may want to include such trees in cocoa systems, further research should be directed at determining appropriate planting distances between the cocoa and the fruit trees to ensure favourable microclimatic interactions leading to improved yields of cocoa.

**Keywords:** Cocoa agroforestry, cocoa yields, dry seasons, light, shade trees, soil moisture