How do shade and auto-shade play a role in pest and disease regulation in cocoa agroforestry systems?

O. Agroforestry - an Essential Pillar of Agroecology

Poster number: O6

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In agroforestry systems, tree shade cover alters understory microclimate which affects yield, and pest and diseases (P&Ds) development. Important P&Ds of cocoa attack the pods that grow on the trunk and on the lower tree branches underneath the canopy. The development of these P&Ds is thus affected by the microclimate within the cocoa tree resulting from both shade canopy and cocoa self-shading. In this study, we focus on filling the knowledge gap related to how shade canopy and self-shading modify microclimate and contribute to regulate P&Ds. We hypothesize that cocoa trees which receive and/or generate lower shade, will benefit from higher temperatures and lower humidity which is unfavorable for P&Ds development and will be less affected. We also hypothesize that there is a threshold below which the provided shade quantity creates conditions of temperature and humidity that favors the yield while keeping the P&Ds at bay. An exhaustive characterization of 320 cocoa trees distributed over eight cocoa agroforestry systems were conducted over two years in the San Martin Region in Peru. Data on the incidence of three major P&Ds (Moniliosis, American cocoa pod borer, and Black pod), on the pods production, on the morphological characteristics of the trees (total height, canopy height, number and diameter of the trunks) and on the microclimate (temperature and relative humidity) are currently being collected. Shade canopy and cocoa self-shading were characterized using hemispherical photographs, above and below the cocoa tree canopy. Contribution of explicative variables to global incidence of pests and disease will be analyzed using GLMM. Understanding the effect of shade over P&Ds incidence is of key importance in this region as many P&Ds ravage the farmer's crops and threaten their livelihood. Indeed, an appropriate canopy shade and self-shading regulation constitute a relevant cropping practice to reduce negative impact of P&Ds.

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