Session Overview

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A3. Transitioning to Healthy Soils

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Belowground controls in coffee agroforestry systems: soil amendment regimes shape root functional trait expression and fungal communities

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Plant resource acquisition strategies reflect a plant's ability to forage and exploit available resources. Belowground, these strategies are coordinated between plant roots and their actively cultivated microbial communities, which is reflected in root functional trait expression that varies along a conservation gradient (from resource acquisition to conservation), and a collaboration gradient (from outsourcing to do-it-yourself strategies). We know that the heterogeneous soil environment largely shapes the expression of root traits and their paired microbial associations, but we have not yet fully explored how the manipulation of the soil environment via specific management practices, including soil amendment regimes, control this plant functioning belowground in biodiverse agroforestry systems. The main objective of this study is to determine how soil amendments shape belowground resource acquisition and microbial collaboration strategies in coffee agroforestry systems. We measured key coffee root functional traits and characterized root endophytic fungal populations under contrasting but widespread soil amendment regimes (inorganic, organic, and organic with additional local soil microbial inoculant). We found that amendment regimes dictate variability in belowground resource strategies. More specifically, coffee plants under inorganic management expressed greater conserving root traits, contrasting plants under organic management with additional local soil microbial inoculant that expressed greater acquisitive roots traits and enhanced collaboration with symbiotic fungi. Interestingly, the local soil microbial inoculant applied to the soil contained relatively minimal symbiotic fungi, but rather mostly moulds and yeasts. Our results highlight that soil amendments differentially control root trait expression and microbial collaborations, providing further insight into the role of sustainable agroforestry management decisions in shaping plant resource acquisition strategies and foraging capacities.