Does Domestication Change the Way Breadfruit Species Store Atmospheric Carbon in the Soil?

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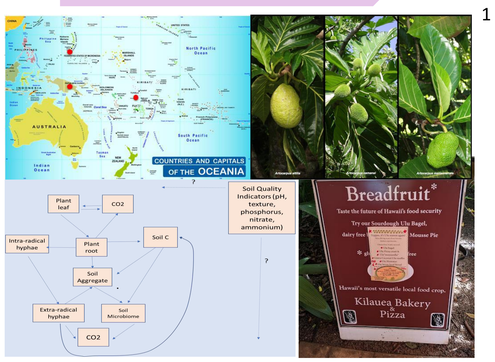
Hypothesis

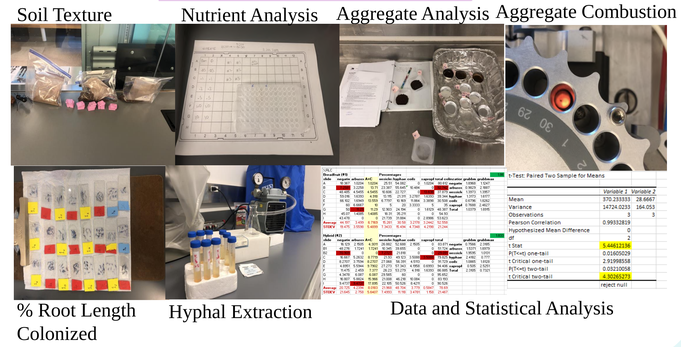
Breadfruit species store soil carbon below ground in a carbon sink; Breadfruit species differ in their ability to store carbon below ground.

Introduction



[1]

Methods



Results

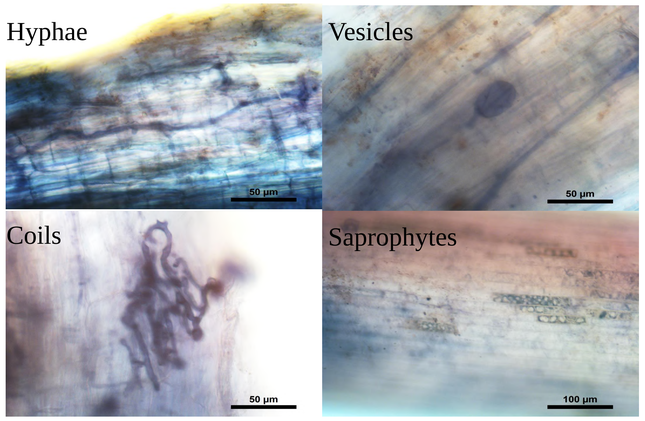


Fig. 1: Microscopic images of hyphae, vesicles, coils, and saprophytes. Taken at 200 and 400 examination.

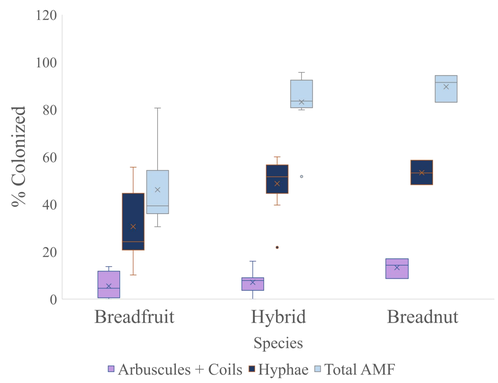


Fig. 2: Arbuscular mycorrhizal fungi percent root length colonization. Intra-radical arbuscules and coils, hyphae, and total AMF.

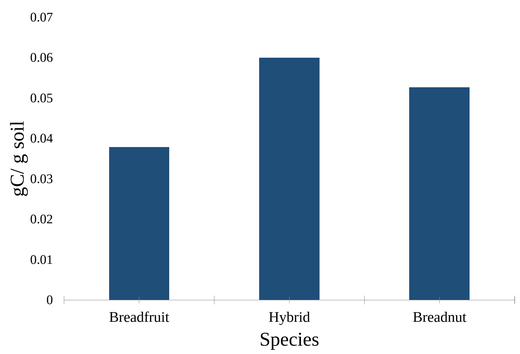


Fig. 3: Bulk soil carbon. Initial mass used to calculate the gC / g soil

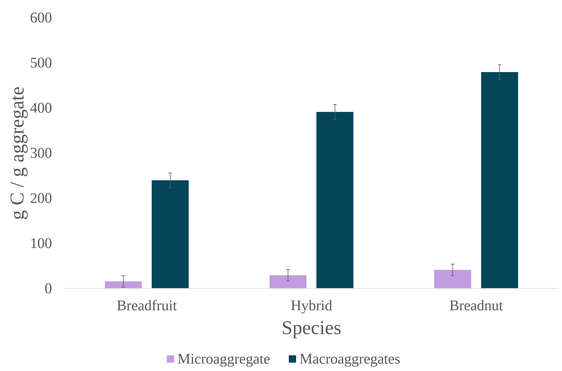


Fig. 4: Microaggregate and macroaggregate carbon. Initial mass used to calculate the gC/ g soil.

Discussion

Breadnut had the highest intra-radical AMF root colonization, as well as the highest soil C from both micro and macroaggregates. While the hybrid had the highest extra-radical hyphae count, hyphae contribute less soil C than soil aggregation, which stores C longer. Hyphae have a more rapid turnover in the soil compared to soil aggregates. Bulk soil C showed that the hybrid species had the most C in the soil, and this may be due to other factors we did not account for which have a quicker turnover in the soil compared to soil aggregation. Also, breadnut had the highest percent of root length colonized by AMF arbuscules and coils. These AMF structures are responsible for nutrient exchange between symbionts supplying trees with nutrients, and receiving C in exchange. Macroaggregates are easily broken down while microaggregates store long-term soil carbon. Future studies could utilize true replication for more robust results. This study will add valuable insight to climate change mitigation strategies by utilizing soil carbon sequestration in tropical agriculture, where fertile humid tropical sites have the greatest carbon storage potential[2,3].

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References: [1]The photo is from https://ntbg.org/breadfruit/about/species [2]Jose, Shibu. 2009. "Agroforestry for Ecosystem Services and Environmental Benefits: An Overview." Agroforestry Systems 76 (1): 1–10. https://doi.org/10.1007/s10457-009-9229-7. [3]Hijbeek, Renske, Marloes Van Loon, and Martin Van Ittersum. 2019. "Fertiliser Use and Soil Carbon Sequestration : Trade-Offs and Opportunities Fertiliser Use and Soil Carbon Sequestration : Trade-Offs and Opportunities," no. 264.