Single-tree effects on soil organic matter and aggregate stability on the terra firme near Manaus

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Soil organic matter and aggregate stability are closely related to soil fertility. On the terra firme, soils are extremely susceptible to degradation after forest clearing and intensive agriculture. The introduction of trees into farmland may have beneficial effects on soil organic matter (SOM). In this work, we are comparing the influence of different tree species in monocultures, agroforestry systems and primary and secondary forest sites on SOM properties on the terra firme near Manaus.

The soil samples from 0-5 cm depth were taken under the tree canopy in three replicates, and their carbon and nitrogen content was determined. The soils were physically fractionated using a combination of density and aggregate fractionation methods. They were sieved to pass 2mm, and put on a cascade with 1000, 500 and 250 µm sieves. First, they were dry fractionated; in a second experiment, they were put into water, slowly wetted to avoid slaking and moved gently up and down in a Yoder apparatus, dried and reweighed. From the individual aggregate sizes, the particulate organic matter (POM) was separated using a sodiumpolytungstate solution with a density of 1.6 g cm^{-3} and combined. The remaining aggregates >2µm were again fractionated using sonication and wet sieving to remove the primary particles of the respective aggregate size classes. From the aggregates, the POM was again separated using the same density solution as described above. In all aggregate separates, carbon, nitrogen, lignin and carbohydrates were determined.

Using wet sieving, most aggregates were larger than 1mm constituing of 28% of the whole soil, but with almost the same amount in the aggregate classes 500-1000µm (21%), 250-500µm (21%) and 20-250µm (22%) though considerably less in <2µm (1%) and in POM (2%). With dry sieving, the amount of aggregates in the 1000-2000µm fraction was as high as 38% compared to 28% when wet sieving. The percentage of decrease of the meanweight diameter between dry and wet sieving (%MWD) was used as an estimate of aggregate stability. The highest aggregate stability was found in soils under *Theobroma grandiflorum*, the lowest under *Bactris gasipaes*. Despite constituing only 2% of the soil mass, 7 to 26% of the soil carbon was in POM, *Pueraria* and *Bactris* with low, *Theobroma* with high values. The proportion of carbon in the aggregate fraction 1-2mm ranged from 22 to 33%. According to these preliminary results, *Theobroma* seemed to be more effective in improving SOM properties than the other investigated plant species in the agroforestry system.