

Organic Matter Management in Perennial Crops in Amazônia

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Organic input directly influences soil organic matter and subsequently crop nutrition in agro-ecosystems. In an agroforestry system with several tree crops, organic inputs are diverse and can determine soil organic matter patterns through single-tree effects. The objective of this work was to determine soil organic carbon patterns in a mixed-crop system. We hypothesize that soil carbon is influenced by three factors: the management options (fertilization or presence of a cover crop), the tree species and the distance from the trunk.

The study was done in one of the agroforestry systems of the SHIFT program, in central Amazonia near Manaus, Brazil. The system consisted of *Bixa orellana* (annatto), *Bertholletia excelsa* (Brazil nut), *Theobroma grandiflorum* (cupuaçu), *Bactris gasipaes* (peach palm) and *Pueraria phaseoloides* (pueraria) as a cover crop. Distance between rows was 4 m. For the study of single tree effects on soil C, we collected four topsoil samples (0-5 cm) under the each tree species, at 50, 100, 150 and 200 cm from the trunk, perpendicularly to planting rows, and in four random places in the middle of between rows in three plots characterized as follows: (i) 100% of the recommended dose (high fertilization treatment, HF), with a well developed cover-crop of pueraria (HFP); (ii) 100% of the recommended dose (high fertilization, HF), without pueraria cover-crop (HF); (iii) 30% of the recommended dose for each species, without nitrogen (low fertilization, LF). In the full fertilization treatment, 40, 22 and 56 kg ha⁻¹ of N, P and K were applied. Soil C was analyzed by an autoanalyzer.

Mean soil organic carbon of the plots were compared from all plot samples. Samples under the four species (at 50, 100 and 150 cm from the trunk) and from the middle of between rows, including samples at 2 m from the trunk) were compared.

Higher SOC was found in the high fertilization (HF) treatment with pueraria. There were no significant differences in SOC under the four species in the LF treatment, contrary to the other treatments. In the LF treatment, SOC was significantly higher under Brazil nut. In the HFP treatment, higher SOC was found in the middle of between rows and under peach palm. Differences in SOC at different distances from the trunk were significant only in the HFP plot under peach palm. Nevertheless, SOC under annatto was positively correlated to the distance from the trunk.

In the absence of pueraria, trees had little influence on total SOC. Trees were often shown to have a positive effect on SOC, but their influence depends on the age of the trees. The studied trees could be too young to show clear effect on total SOC. In the high fertilization treatment, with pueraria, higher SOC was found under peach palm and annatto than under the other tree species. Those patterns seem to be related to the presence of pueraria under the trees. Peach palm and annatto have canopies with small diameters and permit the growth of the cover crop at a close distance from their trunk.

In the studied agroforestry system, trees had indirect effects on SOC, mainly through the influence they have on pueraria. High levels of SOC could be maintained through the management of the cover crop in multi-strata agroforestry systems. The effect of trees on the cover crop should be taken into account for designing spatial layout of those systems, arranging species which promote cover crop growth.

Keywords

Soil organic carbon, Cover crop, Single-tree effect, Multi-strata-agroforestry, Peach palm, Brazil nut, Cupuaçu, Annatto, Pueraria