Tropentag, September 15-17, 2021, hybrid conference

"Towards shifting paradigms in agriculture
for a healthy and sustainable future"

Carbon and Nitrogen Flow within Traditional Cocoa Agroforests in the Eastern Region of Ghana

Deogratias Kofi Agbotui, Mariko Ingold, Andreas Buerkert

University of Kassel, Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics, Germany

Abstract

Cocoa (*Theobroma cacao* L.) is an important export commodity which employs millions of small-scale farmers in the humid tropics. Growing cocoa in agroforestry systems under shade helps to diversify farmers' income, offers ecosystem services, and maintains soil fertility. Although West Africa produces more than 70 % of the world's cocoa, data regarding the influence of organic and conventional management on traditional agroforestry systems on nutrient cycling and soil fertility is scarce. Hence our study aims to determine the carbon (C) and nitrogen (N) flows within traditional cocoa agroforests. It was conducted in four villages near Suhum in the Eastern Region of Ghana, whereby two were under organic and two under conventional management. Within each village three farms were selected for litterfall collection, soil sampling and soil gas flux measurements using a portable photoacoustic multi-gas analyzer (Innova 1312). In each of the 12 farms, soil was taken at depths of 0 – 10 cm and 10 – 30 cm for analysis of soil chemical and biological properties. The results showed no significant difference between organic and conventional management C and N fluxes through litterfall, which contributed 327 ± 22 kg C ha^{-1} $month^{-1}$ and 10 ± 0.7 kg N ha^{-1} $month^{-1}$ to the soil. However, soil organic C and total N were 8 % and 14 % higher in organic farms than in conventional farms. In addition, microbial biomass C (Cmic) and N (Nmic) in the topsoils of organic farms were two-fold greater than in those of conventional farms, while no management effects were observed in the subsoils. Soil organic C was positively correlated ($p < 0.01$) with N, Cmic and Nmic in all soil depths. Management had no effect on CO_2-C emissions. We conclude that soil fertility is higher in organic farms since they had higher SOC, total N and microbial biomass C and N.

Keywords: Carbon dioxide emissions, land use systems, soil fertility, soil organic matter, sustainability

Contact Address: Andreas Buerkert, University of Kassel, Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics, Steinstraße 19, 37213 Witzenhausen, Germany, e-mail: buerkert@uni-kassel.de