Geophysical Research Abstracts
Vol. 18, EGU2016-4845, 2016
EGU General Assembly 2016

Carbon dynamics with prolonged arable cropping soils in the Dano district (Southwest Burkina-Faso)

Ozias Hounkpatin, Gerhard Welp, and Wulf Amelung
Soil Science and Soil Ecology, Univ. of Bonn, Nussallee 13, D-53115 Bonn, Germany (hozias@uni-bonn.de)

The conversion of natural ecosystems into agricultural land affects the atmospheric CO_2 concentration whose increase contributes to global warming. In the low activity clay soils (LAC) of the tropics, farming is largely dependent on the level of soil organic carbon (SOC) for sustainable crop production. In this study, we investigated the changes in SOC in Plinthosols along a cultivation chronosequence in the Dano district (Southwest Burkina-Faso). The chronosequence consisted of undisturbed savannah (Y0) and 11 agricultural fields with short and long histories of cultivation ranging from 1-year-old cropland to 29-year-old cropland (Y29). About 14 soil profiles were described and soil composite samples were taken per horizon. Particulate organic matter (POM) was fractionated according to particle size: fraction 2000 - 250 μm (POM1), 250 μm – 53 μm (POM2), 53 μm – 20 μm (POM3), and < 20 μm (nonPOM). Our results revealed that the extent of change in SOC stock varied with depth and the age of the cropland. The impact of cultivation was greater in the top 10 cm with a decrease in SOC stock of 21 t C/ha after 29 years of cropping indicating that about 60% of the initial stock in the native vegetation had been released. The SOC content and stock in the different POM fractions followed the following pattern: non POM > POM1 > POM3 > POM2 carbon no matter the duration of land use. However, SOC losses occurred not only in the labile C pools but also in the stabile nonPOM fraction with increasing duration of agricultural land use. Compared to the initial carbon content in the Y0 field, about 59% of carbon content loss occurred in the POM1 (> 250 μm), 53% in the POM2 (250 - 53 μm), 52 % in the POM3 (53 - 20 μm) and 47% in the nonPOM fraction (< 20 μm) after 11 years of cultivation while 79 % occurred in the POM1 C, 75% in the POM2C, 78 % in the POM3 C and 67% in the nonPOM C after 29 years of cultivation. Though most carbon was found as nonPOM, indicating that organo-mineral associations are a key parameter for carbon stabilization, its depletion with increasing cultivation intensity suggests that the destruction of aggregates in these fields increased the vulnerability of this pool to microbial degradation.

Keywords: Soil organic carbon, Plinthosols, low activity clay soil, POM