56. Ecological intensification through conservation agriculture in Cambodia: impact on SOC, N and enzymatic activities

Tivet Florent[1,2], Hok Lyda[3,4], Boulakia Stéphane[1], de Moraes Sá João Carlos[5], Kong Rada[2], Leng Vira[2], Briedis Clever[5]

[1]*Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), UR AIDA/CSIA, Avenue Agropolis, 34398 Montpellier, France*

[2]*Ministry of Agriculture, Forestry and Fisheries, General Directorate of Agriculture, Conservation Agriculture Service Centre, Phnom Penh, Cambodia*

[3]*Department of Soil Science, Faculty of Agronomy, Royal University of Agriculture, P.O. Box 2696, Phnom Penh, Cambodia*

[4]*Department of Natural Resources and Environmental Design, North Carolina A&T State University, Greensboro, NC 27411, USA*

[5]*Department of Soil Science and Agricultural Engineering, State University of Ponta Grossa, Av. Carlos Cavalcanti 4748, Campus de Uvaranas, 84030-900, Ponta Grossa, PR, Brazil*

Cambodia has been identified to be one of the most affected countries by climate change. In the past two decades, migration from the central plains to the peripheral areas changed drastically the development of the uplands, inducing tremendous degradation of natural resources. The promotion of cropping systems based on ecological intensification is of paramount importance to strengthen the resilience of small-scale farming, to mitigate the effect of climate change and to advance in farm sustainability. The aim of this study was to quantify the short-term impact of conservation agriculture (CA, direct seeding + use of cover/relay crops), on soil organic C (SOC), soil total N (STN), labile C fractions (particulate organic C - POC and permanganate oxidizable organic C - POXC), β-glucosidase and arylsulfatase activities. Established in 2009, the experimental plots were laid out in a randomized complete block design (3 replicates) with: (i) soybean under conventional tillage (CT), (ii) soybean under conservation agriculture (CA1), and (iii) soybean in bi-annual rotation with maize under conservation agriculture (CA2). Several cover/relay crops were associated prior to and with the main crops. Soil sampling was conducted in 2011 and 2013 at 0-5, 5-10, 10-20, and 20-40 cm depths. Biomass-C inputs ranged from 2.2 to 7.8 Mg C ha^{-1} yr^{-1} under CT and CA respectively, emphasizing the difference of supply of fresh organic matter. On average, CA increased SOC and STN stocks at 0-5 cm depth by 20% and 25% when compared with CT. β-glucosidase and arylsulfatase activities at 0-5 cm depth was 28% and 36% greater in CA1 and CA2 soils. In addition, CA2 (rotational sequence and higher biomass-C inputs) showed a better increasing trend of labile C fraction (HWEOC and POXC) and β-glucosidase and arylsulfatase activities than CA1. Conservation agriculture shows potential for the long term improvement of Cambodia uplands.