

Using Biofunctool® Index to Assess Soil Quality after Eight Years of Conservation Agriculture in New Caledonia

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Abstract : A major challenge for agriculture is to enhance productivity while limiting the impact on the environment. Conservation agriculture (CA) is one strategy whereby both sustainability and productivity can be achieved by preserving and improving the soil quality. Soils provide and regulate a large number of ecosystem services (ES) such as agricultural productivity and climate change adaptation and mitigation. The aim of this study is to assess the impacts of contrasted CA crop management on soil functions for maize (*Zea mays* L.) cultivation in an eight years field experiment (2010-2018). The study included two CA practices: direct seeding in dead mulch (DM) and living mulch (LM), and conventional plough-based tillage (CT) practices on a fluvisol in New Caledonia (French Archipelago in the South Pacific). In 2018, soil quality of the cropping systems were evaluated with the Biofunctool® set of indicators, that consists in twelve integrative, in-field, and low-tech indicators assessing the biological, physical and chemical properties of soils. Main soil functions were evaluated including (i) carbon transformation, (ii) structure maintenance, and (iii) nutrient cycling in the ten first soil centimeters. The results showed significant higher score for soil structure maintenance (e.g., aggregate stability, water infiltration) and carbon transformation function (e.g., soil respiration, labile carbon) under CA in DM and LM when compared with CT. Score of carbon transformation index was higher in DM compared with LM. However, no significant effect of cropping systems was observed on nutrient cycling (i.e., nitrogen and phosphorus). In conclusion, the aggregated synthetic scores of soil multi-functions evaluated with Biofunctool® demonstrate that CA cropping systems lead to a better soil functioning. Further analysis of the results with agronomic performance of the soil-crop systems would allow to better understand the links between soil functioning and production ES of CA.

Keywords : conservation agriculture, cropping systems, ecosystem services, soil functions

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