# TilSoilC (ID 32)

## The effects of tillage practice on soil carbon sequestration mechanisms

**Coordinator**

Dr. Ndzana Georges Martial, University of Dschang, Cameroon

**Project partners**

| Country | Organization |
|---|---|
| **Italy** | University of Basilicata |
| **Switzerland** | University of Lausanne |
| **Switzerland** | Swiss Federal Institute of Technology Lausanne (EPFL) |

**Summary**

Intensive agriculture is a global cause of soil degradation including the decline of soil organic carbon (SOC), and the increase in greenhouse gas emissions. At the same time, the Food and Agriculture Organization of the United Nations (FAO) estimates that agricultural lands should produce 70 percent more food to feed a world population of 9.3 billion by 2050. Agriculture in the 21st century will thus need sustainable management practices which can minimize soil degradation, restore degraded soils, and improve food production while protecting agroecosystems.

High-intensity (conventional) tillage is commonly put forward as one of the leading causes of declines in soil organic carbon (SOC) stocks in agricultural soils. As a result, alternative tillage practices such as no-till, reduced tillage, and strip-tillage have been increasingly promoted during the last decade as a potential solution to protect or even restore agricultural SOC stocks. However, the protective and/or restorative effects of alternative tillage practices remain unclear, with a number of studies reporting contrasting results (SOC increases, zero-sum redistribution, or even decreases). It is therefore critical to clarify the biogeochemical mechanisms that drive SOC dynamics under the above-mentioned tillage practices.

Given that the biogeochemical mechanisms that drive SOC dynamics depend on soil type, the overall objective of the TilSoilC project is to determine the effect of tillage practices on SOC accumulation and persistence across a spectrum of young to highly weathered soils in Africa and Europe. The TilSoilC project will investigate a range of common agricultural soil types including tropical (oxisols), Mediterranean (terra rossa, chromic luvisols), and cool-temperate (cambisols) soils. We hypothesize that tillage negatively affects SOC stocks and persistence through the breaking up of organo-mineral associations (organic carbon is liberated and can be decomposed by microorganisms) and aeration of oxygen-depleted zones in the soil (resulting in faster and more extensive decomposition of organic carbon). We further postulate that soil mineralogy is a major control on tillage-induced SOC losses, with soils dominated by low-activity clays (illite, kaolinite) being the most prone to SOC losses and soils dominated by oxides being the least prone to SOC losses as a result of intensive tillage.

As part of the TilSoilC project, we will sample top- and sub-soils of agricultural fields which have been subjected to different long-term tillage intensities. In order to unravel the interplay between SOC dynamics, microbial activity, and soil minerals, laboratory analyses will jointly focus on soil physico-chemical properties, mineralogy, microbiology, and organic matter properties.

The “TilSoilC” is a consortium of four partners (the University of Dschang-Cameroon, University of Basilicata-Italy, University of Lausanne, and Swiss Federal Institute of Technology Lausanne) which will bring together experience and knowledge in various disciplines to increase the understanding of tillage management practices for long-term carbon sequestration in different soil types across Europe and Africa. Specifically, the project aims to establish a link between soil management and carbon stabilization to identify tillage practices that can restore degraded soil while promoting climate change mitigation through maintaining soil organic carbon stock.