

**Temporal variations in soil organic matter content of different land use types in South
West Nigeria**

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Abstract

A study was conducted to test the effect of different land use types on the organic matter content of soil. The treatments comprised four land use types which were: forest (secondary forest), natural grassland, notill farmland (5 years of conservation tillage), and conventionally tilled farmland (5 years of continuous plough and harrow cropland). The results demonstrated a significant variations ($P < 0.05$) in soil organic matter of the land use types at different soil depths. At the 0 – 5 cm soil depth, there was a similarity in the soil organic matter content of the secondary forest, natural grassland, and the notill farmland. However, as the depth of sampling increased to 30 cm soil depth, there exist a significant different with the secondary forest having the highest organic soil matter followed by the natural grassland. Generally, there was a decrease in soil organic matter with increase in the depth of soil sampling. While the soil organic matter of notill farmland at the 0-5 and 5 -10 cm soil depths were significantly higher than those of the conventionally tilled farmland, there exist no considerable differences in the soil organic matter content of the two land use types at 20-30 cm soil depth.

Keywords: soil organic carbon, land use, Nigeria, forest, conservation farming

Introduction, scope and main objectives

Soil organic matter content is a function of organic matter inputs (residues and roots) and litter decomposition (Bell et al., 1999). It is related to moisture, temperature and aeration, physical and chemical properties of the soils as well as bioturbation (mixing by soil macrofauna), leaching by water and humus stabilization (organomineral complexes and aggregates). Land use and management practices also affect soil organic matter. Soil organic matter – the product of litter and crop residue biological decomposition – affects the chemical and physical properties of the soil.

Many common agricultural practices, especially ploughing, disc-tillage and vegetation burning, accelerate the decomposition of soil organic matter and leave the soil susceptible to wind and water erosion (Brown et al., 2003). However, there are alternative management practices that enhance soil health and allow sustained agricultural productivity. Conservation agriculture encompasses a range of such good practices through combining no tillage or minimum tillage with a protective crop cover and crop rotations. The objective of this study was therefore to evaluate the temporal variations in soil organic matter of different land use types.

Methodology

The study was conducted at the experimental farm of the Federal University of Agriculture Abeokuta, Nigeria. Four treatments which comprised of different land use types were evaluated in the study. The land use types were: 1. secondary forest – the initial vegetation has been replaced by secondary forest. And this area has been under forest for over a decade. 2. Natural grassland – this area contain grasses with very few and scattered woody species. This Area has maintained this condition for over a decade with no history of cultivation at least for a decade. 3. No-till farmland – this is a farmland that has maintained 100 % soil cover

with a variety of improved agronomic practices such as crop rotation, intercropping among others for about five years. 4. Conventionally tilled farmland – this is an area that has been under continuous cultivation for the last five years. The method of land preparation has been predominantly plough and harrow. The area is grown with maize season after season though with NPK fertilizer application. Soil samples were taken with the aid of an auger at 0 -5, 5 -10, 10-20 and 20-30 cm soil depth on each land use type. The organic carbon using Walkley and Black method (Nelson and Sommers, 1982).

Results

Effect of land use types on soil organic matter is presented in Figure 1. There was no significant difference ($P > 0.05$) among the soil organic matter values of the forest, natural grassland and notill farmland. However, these three land use types were significantly different in their soil organic matter values with respect to the conventionally tilled farmland. Soil organic matter shows a gradual decline with increasing sampling depth on all the land use types (Figure 2). The decline was more on the conventionally tilled farmland than others.

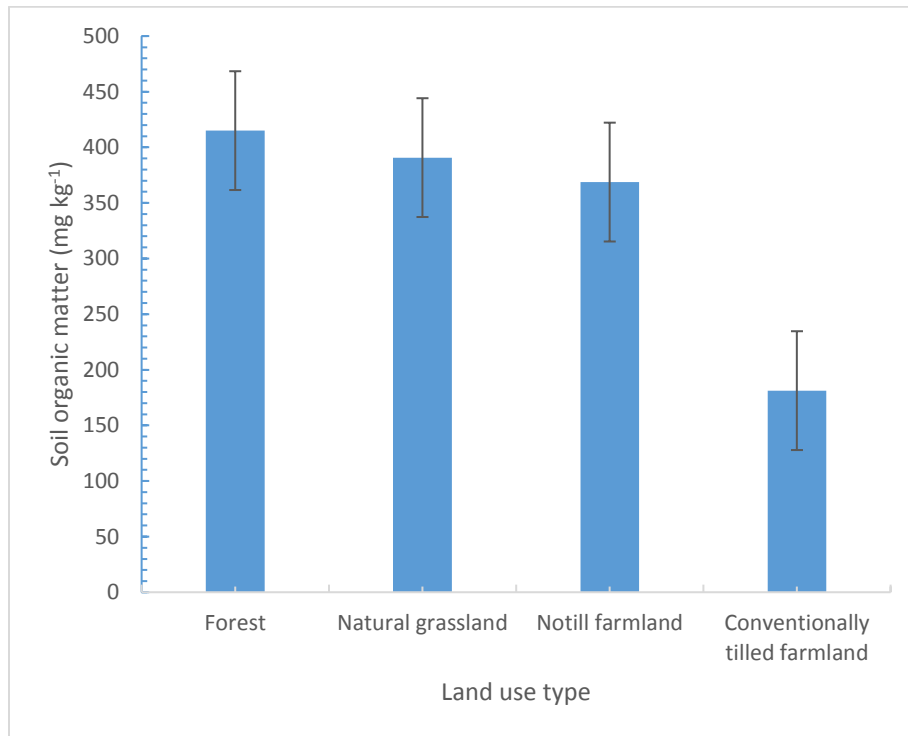


Fig. 1: Effect of land use types on soil organic matter

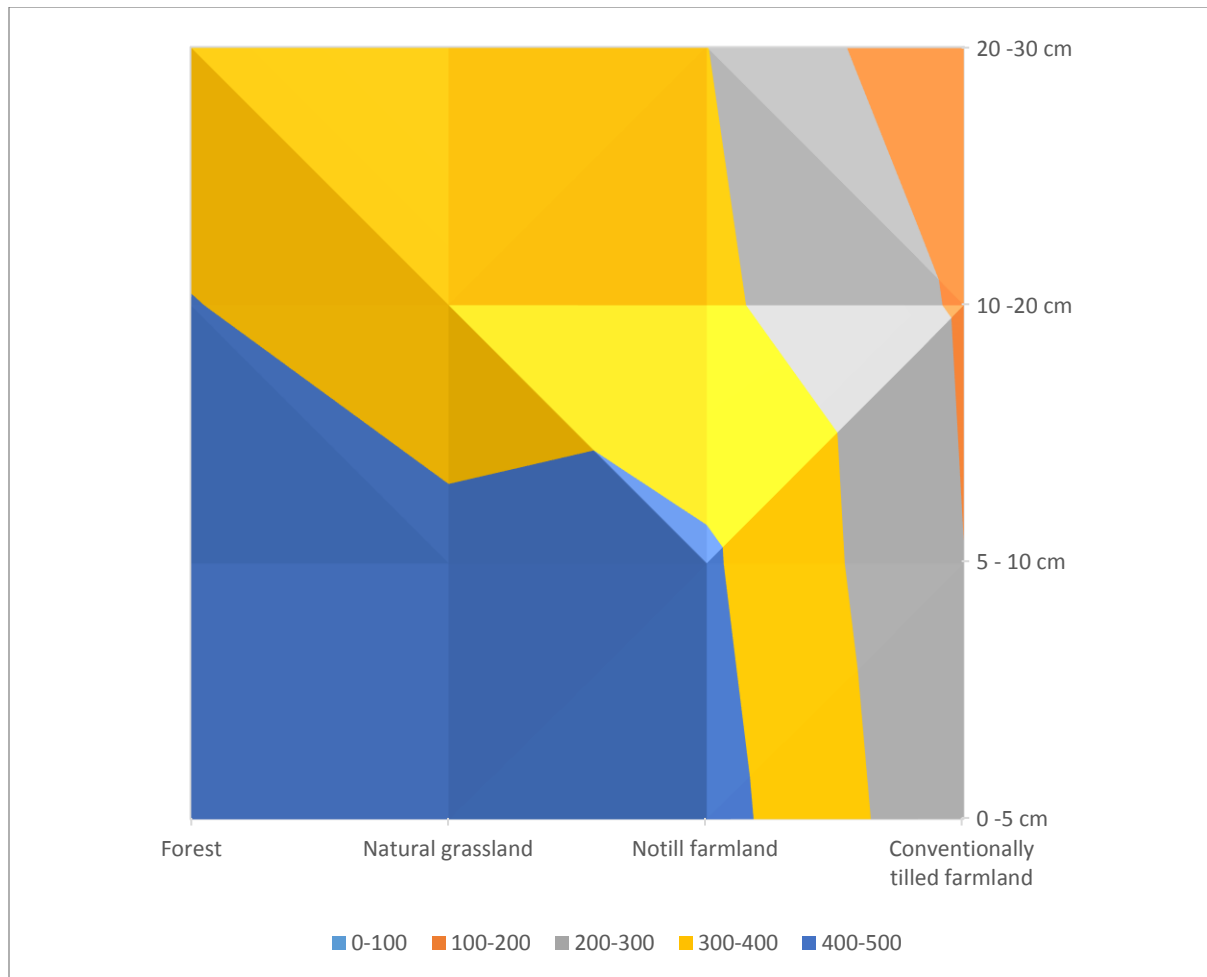


Fig. 2: Variation of soil organic matter with soil depth on different land use types

Discussion

Land use types have profound influence on the soil organic matter content. Notill farmland mimic ecological land use such as forest and natural grassland land particularly with reference to its soil organic matter content at the topsoil (0-5cm). With increasing soil depth, there exist a difference in the soil organic matter content of all the land use types. As expected, the conventionally tilled farmland had the least soil organic matter both at the topsoil and at the subsoils. With appropriate land use types, farmland could mimic natural or semi-natural ecosystems, thereby enhancing not only the sustainability of soil resources but of agricultural productivity. Since the maintenance of soil organic matter is a major challenge in tropical agro-ecosystems due to the rapid decomposition rates, practices such as notill that are able to maintain their soil quality in a way similar to the natural systems are preferable. This system provides a win-win approach, soil quality is maintained while at the same time agricultural productivity is enhanced.

Conclusions

Soil organic matter varied with land use types. After five years of cultivation, Notill farmland, soil organic matter similar to forest and natural grassland. Notill system of farming is therefore an ecological system that provides a win-win approach of soil and crop productivity.

References

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