

## 論文の内容の要約

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学位論文名	Effect of no-tillage on soil organic matter accumulation characteristics of Andosols in a long-term experiment in Japan

## 【論文の内容の要約】

**Background**

Andosols in Japan are predisposed to the loss of huge amounts of soil organic matter (SOM) due to intensive land use and rotary cultivation practices. No-tillage (NT) has been recommended for improving carbon (C) sequestration, sustaining SOM levels, and mitigating climate change, but there is limited information about the effect of NT on SOM accumulation characteristics of Andosols in Japan. The objectives of this study were to evaluate the effect of NT on 1) soil C, nitrogen (N), and phosphorus (P) accumulation characteristics, including its quantity and quality, using physical fractionation methods, and on 2) soil microbial biomass (SMB) and its activity

**Methods**

Soil samples at 0–2.5, 2.5–7.5, and 7.5–15 cm depths from NT and conventional tillage (CT) plots in Andosols in a long-term (19 years) field experiment in Ibaraki, Japan were collected. Soil samples were separated into light fraction (LF), coarse-POM (cPOM:0.25–2 mm), fine-POM (fPOM:0.053–0.25 mm), and silt+clay (mOM:<0.053 mm). The carbon (C), nitrogen (N), phosphorus (P) content and total SOC stock of each fraction were analyzed. The C:N, C:Po, and N:Po ratios were compared between NT and CT for each fraction. The soil microbial biomass C and N and soil enzyme activity ( $\beta$ -glucosidase) were also analyzed.

**Results**

The C content of cPOM and fPOM in NT at 0–7.5 cm was 14.0 and 19.3 g C kg<sup>-1</sup>, respectively, and were larger than those in CT (8.2 and 10.8 g C kg<sup>-1</sup>, respectively) at the same depth, while there was no clear difference in the mOM fraction or deeper layer (7.5–15 cm). Similar trends were observed for N and Po content. The total SOC stock of cPOM and fPOM in NT at 0–7.5 cm was 3.4 Mg C ha<sup>-1</sup> and 4.6 Mg C ha<sup>-1</sup>, respectively, and were larger than those in CT (2.1 and 2.7 Mg C ha<sup>-1</sup>, respectively), but no difference was seen in the mOM fraction or deeper layer (7.5–15 cm). Finally, the total SOC stock at the 0–15 cm depth did not differ between the NT and CT plots. There was no significant difference in C:N ratio for all fractions throughout the depths,

except LF, and C:Po and N:Po ratio also did not show consistent differences. These results indicate that NT increases C, N, and Po contents in labile POM fractions at the surface layers, but didn't increase the stable fraction and also did not change the quality of Andosols in Japan. Microbial biomass carbon (MBC), microbial biomass nitrogen (MBN), and  $\beta$ -glucosidase activity were significantly larger in NT than in CT at the surface depths (0–7.5 cm). These results indicate that NT improves the soil biological conditions and nutrient availability at the surface depth (0–7.5 cm).

### **Conclusion**

In conclusion, the long-term NT management in Andosols should (1) increase the SOM accumulation mainly in labile fractions, such as cPOM and fPOM, at the surface depths (0–7.5 cm), with increasing SMB and its activity, and (2) be a sustainable SOM management practice to improve SOM levels and soil fertility, resulting in the sustainable management of Andosols in Japan.

Keywords: No-tillage, soil organic matter, physical fractionation, particulate organic matter, mineral-associated organic matter, soil microbial biomass,  $\beta$ -glucosidase activity.