

BIOCHAR AND LIME APPLICATION EFFECT ON SOIL ORGANIC CARBON CONTENT UNDER DIFFERENT TILLAGE SYSTEMS ON ACID SOIL: A 7-YEAR FIELD EXPERIMENT

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Biochar has the potential to improve various chemical, biological and physical properties of soil, and it is often recognized for its ability of long-term carbon sequestration. When used in combination with lime, biochar can serve as an effective amendment for extremely acidic soils. Soil organic carbon (SOC) sequestration, however, is influenced by several agrotechnical factors, particularly tillage practices. This study aimed to assess the effects of different tillage systems—conventional tillage (ST), deep conservation tillage (CTD), and shallow conservation tillage (CTS)—as well as liming (without lime - LN, and with lime - LY) and biochar application (40 t ha⁻¹) on SOC content in Stagnosol soil in eastern Croatia. The average SOC value was 1.60%, significantly affected by the time span (F=27.82) and tillage treatment (F=5.19). Significant interactions between Year × Tillage (F=2.44) and Year × Tillage × Liming (F=2.35) were observed. The highest SOC was recorded under CTS LN in 2019 (2.03%) and the lowest in 2023 (1.22%), with a coefficient of variation of 12.95%. Across all years, CTS showed the highest average SOC (1.66%), while ST had the lowest (1.56%), with statistically significant differences except between ST and CTD. After biochar application, SOC exhibited an almost linear increase (38.32%) until 2019, followed by a less pronounced decrease thereafter. Most of the differences in SOC values over the years were statistically significant. Our findings suggest that SOC content increased in the short and mid-term but began to decline after 2019. Conservation tillage, particularly CTS, was found to promote greater SOC accumulation compared to conventional practices, demonstrating its potential for enhancing soil carbon sequestration.

Keywords: Biochar, Soil organic matter, Conservation tillage

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