Tillage, liming and carbon dioxide emissions in maize vegetation: a case study in central Croatia

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Abstract

Agriculture makes a significant contribution to global CO_2 emissions, partly due to soil disturbance and intensive soil management. Understanding how tillage intensity and liming treatments affect CO_2 release is essential for improving soil management. This study aimed to evaluate the effects of different soil management practices on soil C-CO_2 emissions in a maize (*Zea mays* L.) field during the 2024 vegetation season. The research was conducted in Križevci, Croatia, on a Gleysol soil type. The field experiment was set up as a completely randomized block design with a base plot size of 160 m^2. The experimental field included two factors: i) tillage (CT-conventional tillage; CTD-conservation system deep; CTS-conservation system shallow); ii) liming (CN-without liming; CY-with liming). The combination of tillage and liming treatments resulted in six experimental treatments in total. Average annual soil C-CO_2 emissions differed significantly among treatments. The lowest values were recorded under CT without liming (18.30 kg ha^{-1} day^{-1}), while the highest emissions were observed under CTS with liming (25.97 kg ha^{-1} day^{-1}). Average monthly emissions varied seasonally, with the lowest value in April (7.94 kg ha^{-1} day^{-1}) on ST–CY treatment, and the highest in May (43.84 kg ha^{-1} day^{-1}) on CTS–CY treatment. A positive correlation was found between average soil C-CO_2 emissions and soil temperature/soil moisture. These findings highlight the importance of appropriate tillage and liming practices for managing soil C-CO_2 emissions and maintaining sustainable soil management.

Key words: agroecological factors, conventional tillage, conservation tillage, soil respiration

Graphical abstract

