EFFECTS OF TILLAGE SYSTEMS ON METHANE ASSIMILATION IN *CAMBIC CALCISOL* AND IMPLICATIONS FOR CLIMATE CHANGE MITIGATION

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ABSTRACT

Well-aerated soils are essential for methane (CH_4) uptake from the atmosphere, acting as significant sinks for this greenhouse gas, which has a global warming potential 25 times greater than that of carbon dioxide (CO_2). These soils contain methanotrophic bacteria, which oxidize CH_4 and thereby reduce atmospheric methane concentrations. The potential of soils to assimilate CH_4 depends on factors such as soil type and moisture regime. This study investigates the ability of clay soil *Cambic Calcisol* to assimilate CH_4. Measurements were conducted at an experimental site with two tillage systems and two crop rotations from 2018 to 2023, with observations taken every two weeks from April to October. Experimental plots under conventional tillage demonstrated a higher rate of CH_4 assimilation compared to reduced tillage plots (-4.1 g CH_4 ha^{-1} day^{-1} and -3.5 g CH_4 ha^{-1} day^{-1}, respectively). CH_4 uptake by soils plays a vital role in regulating methane emissions, making soil management practices a key factor in climate change mitigation efforts. Understanding the variables influencing CH_4 assimilation is crucial for optimizing land-use strategies to enhance greenhouse gas mitigation.

Keywords: conventional tillage, reduced tillage, agriculture, GHG emissions, Picarro G2508, soil

INTRODUCTION

Well-aerated soils play a crucial role in absorbing methane (CH_4) from the atmosphere, serving as important sinks for this greenhouse gas, which has a global warming potential 25 times that of carbon dioxide (CO_2). These soils host methanotrophic bacteria that oxidize CH_4, thereby lowering its levels in the atmosphere. The capacity of soils to absorb CH_4 is influenced by various factors, including soil type and moisture conditions. For instance, Hansen et al. (2024) found that well-drained sandy soils with lower bulk density in Denmark have higher CH_4 uptake rates compared to coarse sandy soil and the loamy soils [1]. Additionally, Rafalska et al. (2023) suggest that grasslands affected by warming and drought conditions may enhance their CH_4 absorption, primarily due to reduced soil moisture and increased gas diffusivity [2]. Furthermore,

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