

Topic: Agricultural Land Management in Rain-Fed Rice Field using Energy Crop Rotation

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ABSTRACT

This study aims to find a suitable crop rotation system in rice fields for mitigating greenhouse gas (GHG) emissions and improving soil carbon sequestration in order to enhance the utilization of fallow period in rain-fed rice fields and gain more benefits from agricultural land. Field experiments were carried out for two years and six months in which a crop rotation was made in the dry season and rain-fed rice was grown in the wet season. Four different dry season cases were studied: fallow (RF), irrigated rice (RR), corn (RC), and sweet sorghum (RS). Emissions of methane (CH₄), carbon dioxide (CO₂) and nitrous oxide (N₂O) were estimated using the closed-chamber method. Soil carbon budget (SCB), soil organic carbon (SOC) stock and crop yields were also measured. This study found that the RC and RS reduced the CH₄ emission by 78-84%, and reduced the total global warming potential (CH₄ and N₂O) by 59-73% compared with continuous rice (RR). The SCB in rotation with corn showed the highest gain in the second year. The SOC stocks were maintained by the RR, RC and RS treatments, but significantly decreased by the RF treatment in the second year. The rice grain yields of RC and RS were stable in the both years, while RF fell slightly by 11%, and RR significantly reduced by 39% from the first year. The DNDC model simulation of CH₄ emissions and SOC storage from energy crop rotation in rain-fed rice field was sufficiently good for practical use of the model in both short and long term prediction. These results indicated that RC and RS not only reduced GHG emissions but also improved SOC stock and crop yields. Although RF able to reduce GHG emission by 66% compared with RR, but there lose in soil carbon sequestration and agricultural land utilization.

Keywords: Rain-fed rice, Crop rotation, Greenhouse gas, Soil carbon sequestration, Rice yield, DNDC model