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Farmers' and academia's views"

Effect of N fertiliser amount and water management on CO_2 exchange and net ecosystem C balance of rice cultivation in southern Benin

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Abstract

Application of mineral nitrogen (N) fertiliser and water management are two very essential farming practices, used to optimise potential yields in sub-Sahara African rice cultivation. Differences in both practices, however, might affect the patterns of climate relevant gaseous carbon (C) emissions (CO_2 and CH_4) and soil C losses, thus contributing to global climate change. To date, knowledge about the combined effects of different N fertiliser rates together with different water management practices on the gaseous C emissions and soil C losses are very limited. Our study aims to identify the best combination of water management and N fertiliser amount to reduce gaseous C emissions and limit soil C losses for an irrigated rice production in Benin. We hypothesise that especially a combination of alternate wetting and drying (AWD) as water management and an optimum amount of N fertiliser reduce gaseous C emissions and might help to enhance C sequestration by reducing soil C losses from irrigated rice production in Benin. To test this hypothesis, a field experiment was established at Koussin lélé, Cove district, southern Benin using a full factorial, split-plot experimental design. Within the experiment the combination of three levels of water management and two levels of N fertiliser amount are tested. The water management technologies include continuous flooding (CF) and two alternate wetting and drying (AWD) methods (AWD15 and AWD25) of irrigation. Nitrogen fertiliser levels is 90 $^{kg}/_{ha}$ (farmer's practice) and 120 $^{kg}/_{ha}$. To measure gaseous C emissions (CO_2 and CH_4) and estimate dynamics in soil C losses, an innovative, customized low cost dynamic NFT-NSS closed chamber system is used. The system consists of CO_2/CH_4 NDIR sensors connected to a microcontroller for data storage and transparent (NEE measurements) polycarbonate chambers (40 cm × 40 cm × 100 cm). To measure Reco, transparent chambers were covered with an opaque hood. Chamber measurements for diurnal variability in CH_4

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and CO_2 fluxes are performed biweekly at all plots. In addition, agronomy and crop growth indices such as the Normalized difference vegetation index (NDVI) are measured weekly. Here we present CO_2 and NECB balances for the first crop growth period.

Keywords: CO_2 emission, N fertiliser, net ecosystem carbon balance (NECB), rice, water management