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Effect of N fertilizer amount and water management on CO2 exchange and net ecosystem C balance of rice cultivation in Southern Benin

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Application of mineral nitrogen (N) fertilizer and water management are two very essential farming practices, used to optimize 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 fertilizer rates together with different water management practices on the gaseous C emissions and soil C losses are very limited. This is even more the case for arable lands in sub-Sahara Africa. Our study aims to identify the best combination of water management and N fertilizer amount to reduce gaseous C emissions and limit soil C losses for an irrigated rice production in Benin. We hypothesize that especially a combination of alternate wetting and drying (AWD) as water management and an optimum amount of N fertilizer 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 fertilizer 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 fertilizer levels is 90 kg/ha (farmer's practice) and 120 kg/ha (high amount of fertilizer). 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 x 40 cm x 100 cm). To measure R_{eco}, transparent chambers where covered with an opaque hood. Chamber measurements for diurnal variability in CH_4 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.

Key words: Water management, N fertilizer, CO_2 emission, net ecosystem carbon balance (NECB), rice