Tropentag, September 17-19, 2013, Stuttgart-Hohenheim

"Agricultural development within the rural-urban continuum"

Estimation of Methane Emission from Permanently Flooded and Alternately Wetted and Dried Rice Field Supplied with Rice Straw, Biochar and Mineral Fertiliser: A Greenhouse Study

Proyuth Ly, Vuduong Quynh, Arjun Pandey, Andreas de Neergaard

University of Copenhagen, Dept. of Plant and Environmental Sciences, Denmark

Abstract

A study was conducted to estimate the methane (CH_4) emission from rice cultivation in a greenhouse setting. Two by three factorial design experiment was set in which each of permanent flooding (PF) and alternate wetting and drying (AWD) contained 3 treatments; i) Soil amended with rice straw and mineral fertiliser (RS), ii) Soil amended with biochar and mineral fertiliser (BC), and iii) Soil applied with mineral fertiliser (MF) alone. Each of 18 plexiglass base columns with area of 153.86 cm^2 were filled with 3 kg of soil and applied with respective treatments and gas samples were collected mounting a top column on the base column making a airtight chamber. All the columns were flooded throughout the season except draining of AWD plots for 7 days after 30 days of transplanting. Gas samples were collected once a week at the time interval of 0, 20 and 40 minutes during each sampling day and gas was analysed using gas chromatography through flame ionisation detector. High temporal variation in CH_4 flux was observed from all the treatments. CH_4 flux was significantly depressed in AWD-RS treatment due to midseason drainage while PF-RS showed continuously higher flux. All the treatment from both water regimes showed gradual increase in CH_4 flux after 52nd day after transplanting. PF-RS had relatively higher flux for the whole rice-growing season followed by AWD-RS. Biochar treated pots showed lower emission during the initial period but rise in flux was observed during the late season in both water regimes. Mineral fertiliser showed continuously lower CH_4 flux from both the treatment. Cumulative emission of CH_4 from PF-RS was highest among the treatment followed by AWD-RS where the values were 794.9 and 392.3 mg pot^{-1} respectively. PF-BC, PF-MF, AWD-BC and AWD-MF had cumulative CH_4 flux of 203.3, 131.1, 93.1 and 82.9 mg pot^{-1} respectively. Result suggested that organic matter and water management has determining effect on the amount of CH_4 emission. AWD reduced considerable amount of CH_4 emission from all the treatments as compared to that from PF.

Keywords: Alternative wetting and drying, biochar, methane emission, mineral fertiliser, permanent flooding, rice straw

Contact Address: Arjun Pandey, University of Copenhagen, Dept. of Plant and Environmental Sciences, Ørnevej 15, 4 TV, Copenhagen, Denmark, e-mail: arjun_loris@yahoo.com