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Soil respiration under different N fertilisation and irrigation regimes in Bengaluru, India

Suman Kumar Sourav[1], Chickadibburahalli T. Subbarayappa[2], Prem Jose Vazhacharickal[1], Andrea Mock[1], Mariko Ingold[1], Andreas Buerkert[1]

[1] *University of Kassel, Organic Plant Production and Agroecosyst. Res. in the Tropics and Subtropics, Germany*

[2] *University of Agricultural Sciences, Dept. of Soil Sci. and Agricultural Chemistry, India*

Abstract

Rampant urbanisation has led to different levels of agricultural management intensities/practices in urban and peri-urban agriculture (UPA) which affects the soils' physical, chemical, and microbial properties. This study was conducted to investigate the effects of different levels of mineral nitrogen (N) fertiliser and irrigation on CO_2 fluxes in typical crops during the Kharif (wet) and Rabi (dry) season under the monsoonal climate of Bengaluru, S-India.

To this end data were collected from Kharif 2017 to Rabi 2021 in a two-factorial split-plot experiment conducted under rainfed and irrigated conditions in on-station experimental plots at University of Agricultural Sciences Bangalore (UASB). Studied where the three rainfed crops maize (*Zea mays* L.), finger millet (*Eleusine coracana* Gaertn.), and lablab (*Lablab purpureus* L. Sweet) as well as irrigated cabbage (*Brassica oleracea* var. capitata), eggplant (*Solanum melongena* L.), and chili (*Capsicum annuum* L.). CO_2 emissions were determined using a ventilated closed-chamber system connected to a Los Gatos Research (LGR) multi-gas analyzer (CO_2, CH_4, NH_3 and H_2O). Measurements were conducted from 7:00 am to 11:30 am and repeated from 1:00 pm to 6:00 pm.

Under irrigated conditions average soil emissions of CO_2 in maize were 30 % lower than in lablab (2.86 kg ha^{-1} hr^{-1} CO_2-C) and 31 % lower than in finger millet (2.87 kg ha^{-1} hr^{-1} CO_2-C). In rainfed maize soil respiration was 0.3 % higher than in irrigated maize (2.19 kg ha^{-1} hr^{-1} CO_2-C) and rainfed finger millet had 1.6 % lower values than irrigated finger millet (2.87 kg ha^{-1} hr^{-1} CO_2-C). Under rainfed conditions high N maize plots had 94 % higher CO_2 fluxes than maize without N (1.48 kg ha^{-1} hr^{-1} CO_2-C). Similarly, in rainfed finger millet, CO_2 emissions on high N plots were 30 % higher than on controls (2.47 kg ha^{-1} hr^{-1} CO_2-C). During the Rabi season flux rates did not significantly differ between chili, cabbage and eggplant across fertiliser rates.

The results indicate that crop-specific CO_2 fluxes were independent of N fertilisation under irrigation, but were remarkably consistent across years. Under rainfed conditions CO_2 emissions on high N plots were significantly higher than on plots without N.

Keywords: CO_2 flux, fertiliser, multi-gas analyzer, seasonal CO_2 emissions

Contact Address: Suman Kumar Sourav, University of Kassel, Organic Plant Production and Agroecosyst. Res. in the Tropics and Subtropics, Steinstraße 19, 37213 Witzenhausen, Germany, e-mail: sourav.suman@gmail.com