Small scale CO2 fluxes in a rainfed maize field under N fertilization

Györgyi Gelybó1, Réka Deli2, Márton Dencső1, Bernadett Kósa2, Viktória Mateika2, Márton Tóth3, Emese Ujj1, Tamás Árendás4, Nándor Fodor5, and Hosam Bayoumi3

1Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Sciences, Department of Soil Physics and Water Management, Budapest, Hungary (gyoresz@elte.hu)
2Institute of Environmental Engineering, Óbuda University, Sándor Rejtő Faculty of Light Industry and Environmental Protection Engineering, Budapest, Hungary
3Department of Soil Mapping and Environmental Informatics, Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Budapest, Hungary
4Crop Production Department, Agricultural Institute, Centre for Agricultural Research, Martonvásár, Hungary

Carbon-dioxide (CO2) fluxes in the soil-plant-atmosphere system contain bidirectional material transport with organic and inorganic sources and sinks, and various pathways. Proportion of irrigated fields in the total area of Hungarian arable lands is low, and in case of a rainfed field water and CO2 fluxes are only driven by meteorological factors. In this study we focused on maize under different fertilization treatments to see the plot scale variability of CO2 fluxes and connected parameters.

The site is a multifactorial sowing time-fertilizer-maize variety field experiment near Martonvásár. Two treatment plots were selected for the measurements with contrasting 60 kg N ha\(^{-1}\) and 180 kg N ha\(^{-1}\) fertilizer treatments and no other factors were considered in the present study. We performed synchronized observations of (i) CO2 fluxes: soil respiration (Rs; EGM-5 gas analyser + SRC-1 chamber, PPSystems); leaf scale photosynthesis (A; CIRAS-3 portable photosynthesis system, PPSystems), (ii) soil temperature and soil water content, (iii) plant parameters: root growth (CI-600, CID-Bioscience), plant height, leaf area index (Accupar LP-80 ceptometer, Li-Cor). Data on the above parameters comprise several spatial replicates to explore spatial heterogeneity in case of a maize field managed in accordance with the typical Hungarian practice. The average applied N amount in the country is around 100-105 kg ha\(^{-1}\).

Field measurements for CO2 fluxes and biotic and abiotic drivers were performed six times in the vegetation period to establish relationship among them. Data were analyzed to optimize the labour intensive protocol for this experimental setup. Photosynthesis varied within the vertical canopy as reflected by measurements on five leaves per plant. Soil respiration was more dependent temporally on soil water availability than on temperature.

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