Geophysical Research Abstracts
Vol. 20, EGU2018-12676-1, 2018
EGU General Assembly 2018

Decomposition of recently added and old SOM sources during crop growth estimated by ^{13}C abundance in organic matter and respired CO_2 after 17 years of maize grown on C3 soil

Muhammad Shahbaz (1), Lorenzo Menichetti (2), Thomas Kätterer (2), and Gunnar Börjesson (1)

(1) Swedish University of Agricultural Sciences, Department of Soil and Environment, box 7014, Uppsala, Sweden (muhammad.shahbaz@slu.se), (2) Swedish University of Agricultural Sciences, Department of Ecology, box 7044, Uppsala, Sweden

To maximize carbon (C) storage in soils, understanding the turnover of different pools of soil organic matter (SOM) under crop growth is critically important. Based on a long-term Swedish field experiment (started in 1956), in which C3 crops were substituted with a C4 crop (maize) 17 years ago, we investigated microbial utilization of C sources (rhizodeposition and old SOM) during on growing season in maize. Assuming that C that recently entered the soil is more easily available for microorganisms in comparison to older C, we hypothesized that as compared to old SOM the contribution of younger C (C4-derived) in soil respiration will be enhanced during the growth season (i.e. during rhizodeposition) which would results in greater losses of younger C rather than contributing to SOM formation. Soil respiration was measured in situ prior to planting and after every second week during crop growth and after harvest in four treatments: bare fallow (without vegetation), a C3-reference site and cropped with maize (unfertilized and N fertilized). Based on the $\delta^{13}C$ of CO_2 purified from the admixture of atmospheric CO_2 and soil derived $\delta^{13}C$ (0-20 cm), the contributions of younger (C4-derived) and older (C3-derived) C sources to SOM and CO_2 fluxes were assessed. Depending on the maize growth stage and N fertilization, the total soil CO_2 efflux ranged from 10-40 mg C $m^{-2}h^{-1}$. The preliminary results show that the contribution of younger C to soil CO_2ranged from 15 to 65% but to SOM was less than 9-11%. The contribution of C4-C to soil CO_2 efflux increased during crop growth (highest in August, a peak crop growth) and declined after harvest, indicating the faster turnover of younger C in the presence of rhizodeposition. By comparing the contribution of older and younger C to CO_2 and SOM, we found that decomposition of young C4-derived material was up to 4 (unfertilized) to 6 times (fertilized) higher than decomposition of old, C3-derived C stabilized in soil for longer than 17 years. We concluded that simultaneous analysis of the $\delta^{13}C$ in both SOM and CO_2 evolved during the growing season allows not only for the quantification of the CO_2 from rhizodeposition, but also for the estimation of the availability of recent and old pools of SOM for microorganisms.