Geophysical Research Abstracts
Vol. 18, EGU2016-9143, 2016
EGU General Assembly 2016

The impact of extreme environmental factors on the mineralization potential of the soil

Natalia Zinyakova (1) and Vyacheslav Semenov (2)

(1) Institute of Physicochemical and Biological Problems in Soil Sciences of the Russian Academy of Sciences, Pushchino, Russian Federation (nakhodkanbz@mail.ru), (2) Institute of Physicochemical and Biological Problems in Soil Sciences of the Russian Academy of Sciences, Pushchino, Russian Federation (v.m.semenov@mail.ru)

THE IMPACT OF EXTREME ENVIRONMENTAL FACTORS ON THE MINERALIZATION POTENTIAL OF THE SOIL
Natalya B. Zinyakova1, Vyacheslav M. Semenov2,
Institute of Physicochemical and Biological Problems in Soil Sciences of the Russian Academy of Sciences, Pushchino, Russia
nakhodkanbz@mail.ru1; v.m.semenov@mail.ru2

Warming, drying, wetting are the prevalent disturbing natural impacts that affect the upper layers of uncultivated and arable soils. The effect of drying–wetting cycles act as a physiological stress for the soil microbial community and cause changes in its structure, the partial death or lysis of the microbial biomass.
The mobilization of the SOM and the stabilization of the potentially mineralizable components lead to change of mineralization potential in the soil.
To test the effects of different moisture regime on plant growth and soil biological properties, plot experiment with the gray forest soil including trials with plants (corn) and bare fallow was performed. Different regimes of soil moisture (conditionally optimal, relatively deficient soil moisture and repeated cycles of drying-wetting) were created. Control of soil moisture was taken every two or three days. Gas sampling was carried out using closed chambers. Soil samples were collected at the end of the pot experiment. The potentially mineralizable content of soil organic carbon (SOC) was measured by biokinetic method based on (1) aerobic incubation of soil samples under constant temperature and moisture conditions during 158 days, (2) quantitation of C-CO_2, and (3) fitting of C-CO_2 cumulative curve by a model of first-order kinetic. Total soil organic carbon was measured by Tyrin's wet chemical oxidation method.
Permanent deficient moisture in the soil favored the preservation of potentially mineralizable SOC. Two repeated cycles of drying-wetting did not reduce the potentially mineralizable carbon content in comparison with control under optimal soil moisture during 90 days of experiment. The emission loss of C-CO_2 from the soil with plants was 1.4-1.7 times higher than the decrease of potentially mineralizable SOC due to the contribution of root respiration. On the contrary, the decrease of potentially mineralized SOC in the soil without plants was 1.1-1.2 times larger than C-CO_2 emissions from the soil as a result of stabilization processes. Thus, the alternation of drying–wetting cycles results in 1) the death of microbial biomass and recolonization of the soil microorganisms; 2) favors the splitting and degradation of soil aggregates, as well as the reaggregation and stabilization of aggregates; 3) contributes to the mobilization of the SOM and also 4) initiates the stabilization of the potentially mineralizable components. The effect of drying–wetting cycles is expressed not so much in the loss of the total soil organic carbon as in the degradation of the SOM quality with decreasing its mineralization potential.
We can conclude that different soil moisture regimes lead to essential changes of mineralization potential in the gray forest soil. The amount of mineralization loss soil carbon via C-CO_2 emission is directly associated with the decrease of potentially mineralizable carbon. Deficient moisture is a reason for temporarily sequestration of SOC potentially mineralizable under optimal moisture.
This work was supported by RSF. Project number 14-14-00625