Estimation of processes of carbon and nitrogen mineralization <=> (re)immobilization and functioning of agroecosystems

L. Pomazkina

Siberian Institute of Physiology and Biochemistry of Plants SB RAS, Irkutsk
lvp@sifibr.irk.ru

This work presents results of studies on transformation of carbon (C-CO2 and Cmicr) and nitrogen (^{15}N) obtained during long-term field experiments with spring wheat in gray forest and alluvial soils of forest steppes of the Baikal region polluted with fluorides as a result of aluminum production. Soils differ in the concentration of water-soluble fluorides (maximum permissible concentration 6 and 10, correspondingly) and in physical and chemical characteristics including concentrations of humus (2.5 and 11.9%) and nitrogen (0.14 and 0.67%). Humus in both types of soils is fulvate-humate and the level of humification is “high”. The humus mobility (Mh) for both carbon and nitrogen is twice as high in gray forest soil (0.6 and 0.9, respectively).

Mineralization of organic matter in gray forest soil mostly depends on its mobility, while in alluvial soil – on concentration of organic substance. The absolute value of mineralized carbon ($\mathbf{C_M}$) and nitrogen ($\mathbf{N_M}$) is lower (203 and 34 g/m^2) in gray forest soil than in the alluvial one (335 and 54 g/m^2), whereas the relative value is two times higher (4% of C_{org} and 11% of N_{org}). Values of net mineralized carbon and nitrogen in soils are also different (135 and 25 g/m^2 versus 178 and 32 g/m^2, respectively), fluxes of carbon and nitrogen in gray forest soil being two times higher. Their return into the intersoil cycle (recirculation) characterizing microbial reimmobilization is two times less in gray forest soil. C_M and N_M make up 33 and 27% in gray forest soil, while in the alluvial one – 47 and 41%. Due to newly formed structures (renewal), the concentration of labeled nitrogen in organic matter is higher in gray forest soil (3.5 versus 2.3% of N_{total} in the alluvial soil) which is in agreement with high mobility of humus unlike carbon the concentration of which is less and equal in both types of soil (1.9 and 1.8% of C_{total}).

Therefore, the balance of carbon and nitrogen fluxes within the intersoil cycle (mineralization <=> immobilization) connected with the activity of a microbial aggregate is unequal in soils which differ in characteristics and state of humus. The system analysis allows to integrally estimate the functioning of a microbial aggregate and agroecosystems. According to elaborated criteria, their functioning in gray forest soils corresponds to resistance regime (load is maximum permissible), while in alluvial soils – to stress regime (the load is permissible). This demonstrates unequal resistance to anthropogenic impact.