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CO_2 Fluxes Monitoring at the Level of Field Agroecosystem in Moscow Region of Russia

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The Central Russia is still one of the less GHG-investigated European areas especially in case of agroecosystem-level carbon dioxide fluxes monitoring by eddy covariance method. The eddy covariance technique is a statistical method to measure and calculate vertical turbulent fluxes within atmospheric boundary layers. The major assumption of the metod is that measurements at a point can represent an entire upwind area. Eddy covariance researches, which could be considered as repeated for the same area, are very rare.

The research has been carried out on the Precision Farming Experimental Field of the Russian Timiryazev State Agricultural University (Moscow, Russia) in 2013 under the support of RF Government grant No. 11.G34.31.0079. Arable derno-podzoluvisls have around 1

The results have shown high daily and seasonal dynamic of agroecosystem CO_2 emission. Sowing activates soil microbiological activity and the average soil CO_2 emission and adsorption are rising at the same time.

CO_2 streams are intensified after crop emerging from values of 3 to 7 μmol/s•m2 for emission, and from values of 5 to 20 μmol/s•m2 for adsorption. Stabilization of the flow has come at achieving plants height of 10-12 cm. The vegetation period is characterized by high average soil CO_2 emission and adsorption at the same time, but the adsorption is significantly higher. The resulted CO_2 absorption during the day is approximately 2-5 times higher than emissions at night. For example, in mid-June, the absorption value was about 0.45 mol/m2 during the day-time, and the emission value was about 0.1 mol/m2 at night. After harvesting CO_2 emission is becoming essentially higher than adsorption. Autumn and winter data are fluctuate around zero, but for some periods a small predominance of CO_2 emissions over the absorption may be observed. The daily dynamics of CO_2 emissions depends on the air temperature with the correlation coefficient changes between 0.4 and 0.8. Crop stage, agrotechnological operation and soil moisture has stronger influence on the seasonal dynamics of soil and agroecosystem CO_2 emissions.

Obtained unique for Russian agriculture data are very useful for land-use practices environmental assessment, for soil organic carbon dynamics analysis and agroecological evaluation, and for food C-footprint calculation. Their system analysis together with the nearest forest eddy covariance stations helps us to understand better the land-use change impact on the GHG fluxes dynamics and ecosystem services.