Soil CO_2 emission measurements on laboratory and field scales

Eszter Tóth[a], Csilla Farkas[a]

[a] Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, HAS
Tel.: +36-1-212-2265 , E-mail: teszter@mail.iif.hu

Soil CO_2 emission measurements have been carried out on laboratory and field scales since 2005 in the Institute for Soil Sciences and Agricultural Chemistry, CAR HAS. The main aim of our work was to determine the tillage effects on soil CO_2 emission and on the main CO_2 emission controlling factors. Two experimental sites have been involved in our investigations; a tillage treatment experiment set up on Calcic Chernozem and a peach plantation set up on Mollic Cambisol. From these sites the less and most disturbed treatments - direct drilling (DD) and ploughing (P) in case of the tillage experiment and grass-covered (G) and regularly disked (D) rows in case of the plantation - were studied. Laboratory experiments were set up in climatic room (T = 21 ^{o}C, humidity = 35%), where air samples were taken from the headspace of undisturbed soil columns (h = 10cm, d = 10cm) originating from the different treatments. Under field circumstances manual static chamber method was used. The CO_2 concentrations of samples have been analysed using gas chromatograph and the emission rate was determined from the concentration changes. Beside CO_2 emission values the main soil properties (temperature, water content, humus content, organic carbon content, microbial activity, etc.) have also been determined.

We detected during the laboratory and the field measurements as well that directly after soil disturbance soil CO_2 emission values increased and significantly differed from those measured few days later. The emission from less disturbed treatments (DD and G) was higher almost on all measurement days during field measurements than in the other (P and D) treatments. With our experimental set up we could demonstrate the short – and long-term effects of tillage applications on soil respiration. We established that coherences between soil CO_2 emission and soil water content declined because of the effect of disturbance.