

The short-term effect of soil disturbance on water content and soil carbon-dioxide emission examined on the example of a soil tillage treatment

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Soil tillage treatment is thought to influence soil organic matter balance as well as the carbon-dioxide (CO₂) emission. Our soil CO₂ emission measurements were carried out weekly during the vegetation period (mid-March to October) since 2005 in a long-term tillage treatment experiment. The experiment site is located near the city of Hatvan, northern Hungary. The study site comprises of a chernozem (Calcic Chernozem – WRB) soil with a clay loam texture. The annual average precipitation is 580 mm (323 mm in the vegetation period). Six different tillage treatments were established at the site, from which the following three were involved in our investigations: no-till, ploughing (26-30 cm) and cultivating (12-16 cm). Beside the regular weekly measurements, one-day measurements were also carried out in the same treatments during the day of the tillage operations. Soil CO₂ emission was measured before the tillage operation and was used as a reference value of CO₂ emission for the treatments. After the different tillage operations were finished, in 20 minute intervals, simultaneous soil CO₂ emission measurements were taken in all treatments for 24 hours using static chamber method with five spatial replicates. In every hour - including night - the air in the chambers were sampled and later analysed on gas chromatograph. Ancillary environmental variables were also recorded including soil moisture and soil temperature values in every 10 minutes by installed probes. Our main aims were to determine the short-term effects of ploughing on soil CO₂ emission and the main driving factors such as temperature and soil water content. In the ploughing treatment the reference value of CO₂ emission (measured before the tillage) was 8.99 E-05 (+3.95 E-05) g CO₂ m⁻² sec⁻¹. 20 minutes after the tillage operation, soil CO₂ emissions were doubled; we measured 1.85 E-04 (+2.45 E-05) g CO₂ m⁻² sec⁻¹. Then a small decrease in CO₂ values were observed, in the following two hours CO₂ emission were 1.67 (+3.50 E-05) and 1.53 (+4.38 E-05) g CO₂ m⁻² sec⁻¹, respectively. Parallel with these measurements the soil CO₂ emission was also determined in the no-till treatment. In the first four hour of the measurement the emission values were 1.18 E-04 (+3.93 E-05), 1.30 E-04 (+1.85 E-05), 1.23 E-04 (+5.1 E-05) and 1.40 E-04 (+2.08 E-05) g CO₂ m⁻² sec⁻¹, respectively. Further results will be presented.

Keywords: tillage treatment, soil disturbance, CO₂ emission, soil water content