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Impacts of different soil tillage systems on soil respiration

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Carbon dioxide is an important greenhouse gas accounting for 60 % of the total greenhouse effect. In times of global warming the investigation of potential carbon sinks becomes more and more important. Due to soil microbial activity soil is one major source of atmospheric carbon dioxide, but it is also expected to act as a carbon sink under certain conditions. Consequently, an adapted soil management may enhance carbon sequestration in soils.

Tillage often decreases soil organic matter content and increases the flux of carbon dioxide from soils because soil gets aerated and soil microbial activity rises resulting in higher soil respiration rates. For investigating the impact of different soil management systems on carbon dioxide emissions a field study was performed during the vegetation periods of the years 2005 (sunflower) and 2006 (winter wheat). The study site is an agricultural field in Pixendorf near Tulln in the eastern part of Austria. It belongs to a long-term tillage experiment to determine efficiency of soil conservation. Average precipitation amounts to 685 mm, average air temperature to 9.4 ˚C. Soil texture is a sandy silt with 28 % sand, 62 % silt, 10 % clay and 1.2 % organic carbon content.

Three different tillage systems were investigated: Conventional tillage (CT), reduced tillage (RT) and no-tillage (NT) while RT and NT used cover crops during the winter period. There are three replications for each tillage systems (plot size 6 m x 100 m).

In most cases the study showed higher carbon dioxide releases for CT than for RT or NT however, differences were not always significantly. But as soil respiration is a result of microbial activity and therefore strongly influenced by temperature, soil water

content and a series of other physical and chemical properties the three replications of the same treatment system often showed numerical differences. Further intensive studies have to answer the question to which extent different soil respiration rates are due to tillage system or to site specific conditions and spatial variability.