Geophysical Research Abstracts
Vol. 17, EGU2015-2024, 2015
EGU General Assembly 2015

Soil erosion measurements under organic and conventional land use treatments and different tillage systems using micro-scale runoff plots and a portable rainfall simulator

Steffen Seitz (1), Philipp Goebes (1), Zhengshan Song (1), Raphaël Wittwer (2), Marcel van der Heijden (2), and Thomas Scholten (1)

(1) Eberhard Karls Universität Tübingen, Institute of Geography, Department of Geosciences, Tübingen, Germany (steffen.seitz@uni-tuebingen.de), (2) Agroscope, Federal Office for Agriculture, Zürich, Switzerland

Soil erosion is a major environmental problem of our time and negatively affects soil organic matter (SOM), aggregate stability or nutrient availability for instance. It is well known that agricultural practices have a severe influence on soil erosion by water. Several long-term field trials show that the use of low input strategies (e.g. organic farming) instead of conventional high-input farming systems leads to considerable changes of soil characteristics. Organic farming relies on crop rotation, absence of agrochemicals, green manure and weed control without herbicides. As a consequence, SOM content in the top soil layer is usually higher than on arable land under conventional use. Furthermore, the soil surface is better protected against particle detachment and overland flow due to a continuous vegetation cover and a well-developed root system increases soil stability. Likewise, tillage itself can cause soil erosion on arable land. In this respect, conservation and reduced tillage systems like No-Till or Ridge-Till provide a protecting cover from the previous year's residue and reduce soil disturbance. Many studies have been carried out on the effect of farming practices on soil erosion, but with contrasting results. To our knowledge, most of those studies rely on soil erosion models to calculate soil erosion rates and replicated experimental field measurement designs are rarely used.

In this study, we performed direct field assessment on a farming system trial in Rümlang, Switzerland (FAST: Farming System and Tillage experiment Agroscope) to investigate the effect of organic farming practises and tillage systems on soil erosion. A portable single nozzle rainfall simulator and a light weight tent have been used with micro-scale runoff plots (0.4 m x 0.4 m). Four treatments (Conventional/Tillage, Conventional/No-Tillage, Organic/Tillage, Organic/Reduced-tillage) have been sampled with 8 replications each for a total of 32 runoff plots. All plots have been distributed randomly within the treatments. Linear mixed effect modelling was used to examine the effects of the treatments on sediment discharge and surface runoff. Results were compared with recent findings from erosion models and laboratory studies.

Results show that sediment discharge is significantly higher (59 %, p=0.018) on conventional treatments (31.8 g/m2/h) than on organic treatments (20.0 g/m2/h). This finding supports results from several studies, which found soil erosion rates from 18 % to 184 % higher on conventional than on organic treatments. Under both farming systems, ploughed treatments show higher sediment discharge (conventional farming: 104 %, organic farming: 133 %, p=0.004) than treatments with reduced or no tillage. Runoff volume did not show significant effects in our treatments. An interaction between the farming practice and the tillage system could not be found, which strengthens the importance of both. With the help of a well-replicated micro-scale runoff plot design and a portable rainfall simulator we were able to gather reliable soil erosion data in situ in short term and without external parameterization. Our field assessment shows that organic farming and reduced tillage practices protect agricultural land best against soil erosion.