Geophysical Research Abstracts
Vol. 12, EGU2010-4987, 2010
EGU General Assembly 2010

Assessing the effect of soil management on soil functioning: a meta-regression analysis on European crop yields under conservation agriculture.

An Van den Putte (1), Gerard Govers (1), Jan Diels (1), Katleen Gillijns (2), and Matthias Demuzere (1)

(1) Department of Earth and Environmental Sciences, K.U.Leuven, Celestijnenlaan 200 E, 3001 Heverlee, Belgium (an.vandenputte@ees.kuleuven.be), (2) Province of Vlaams-Brabant, division Water, Provincieplein 1, 3000 Leuven, Belgium

Many strategies exist to combat soil degradation through erosion and compaction on agricultural fields. One of these strategies is conservation agriculture (CA). Reduced or zero tillage techniques, together with crop residue management and crop rotation are the pillars of CA. The term reduced tillage covers a range of tillage practices but it never involves inverting the soil. In this way, soil disturbance is minimised and crop residues are left on the soil. As CA also requires less wheel traffic that can increase soil bulk density and reduces infiltration rates, CA has the potential to reduce degradation and improve soil functioning. Studies in many European countries have shown that CA can indeed be very effective in combating soil erosion. However, soil and water conservation do not appear as main drivers in farmers' decisions to shift or not to CA. Economic factors tend to be more important, but there are a lot of uncertainties on this domain. Studies show that production costs are mostly reduced, mainly by reduced fuel costs. However, on production outcome, i.e. crop yield, a lot of uncertainties exist. To ensure proper functioning of agricultural soils that are prone to degradation, it is clear that these uncertainties have to be quantified. Many European studies have investigated the effect of reduced soil tillage on crop yields. However, the anecdotic evidence is often contradictory and therefore difficult to interpret. Most of them only cover a small range of field experiments, in one region. We present a meta-regression analysis (47 European studies, 565 observations) that compares crop yields under conventional tillage (CT), reduced tillage (RT) and zero tillage (ZT) techniques. We analysed the possible influence on the relative yield ((RT or ZT)/CT) of crop type, tillage depth, climate, CT yield and length of application of RT/ZT. ZT reduces crop yield on average with 8.5%. However, RT leads to a reduction in crop yields for maize and winter cereals only. By applying a linear mixed model, the importance of tillage depth and crop type as classification effects could be confirmed. Our analysis also allowed to identify some effects that are not always in agreement with common beliefs. For instance, yields under CA tend to decline with time, especially for monoculture maize. An effect of climate on relative crop yields could only be distinguished in the case of zero tillage: there is a positive relationship between crop yield and the seasonal water balance, contradicting the idea that CA is more efficient in dry areas due to more efficient water conservation.