Geophysical Research Abstracts
Vol. 12, EGU2010-12538, 2010
EGU General Assembly 2010

Phosphorus and potassium losses by runoff under three oats residue treatments in two no-tillage variants on a Southbrazilian Typic Hapludox

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Different variants of no tillage (NT), as for example disking or disking plus harrowing along a narrow strip, affect the state of the soil surface, mainly surface roughness and porosity. Soil surface conditions are also affected by the rate of left crop residues. In turn, soil surface state influences total water losses and nutrient losses due to water erosion. The objective of this work was to quantify total water losses as well as P and K content and losses in runoff water. Oat residues produced at the experimental field were applied at three different rates: 5.30 Mg ha^{-1}, 2.65 Mg ha^{-1}, and 1.32 Mg ha^{-1}, which corresponded to 1, $1/2$, and $1/4$ of dry mass production. Moreover, two variants of NT were tested, the first one consisted of disking alone with no additional furrowing, whereas the second involved a cutting disk plus a furrower with tine blades intended to till a narrow strip. The study was carried out in Lages-Santa Catarina, Brazil, during 2009 under simulated rainfall. A Swanson rotating-boom rainfall simulator was employed. The study soil is a Typic Hapludox with 0.16 mm^{-1} slope-steepness. The crop succession was first oats (*Avena strigosa*) followed by maize (*Zea mays*) during 2.5 years. In the first crop cycle, the soil was tilled using ploughing and harrowing twice and after them no tillage was practised. Simulated rainfall tests were carried out in each treatment at constant intensity of 64 mm h^{-1} with 75 minutes duration. Irrespective of crop residue rate, treatments where the soil was partly removed by the furrower showed the lowest total water losses. The range of soil water losses for all the crop residue rates and NT treatments was from 2.9 to 33.7 mm. In the treatments where the soil surface was mobilized by furrower water losses were 19.7 mm, 18.7 mm, and 2.9 mm for crop residue rates of 1, $1/2$, and $1/4$, respectively. However, when NT involved single disking and no furrowing water losses were 28.8 mm, 33.7 mm, and 19.4 mm, for crop residue rates of 1, $1/2$, and $1/4$, respectively. Phosphorus and potassium levels in runoff water showed a similar trend than water losses, so that they decreased as the crop residue rate decreased. In our conditions the value of P and K losses varied between 0.31 and 12.08 US \$ ha^{-1}. We concluded that the state of the soil surface under NT, which depends on the operations during sowing and on the rate of addition of previous crop residue, influence total water losses as well as P and K contents. In turn differences in P and K losses have a bearing on financial aspects of nutrient application.

Acknowledgement: This work was supported by Spanish Ministry of Education (Project CGL2005-08219-C02).