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Estimation of nutrient movement caused by wind erosion on chernozems based on wind channel experiments

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There are several studies all around the world, including Hungary to quantify the amount of soil eroded by wind. Estimation of eroded nutrients (humus, nitrogen, phosphorus, potassium) plays more and more important role in these investigations. Hungarian studies were focused mainly, however chernozem areas are also highly endangered. Our high quality chernozems can be eroded by wind mainly in springtime when the vegetation cover is quite low. This study focuses on chernozems in SE-Hungary in order to determine the movement and loss of soil nutrients by wind.

The study areas were chosen in the SE part of Csongrád County, near Csanádpalota, Csordakút and Apátfalva villages. From the upper 5 cm of each study plot 300-350 kg of soil samples were collected in July 2008 after harvest. All samples have silty loam texture with a humus content between 1,4-1,8 %. Experiments were performed in the wind channel at the University of Debrecen.

Samples were put into 30x50 cm holder and they were blown by wind at 4 different speeds (12, 13, 14 and 15 m/s) in a 12,3 m long wind channel. There were 3 parallel experiments for each soil sample, all of them took 15 minutes. Sediment traps were placed at 0-10 cm and 10-40 cm heights. Besides measuring the soil mass before and after the experiments, the mass of accumulated soils collected from the lee side of the holder and from sediment traps, the critical wind speed and the wind profile were also measured. From the collected samples the following parameters were measured: particle size distribution, pH, clay, carbonate, salt, humus, phosphorus (AL-P2O5), nitrogen and potassium (AL-K2O) content.

Eroded soil mass was between 0,5 and 3,4 kg and it grew with wind speed. Only small portion of the total eroded soil was sedimented after the holder, most of the moving soil was collected in the lower trap (0-10 cm), and only 20-30% were received by the upper trap (10-40 cm). There are important differences between the structure and nutrient content of the soils sedimented in these different places: sediments after the holder contain bigger aggregates with high clay and silt content, while sand without structure was caught in the two traps. Therefore the humus content is much higher after the holder, it can reach even 2 %.

The amount of eroded nutrients per hectare was calculated based on the weighted average of the nutrient content in the two sediment traps, the area of the sample holder and the total amount of eroded soil. The results show that the amount of eroded humus can reach 3 t/ha, phosphorus (P2O5) loss can exceed 60 kg/ha, potassium (K2O) loss is higher than 70-90 kg/ha and the nitrogen loss is between 280-340 kg/ha at the highest wind speeds.