Rainfall simulations of Jokioinen clay soils amended with gypsum to decrease soil losses and associated P transfer

Risto Uusitalo[1*], Kari Ylivainio[1], Pauliina Nylund[1], Liisa Pietola[2], Eila Turtola[1]

[1]MTT Agrifood Research Finland, [2]Yara International ASA/ Yara Suomi Oy,
*risto.uusitalo@mtt.fi

The bulk of phosphorus (P) loss is in annually tilled non-calcareous clay soils typically associated with soil losses. To decrease dispersion and off-site transport of soil matter, we amended two clayey fields with gypsum (6 tn ha^{-1}) that is obtained as a by-product of phosphoric acid manufacturing at Yara Siilinjärvi plant (East Finland); unamended plots and plots that received ground limestone (the same Ca application as with gypsum) were used as control treatments. The fields were cropped with spring-sown wheat and tilled either to about 10 or 20 cm depth in the autumn. Soil cores with 15 or 30 cm in diameter were retrieved for indoor rainfall simulations at intervals. The 15 cm diameter soil cores (4 of the 5 planned samplings analyzed to this date) were used for surface runoff generation (bottom plugged), whereas percolation water was collected from the 30 cm soil cores (1 of the 2 planned samplings analyzed).

As for surface runoff, gypsum application decreased particle mobilization from the uppermost surface soils, and also dissolved P concentrations in runoff as compared to the control treatments, but the effect of gypsum on the uppermost soil appeared to be fading one year (with 630 mm rainfall) after the amendment. In percolation water for which one set of soil cores (sampled 7 month after applications) have been analyzed, gypsum radically decreased turbidity, particulate P, and also dissolved P concentrations. At the same time, cation leaching and electrical conductivity of percolation water increased. Gypsum amendment didn't affect the harvested crop yields or nutrient uptake, except for hampering Se uptake by wheat (one crop year analyzed). Our results concerning lower soil losses after gypsum application were in agreement with the data from the simultaneous catchment study on gypsum effects on discharge quality (see the abstract of Ekholm et al. on page 26).