



## Horse paddocks - an emerging source of agricultural water pollution

Mohammed Masud Parvage, Barbro Ulén, and Holger Kirchmann

Swedish University of Agricultural Sciences (SLU), Ultuna Campus, 75007 Uppsala, Soil and Environment, Sweden  
(masud.pavrage@slu.se)

Horse farms occupy about 4% of the total agricultural land in the EU but are not well investigated with regard to their impact on water quality. Horse paddocks commonly hold horses on a limited space and the animal density often exceeds the recommended density. Therefore, paddock soils receive significant amounts of phosphorus (P) and nitrogen (N) through feed residues and deposition of faeces and urine, which can lead to nutrient build-up in the soil and subsequent losses to aquatic systems. This study characterized the potential risk of phosphorus (P) and nitrogen (N) leaching losses from Swedish horse paddocks through three stage examination of soil and water P and N status. The experiment began with a pilot study where surface soil P status and eight years of drainage P data were examined from a paddock catchment and an adjacent arable catchment both receiving similar amount of P and N over years. Results showed that there were no significant differences in water-soluble P (WSP) or total P data in soils but the drainage water P concentrations, being higher in the paddock catchment ( $0.33 \text{ mg P l}^{-1}$ , mainly in dissolved reactive form) than the arable catchment ( $0.10 \text{ mg P l}^{-1}$ ). In the second experiment, soil P and N status were examined in different parts of horse paddocks (feeding, grazing, and excretion areas) to identify existence of any potential hotspots for losses within the paddock. In total, seven horse farms, covering different grazing densities and soil textures representative of Swedish horse paddocks were examined. The results showed that concentrations of WSP, plant available P or P-AL (P extracted in ammonium acetate lactate solution at pH 3.75), and total N were highest in feeding and excretion areas within the paddocks. It was also observed that the WSP concentration in the paddocks was strongly correlated with horse density ( $R^2 = 0.80$ ,  $p < 0.001$ ) and P-AL with years of paddock management ( $R^2 = 0.78$ ,  $p < 0.001$ ). In the final experiment, topsoil columns (0-20 cm) from the different segments of the paddock were isolated and potential leaching losses of P, N and carbon (C) were measured from two representative horse paddock (a clay and a loamy sand) following simulated rainfall events in the laboratory. Results showed that the leachate concentrations and net release of P, N, and dissolved organic C (DOC) from paddock topsoils were highest in feeding and excretion areas and considerably higher from the loamy sand than the clay paddock topsoil. It was concluded that: i) horse paddocks pose a potential threat to water quality via leaching of excess P and N, ii) feeding and excretion areas are potential hotspots for highly enhanced leaching losses, and iii) paddocks established on sandy soils are particularly susceptible to high losses.