Seasonal and spatial changes in easily soluble P in buffer zones under different management practices in Finland

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Fertilization and harvesting of agricultural fields cause changes soil P cycle. Along with the human induced changes in soil P status, soil labile P is also subjected to seasonal changes caused by varying e.g. meteorological and soil conditions (Styles and Coxon 2007). Regarding buffer zones (BZs) established between a cultivated field and a watercourse, the P status of BZs is also affected by the management of the field above these sites. The aim of this study was to evaluate the amounts, and seasonal and spatial changes in easily soluble P in differently managed vegetated BZs in Finland.

The vegetated, unfertilized BZs, established in 2002 or 1991 in SW Finland, have been (i) harvested by cutting the grass and subsequently removing the residue or, (ii) the vegetation has not been removed at all. The experimental soil was classified as a Vertic Cambisol (clay content > 50%, pH(H_2O) > 6.0, org. C < 5.4%). The soil samples were taken with six replicates in 2005 on May, August and October and in 2006 on April to the depth of 10 cm. Dilute $CaCl_2$ extraction (0.01 M, 1:50 w:v, 1 h) was done for air-dried and sieved (2 mm) soil samples. Molybdate-reactive P (MRP) and total P (TP, acid $K_2S_2O_8$ oxidation) were determined on centrifuged and filtered samples with a molybdenum blue method of Murphy and Riley (1962).

The preliminary results indicated that in the uppermost 2.5 cm, differently managed BZs exhibited different, even reverse trends in seasonal variation in soil easily soluble P. In the 14-year-old unmanaged BZ, TP and MRP showed a spring maximum, and summer and autumn minimums, whereas in the 14-year-old mechanically harvested BZ, MRP and TP peaked distinctly in late growing season. Regarding the deeper soil layers, the differences between BZs in seasonal patterns for soil P evened out. However, high variation between replicates indicates the complexities of sampling unploughed and/or unmanaged soils where the organic residues accumulated on the soil surface. Variability within the BZs and mechanisms related to effectiveness of P removal may vary in differently managed BZs, and these differences are reflected to P cycling in the soil. Further studies with more frequent sampling are therefore needed to understand the management-related variation in biogeochemical cycling of P.

Murphy, J. and J.P. Riley. 1962. A modified single solution method for the determination of phosphate in natural waters. Anal. Chim. Acta 27:31−36.

Styles, D. and C. Coxon. 2007. Meteorological and management influences on seasonal variation in phosporus fractions extracted from soils in western Ireland. Geoderma 142:152−164.