Do a simple water dispersion test and soil properties allow to evaluate and prevent the risk of eutrophication deriving from soil particulate P losses?

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Under the requirements of the EU Water Framework Directive (WFD), surface waters must achieve good chemical and ecological status by 2015 (European Parliament, 2000). Levels of P are of particular concern, because P favours algal growth in surface waters and is the key limiting nutrient in freshwater rivers and lakes. Inputs from agriculture account for up to 20% of all P inputs to surface waters. Indeed, many European soils are overfertilized and, as a consequence, controlling the transfer of P from agricultural land to water has become a priority for catchment managers.

Many European regions have adopted mitigation measures to limit P transfer from soil to waters, most of them applied to a limited portion of the catchment, the so called 'critical areas'. Thus simple tools able to identify the critical areas are needed.

According to the main process responsible for P transfer, different P forms are mobilized and thus the appropriate tool must be used. Where leaching is the prevalent process, soluble P (RP) is the main mobilized form while in runoffed subjected soils P is mobilized in particulate form attached to the suspended solids. On average particulate P (PP) represents up to 90% of the total P lost, and total P losses depend both on soil particle dispersion and on P solid enrichment.

To estimate P losses by leaching many Authors related RP to the soil P status through various equations, while by runoff potentially mobile PP can be predicted using dispersion tests, or as a function of soil properties affecting both soil dispersion and P enrichment.

Recently a simple test based on water dispersion with quite large soil to solution ratios has been proposed and validated through outdoor and indoor experiments (Withers et al., 2007). This test has been applied to various soil types in order (i) to obtain pedotransfer functions able to predict the risk of soil and P losses from soil properties (Withers et al., 2007, Borda et al., 2010), (ii) to evaluate whether the P suspended particles may act as sink or source of P as a function of soil P status (Hartikainen et al. 2010, Withers et al. 2009, Borda et al., 2011a, Borda et al., 2011b) and to individuate which is the size of more P enriched and potentially lost soil particles (Quinton et al. 2009).

Aim of this work is to review the results obtained with the water dispersion test:

a) to calculate pedotransfer functions for a larger number of soil types;

b) to evaluate the efficacy of the test to highlight modifications induced by applied mitigation options (minimum tillage, low input, increased aggregation, increased organic matter);

c) to estimate the effective availability of P bound to dispersed particles.