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The Phosphorus Transfer From Soil To Water As Affected By The Agronomic Management

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Fertilizer management, in the long term, can affect the amount of P that can be in excess compared to the cultural needs and modify the soil P buffer capacity. These factors can led to P losses from soil to waters, especially via runoff and as particulate P (90% of TP). Soil texture and the amount of organic matter are the main key factors to estimate soil disperdibility but, in turn, the P amount and its forms can also have a dispersive effect and can influence P enrichment of particles potentially lost during runoff processes and its contribution to water eutrophication.

The environmental impact due to the P transfer depends on P speciation, because only the inorganic and soluble P forms, or the most degradable organic P ones, are bioavailable.

To evaluate the effect of agronomic practices on P losses and on its bioavailability in the long term, soil samples from a middle term experiment have been selected. The field experiment is based on maize cropping systems applying different fertilizers, mineral, as NPK and PK, and organic, as manure (M) and slurry (S) since 1992. To obtain the suspended sediment from soil, a simple water dispersion test was applied (Withers et al., 2007) and the different P forms were characterized. On soil and on suspended sediment the Hedley fractionation (Hedley et al., 1982) was used to determine the P forms, their potential lability and the effect on soil disperdibility. The adoption of isotopic techniques was considered to compare different methods and to estimate the risk of P losses in the long-term.

Dispersion test, to simulate the rainy event and the irrigation practices effect on soil, showed that the amount of total suspended sediment lost (TSS) was lower in the organic fertilized plots, while the particulate P bounded to sediment (PP/TSS) was higher than in the mineral fertilized plots. Indeed the complexive effect of organic fertilization, increasing organic matter content and Olsen P, was reflected in a lower soil dispersibility but in a P enrichment of the potentially lost particulate.

In the sediment lost during runoff, as well as in soil, the agronomic management did not affect the P build-up like apatitic nor residual P, which can indicate the evolutive soil status. The mostly affected forms were the labile and medium labile ones: resin extractable P was the most representative fraction, up to 5.7 and 14% of total P in soil and in the suspended sediment, respectively.

The soil P buffer capacity, as described by DPS was related to the different P fertilization, and, an increase of saturation degree was observed in the order of NPK < PK < S < M both in soil (29 – 46%) and in the suspended sediment (35 – 52%). These data were further confirmed by isotope exchange kinetics (IEK) with labeled P, with a larger 33P-31P exchange in the slurried and manured plots,

From these results it appears that P fertilization should be carefully managed to limit nutrient losses from soil to waters especially in the particulate form.

Key words: phosphorus fractions, fertilization, phosphorus availability, soil dispersion, IEK