Contribution of P supply to P losses from fields

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Phosphorus losses by runoff or subsurface drainage in fields mainly come from two sources:

- mobilization of P accumulated in the soil
- inorganic or organic fertilizer supply followed shortly after by rainfall causing runoff or subsurface drainage. Such losses called incidental losses (Whithers et al 2003) sometimes accounts for the largest losses of P.

The share of P losses due to incidental transfers following P supply was determined in a long term field experiment carried out in western France on a silty soil, during 10 years (1998-2007). Flows from runoff and pipe drainage coming from 5 plots (4200 to 10800 m^2) were continuously collected and weekly sampled in order to measure the concentration of total and dissolved P (total P in water filtered to 0,70 µm). One of the five plots (L1) was not drained. The plots L1, L2, L3 were cropped with maize and wheat and L4, L5 were cropped with wheat, pea and rape. For L1, L2, L3 each crop received each year a P supply from cattle manure and sometimes an additional supply of triple super phosphate. L4, L5 received only phosphorus from triple super phosphate fertilizer.

Incidental P losses due to phosphorus supplies were detected by the abrupt changes in slope of the relationships between cumulated flows during the 10 years and the cumulated loads of dissolved P. The contribution of the soil to dissolved P losses was calculated from the relationship established by omitting the periods when incidental P losses occurred.

Over the 10 years of this experiment the incidental losses due yearly applications of manure or fertilizers contributed for 36 to 53 % of the total losses of dissolved P depending on the plot. For all the plots the losses attributable to phosphorus applications (fertilizer transfer ratio) represented less than 1% of the amount of phosphorus supplied to the crops.

Table 1: Total P inputs, flows, dissolved P losses and share due to the P supplies for 5 plots during the 10 years of an experiment carried out in western France

Plot	L1	L2	L3	L4	L5
P inputs (kg P ha^{-1})	464	464	464	274	274
Runoff + Drainage (mm)	2225	2965	2661	2491	2727
Dissolved P losses (g P ha^{-1})	7957	5279	6508	4699	4554
Weighed DP concentration (µg P L^{-1})	358	178	245	189	167
Share due to P supply (%)	53	45	42	36	48
Fertilizer transfer ratio (%)	0.91	0.51	0.58	0.62	0.81

Whithers J. A., B. Ulen, C. Stamm, M. Beckmann. 2003. Incidental phosphorus losses- are they significant and can they be predicted? J. Plant Nutr. Soil Sci. 166:459-468.