

Biologically adjusted P cycle as a measure to reduce P losses from Finnish agriculture

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How much would phosphorus (P) losses decrease from cultivated fields, if P was applied in Finnish agriculture according to the actual, biological need of plants and livestock? We estimated the decrease in P transport by taking account the current P status of the cultivated fields. The adjusted P cycle for Finnish agriculture was calculated for twenty years onwards using yield responses to P fertilization according to a recent overview of P fertilization experiments in Finland. The estimation was done for the whole country and different smaller regions having either intensive animal production (Varsinais-Suomi, pig and poultry,; Pohjanmaa, dairy cattle and fur production) or mainly plant production (Uusimaa). We considered plant P uptake, P balances and consequent changes in soil P status, the latter being estimated according to equations from long-term fertilization trials. Fertilization was adjusted in five-year intervals along with changes in soil P status. As manure application is often an important factor behind over-use of P, we further quantitatively estimated possibilities to reduce P content of manure by adjusting livestock diets. The calculations resulted in biologically justified P fertilizer requirements, P contents in manure and P status of soil after 5, 10, 15 and 20 years in the different areas. The potential of dissolved P losses from soils was estimated from soil P status using a simple equation. According to the calculation, the amount of P fertilization at the starting point (in 2005) was over 4-fold compared to the actual need of cultivated plants, and in areas of intensive animal production it was even higher, more than 10-fold. If P fertilization was adjusted according to the biological response, no P in chemical fertilizers would be applied and a substantial amount of manure would be transported out of the latter areas during the next twenty years. If the livestock diets were adjusted towards minimum P contents, P amount in animal manures would decrease by 12%. In twenty years, 49 % of P applied to fields would be saved compared to situation where P fertilization would continue as in 2005. For chemical P fertilizers, the saving would be 90%. Meanwhile, the transport of dissolved P into surface waters from the cultivated soils would decrease by 30-40 %, most in areas of intensive animal production, which contribute to the water quality of the Baltic Sea.

Key words: Livestock, manure, P fertilization, soil P status
