Biomass harvesting decreases phosphorus runoff from frozen and thawed grass fields

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Dense grass on fields decreases erosion and particle bound nutrients in surface runoff. In cold regions, however, high amounts of dissolved reactive phosphorus (DRP) may be leached from perennial grass and soil surface in spring due to P liberation from frost-injured vegetation.

Study methods

Undisturbed soil blocks (0–7 cm) were taken from grass fields (Fig. 1). Before indoor rainfall simulation, the blocks were frozen and thawed in cool. Surface runoff was collected for P analyses (Fig. 2). Soil samples (0–2, 2–5 and 5–10 cm) were also taken for analyses of plant available P (P_{Ac}).

Phosphorus loss potential from frozen and thawed grass was estimated in laboratory study, Plants were sampled from a grass field in October. They were frozen, thawed and washed with deionized water in cool. The solution was filtered for P analyses (Fig. 3) and the grass was frozen again. Concentration of TP in different age of plants was also investigated.

Figure1. Soil blocks taken from grass fields

Figure 2. Rainfall simulation

Figure 3. Filtration of grass leachates

Results

Freezing and thawing of the samples increased the surface runoff DRP concentration from 0.19–0.46, to 2.6–3.7 mg l^{-1}. (Fig. 4). The highest relative increase was 14-fold and peak DRP concentration was 3.7 mg l^{-1}. Soil P also increased in surface when grass was not harvested (Fig. 5).

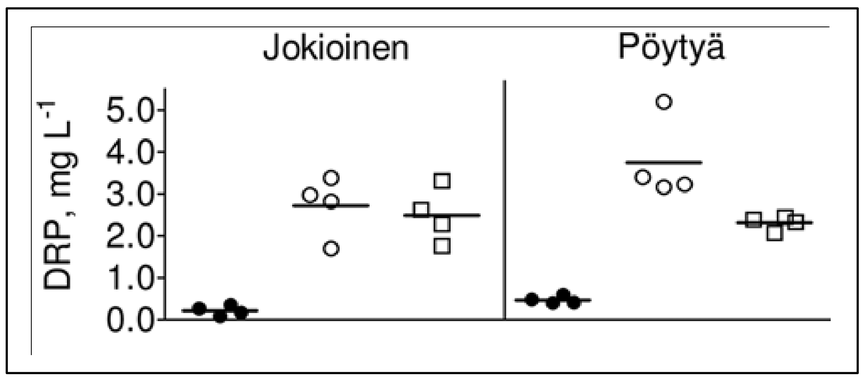

Figure 4. Concentration of DRP in runoff from the rainfall simulation study before (black) and after (white) freeze-thaw cycles of the soil blocks

High DRP quantities (1.6–3.1 kg ha^{-1}) were observed in plant leachates after freeze-thaw cycles (Fig. 6). The concentration of total P (TP) in plants decreased during growing season (Fig. 7).

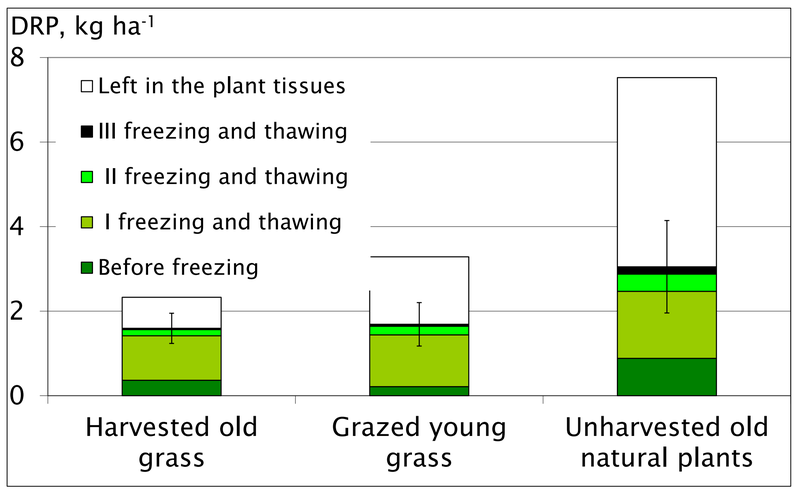

Figure 6. Losses of DRP in plant leachates

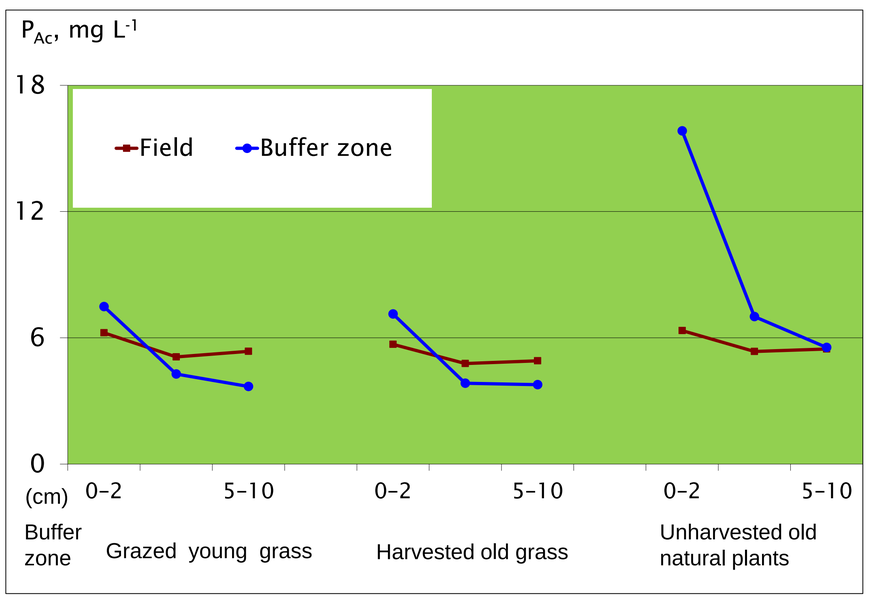

Figure 5. Concentration of P_{Ac} in grassed soil

Conclusion

The spring time load for DRP from grass to water can be decreased by annual harvesting of the grass biomass. More research is needed to specify the optimum harvest time.

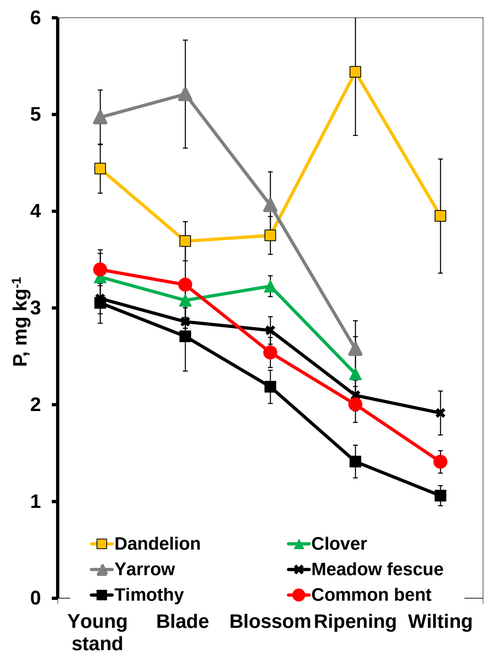

Figure 7. Concentration of TP in plants

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