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**Background** Agriculture is a significant component of phosphorous (P) loadings to surface waters in Ireland and P losses from agriculture have to be lowered if eutrophication is to be controlled.

However elevated P losses from agriculture reflect a number of factors, including build-up of soil P and losses associated with manure spreading to land. Grassland productivity and cattle stocking rates in Ireland have increased by over 100%. The question arises whether grazing animals are directly contributing to P losses?

To answer this question a comparison was made of P losses in overland flow from grazed and cut field plots with range of soil test P (STP). Phosphorus in runoff was sampled on a flow proportional basis throughout 2002 and 2003 from three sets of ca.1 ha paired cut and grazed grassland plots. Plots were paired according to Morgan's STP status which ranged from 3.5 to 17.9 mg L<sup>-1</sup> soil. Grazing took place from April to September-October under two regimes: A continuous-extensive system at the low STP site and a 21 day rotational-intensive regime on the more productive plots.

**Results** Mean annual total P (TP) measured in runoff from plots ranged of 0.17 to 0.91 mg P L<sup>-1</sup> and tracked differences in STP status between plots. DRP was the largest P fraction and the range of concentrations (0.04 to 0.66 mg P L<sup>-1</sup>) was also linked to STP. The concentration range for particulate P (PP) was 0.07 to 0.18 mg P L<sup>-1</sup>. Dissolved unreactive P (DUP) was the least abundant P fraction and covered the range 0.03 to 0.10 mg P L<sup>-1</sup>.

All sites showed a peak in P concentrations in autumn when overland flow commenced. This peak took 2-3 months to subside (Figures 1 and 2).

This strong seasonal component to P concentrations occurred irrespective of grazing or cutting regimes and in some plots overland flow only commenced after grazing had ended in early autumn. It dominated annual P losses

Overall it was not possible to show consistent differences in annual P losses between cutting and grazing regimes.

Figure 1 plots seasonal changes in TP over two years from one of the two rotational grazing plots. Grazing and overland flow only occurred together with any frequency during April to June of 2002. During this period there was not a statistically significance difference between TP concentrations in runoff from the cut and grazed plots.

In contrast, on the second rotational grazing plot heavy rain in April 2002 did coincide with the presence of grazing cattle. This resulted in significant poaching of the pasture (ground disturbance). Overland flow from this grazed plot had an much more opaque appearance than from the cut plot. (See photographs below)

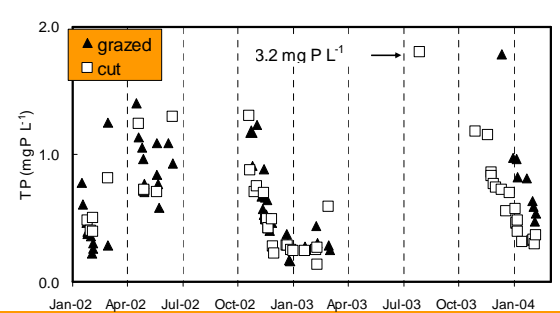


Fig.1 Total P in runoff from plots with STP of 7 mg P L<sup>-1</sup>

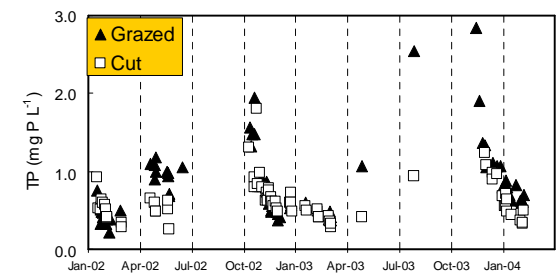


Fig.2. Total P in runoff from plots with STP of 17 mg P L<sup>-1</sup>

Poaching on a rotationally grazed plot after heavy rain in April 2002



Appearance of overland flow P dat in Figure 2



During April-June 2002, TP from the poached grazed plot averaged 0.97 mg P L<sup>-1</sup> compared to 0.52 mg P L<sup>-1</sup> from the cut plot (Fig. 2)

The increase reflected significant increases ( $p < 0.05$ ) in DRP (+0.24 mg P L<sup>-1</sup>) and PP (+0.28 mg P L<sup>-1</sup>). The change (+0.02 mg P L<sup>-1</sup>) in DUP was not significant.

As most runoff occurred in winter, this grazing effect only represented less than 10% of annual TP export from the plot of 2 kg P ha<sup>-1</sup> year<sup>-1</sup>.

**Conclusions:** Where surface poaching of pasture and wet weather coincided, elevated concentrations of both dissolved reactive P and particulate P were observed. Where poaching did not occur this increase was not observed.

As most of the annual P loss occurred in autumn and winter after grazing finished and when TP concentrations and overland flow were both high, this potential grazing/poaching effect had only a small impact on TP loss rates.

To minimise P losses poaching should be avoided. On most farms this would already be good practice to prevent damage to the grass sward.