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Leaching losses of N, P and K from grazed legume based swards: some preliminary results

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Introduction There is increasing interest in sustainable agricultural systems because of environmental concerns. Animal production which utilises mixed grass and legume swards could be an effective measure in increasing the efficiency of nutrient utilisation, and investigation into different legume species is necessary. Leaching losses of N, P and K from 3 legume species under grazing by sheep were measured using *Teflon*-coated suction cups. The experiment took place on the UK site of the EU-funded, multi-site experiment – LEGGRAZE.

Materials and methods Three replicate plots (0.55 ha each) of 3 legumes species:- white clover (*Trifolium repens*), Caucasian clover (*Trifolium ambiguum*) and lotus (*Lotus corniculatus*), each in mixtures with ryegrass (*Lolium perenne* L.), were established in June 2002 at the Institute of Grassland and Environmental Research, North Wyke Research Station in Devon. The site is gently undulating on a free draining sandy loam soil (FAO dystric or eutric cambisol) over a deep water table. The plots were grazed by lambs (Suffolk x Mule) at a continuous variable stocking rate to maintain a sward height of approximately 7 cm, from mid August until mid-October. In October 2002, twenty *Teflon*-coated suction cups per plot were installed on a square (5 x 4) grid basis at a depth of 90 cm. These were sampled on 4 occasions during the drainage season (December to March). The samples were filtered (<0.45 microns) and frozen prior to analysis for $\text{NH}_4^+\text{-N}$, $\text{NO}_3^-\text{-N}$, total N, soluble reactive P, and K. Drainage was calculated as: 'rainfall minus evapotranspiration' and each increment in drainage was allocated to the measured nutrient concentrations.

Results The total drainage for the season was 489 mm with 252 mm measured in December
N: White clover, lotus and Caucasian clover lost (mean values) 10.8, 8.2 and 6.4 kg inorganic N/ha and 13.4, 10.6 and 8.9 kg total N/ha, respectively, by leaching over the drainage season with greatest losses observed in December from all treatments. The strongest mean concentrations of $\text{NO}_3^-\text{-N}$ (mg/l) from each treatment were found in March: 2.9 (white clover), 2.4 (lotus) and 2.0 (Caucasian clover).

P: Caucasian clover, lotus and white clover lost (mean values) of 0.98, 0.48 and 0.47 kg soluble reactive P (SRP)/ha, respectively, over the drainage season, of which 0.66, 0.34 and 0.31 kg SRP/ha was lost in December. The strongest mean concentrations of SRP were found in March: 0.26 (Caucasian clover), 0.13 (lotus) and 0.12 (white clover) mg SRP/l.

K: Caucasian clover, lotus and white clover plots lost (mean values) of 22.0, 13.6 and 11.8 kg K/ha, respectively, over the drainage season of which 17.6, 7.3 and 7.1 kg K/ha was lost in December.

A visual assessment of percentage cover of the sown species conducted in September 2002 gave lotus; white clover and Caucasian clover mean covers of 22%, 20% and 7%, respectively.

Discussion and conclusions These preliminary findings show that, whilst the overall amounts of nutrients leached were relatively small, they are comparable with other studies. Drainage during the winter period was lower than average (*viz.* 89% of 30 year mean) which may have reduced the amount of nutrients lost. Mean $\text{NO}_3^-\text{-N}$ concentrations were weak relative to water quality legislative limits, but the highest mean SRP concentrations measured exceeded the OECD 35 $\mu\text{g/l}$ total P threshold for increased risk of eutrophication in standing waters. The small differences in the amounts of N leached from the 3 legumes may be a reflection of the different legume contents of the swards, where interactions between source (N fixation) and sinks (unfertilised grass) and the extent to which the different legumes could have improved the soil structure (Scholefield, 2003; Rochon *et al.*, 2004 and Mytton *et al.*, 1993) would further complicate the between-species comparisons. However, these findings will be put into a wider environmental context when the results from all the European sites, over 3 years, are reported in a future paper.

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