

North Wyke Farm Platform

Case study no. 12

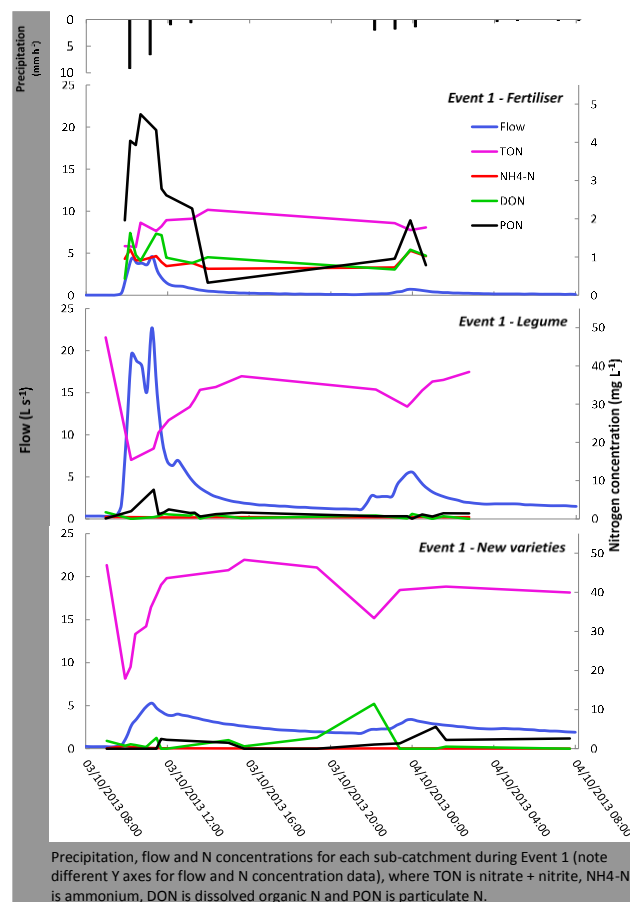
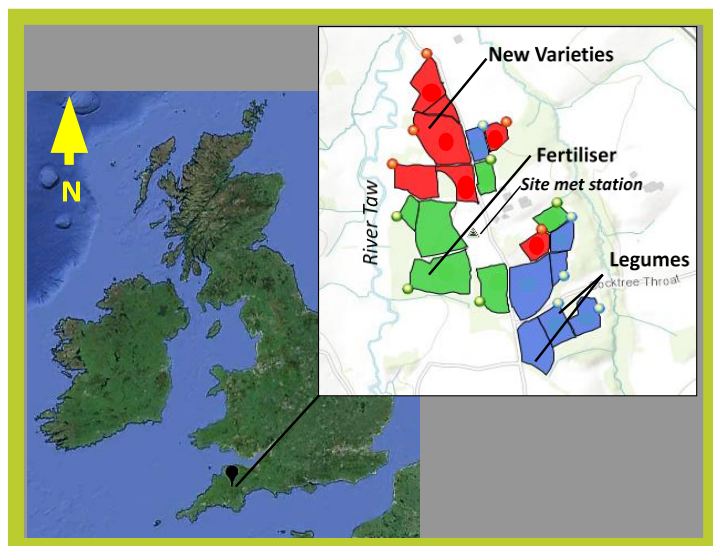
Transfers of dissolved organic nitrogen under different grassland management systems

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The North Wyke Farm Platform (NWFP) lies within a nitrate vulnerable zone, which means it is at risk of nitrate pollution from agriculture. Another nitrogen (N) pollutant is ammonium, which can also pose a risk to the health of freshwater systems. The NWFP, with its 15 hydrologically isolated sub-catchments, is well placed to monitor both nitrate and ammonium losses from grassland systems. Consequently, nitrate and ammonium in the combined surface and lateral-subsurface flow from each of the NWFP sub-catchments are measured at 15 min intervals where flow occurs. However, another potential N pollutant is the organic N fraction. Nitrogen in its organic forms can also pose a risk to aquatic systems, as it can also be readily cycled by microorganisms and some plants. At the NWFP organic N losses are an unquantified N loss pathway, which could be particularly significant in an agricultural system where N amendments from farmyard manure, and direct inputs via urine and dung from grazing animals occur.

In this study hydrological N losses during 3 rainfall events, (1) 3rd Oct 2013, (2) 3rd Apr 2014, and (3) 7th Apr 2014, are quantified on 3 different grassland management systems on 3 NWFP sub-catchments (see figure below), to determine the importance of organic N losses, both as dissolved organic N (DON) and particulate N (PN):

- Fertiliser – sward is improved through increased fertilisation
- Legumes – white clover is introduced to reduce nitrogen fertiliser requirements
- New varieties – permanent pasture is reseeded with a high-sugar grass to increase early stage animal growth



The figure above provides an example of the temporal variation in N concentrations across the rainfall event.

Results summary:

Event 1:

- Greatest N losses occurred following ploughing and reseeded on the legumes and new varieties treatments, at 1.1 and 1.4 kg ha⁻¹ respectively
 - The N loss from the legumes and new varieties treatments was dominated by nitrate at 89 and 92% respectively
 - Under the fertiliser treatment, which had not been ploughed, losses were lower at 0.4 kg ha⁻¹ and this was dominated by PN and nitrate at 44 and 26% respectively
- Events 2 & 3
- Under all treatments N losses were dominated by the soluble and more easily mobilised DON fraction and nitrate

Conclusions

This study has shown that DON and PN can comprise a significant proportion of N lost from grassland systems in runoff.

However, following ploughing and reseeded mineralisation of soil organic N led to large nitrate losses once runoff occurred in the first flow event following the reseed. More measurements of PN and DON are required to determine their contribution to N losses from grassland systems.