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Medium term fate of carbon in upland grassland subjected to liming

B. Foereid (1) L.A. Dawson (2) D. Johnson (1) J.I. Rangel-Castro (1)

(1) Plant & Soil Science, University of Aberdeen, UK, (2) Macaulay Institute, UK
(b.foereid@abdn.ac.uk / Fax: +44 1224 272703 / Phone +44 1224 272257)

Knowledge of the fate of plant assimilate is fundamental to our understanding of the terrestrial carbon cycle, particularly if we are to predict the effects of changes in climate and land management practices on agroecosystems. These processes are described in carbon turnover models. When grasslands in Scotland were simulated using the CENTURY model, large discrepancies between simulated and observed values of soil carbon and nitrogen were found (Foereid et al., 2007). It was assumed that low and variable pH at the sites could explain the results. However, we wanted to investigate this further. At one of the simulated sites, Sourhope, an experiment containing limed and unlimed acid plots had been running for several years. Pulse-labelling with $^{13}CO_2$ at the site (Johnson et al., 2002; Rangel-Castro et al., 2004) have revealed that some of the carbon fixed by plants is rapidly allocated below-ground and released back into the atmosphere in respiration. However, little is known about the fate of plant assimilate, not accounted for in soil respiration, in the longer-term and how current management practices such as liming may affect this. The labelled plots were therefore re-sampled 1 and 2 years after labelling. The amount of labelled carbon remaining in shoot, root and bulk soil pools, and how this differed between limed and unlimed plots was investigated. The results indicated that plant root turnover was faster, and plants invested less nitrogen in the roots in the limed plots than in the unlimed plots (Foereid et al., 2006). More ^{13}C remained in the soil in the unlimed treatment compared to the limed treatment, but the main difference was found in the particulate organic matter, which turned over relatively quickly. The label was still above natural abundance one and two years after labelling in many cases. In addition, the results demonstrate that a

$^{13}CO_2$ pulse-label administered for only a few hours can be a useful approach for investigating turnover of carbon several years later.

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