PLANT-MICROBE INTERACTIONS CONTROL N LEACHING FROM GRASSLAND SOILS

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Nitrogen (N) leaching from agricultural soils is a major problem. It has resulted in widespread changes in plant community composition and loss of grassland species diversity, hypoxia in aqueous systems, and increased levels of nitrate in drinking water with consequences for human health. Evidence is culminating that extensively managed grasslands with fungal-based soil food webs are less leaky of N than their intensively managed, bacterial-based counterparts. Extensively managed grasslands have lower N availability, supposedly because fungi slow down rates of N cycling and immobilize added N. However, because of the strong links between plant communities and soil microbes it is not clear which of the two is a stronger control of N leaching. Here, we explored how grassland management affects N leaching in a field sampling across 22 mesotrophic grasslands in northern England. Leaching losses of inorganic N were lower from extensively managed, plant species rich grasslands than from intensively managed, species-poor grasslands. We found that N leaching was best predicted by shoot C/N ratio of the plant community. In turn, the fungal/bacterial ratio, measured by microscopy, was best explained by the C/N ratio of roots. We tested the mechanisms for differences in N leaching in a linked greenhouse experiment with soils from a subset of these grasslands, to which we added 15N. We found that extensively managed grassland soils also retained added 15N better; further analysis will show whether this was because of increased uptake of 15N by microbes or plants. These results show that interactions between plants and microbes control N leaching from grasslands, and might help to improve management for N retention in soils, which is central to ‘sustainable intensification’ of agriculture.