North Wyke Farm Platform

Case study no. 35

How do Deep Rooting Grasses affect Soil Micronutrients

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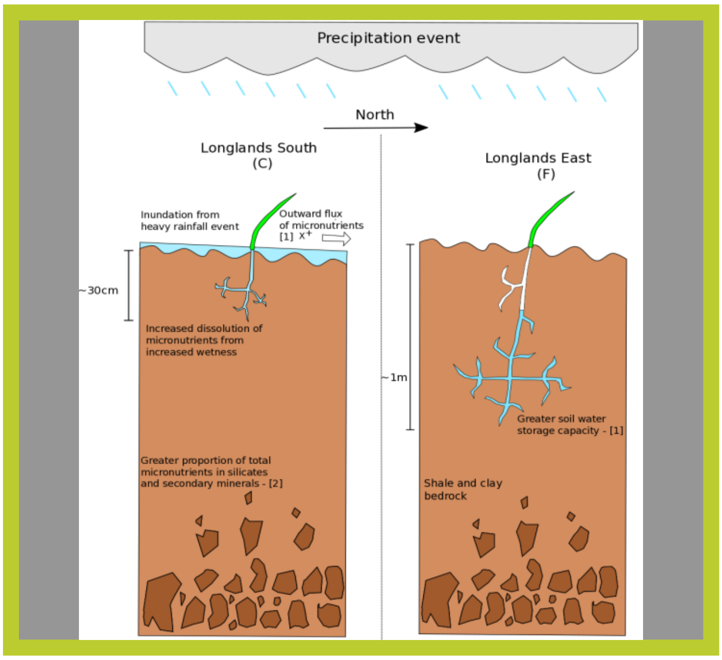
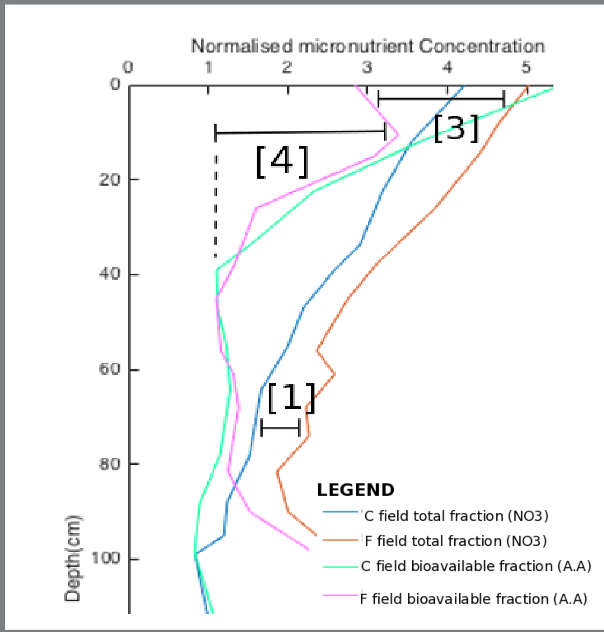
Micronutrients are an important part of human and non-human nutrition, but recent concerns have been raised about the declining levels of micronutrients in foods. Micro- and macronutrients are removed from soil as crops are harvested, but fertilisers typically only replace macronutrients N, P, K. Furthermore, most studies of soils only measure C, N, and P, and focus on the top 10-30 cm of the soil. However, the production of inorganic nutrients via chemical weathering happens predominantly at the rock-soil interface, well below this depth. The ultimate source of most micronutrients is from weathering of minerals, although additional sources include atmospheric deposition and deposition of sediments or solutes via erosive or fluvial transport.

Plants take up micronutrients through their roots. Deep rooting plants have been developed to increase C-sequestration and to adapt to changes in hydrological processes driven by climate change (i.e., flooding and drought), but it is not yet known how these grasses may influence the bioavailability or the distribution of micronutrients in soils. At the North Wyke Farm Platform, deep rooting grasses are grazed by sheep in several fields on heavy clay soil with an underlying shale layer. Their roots can potentially grow to 1 m depth, in contrast to conventional grasses which have rooting depths of approximately 30 cm.





As a 3rd year undergraduate research project for students on the Environmental Geoscience degree course in the School of Earth Sciences at the University of Bristol, 3-5 students per year examine the soil micronutrients and associated soil parameters (colour, moisture, pH, bulk carbon and nitrogen) in depth profiles (to 1 m) at the NWFP in a field (Longlands East), planted with deep-rooting *Festulolium loliaceum* (**F in the figures**), and in a nearby field (Longlands South) , planted with a conventional grass, *Lolium perenne* (**C in the figures**). This project was completed in 2015-2016.

The deep rooting grass was developed to increase infiltration of rain water, as a flood prevention mechanism. The previously demonstrated reduction of these runoff events with the *Festulolium* cultivar was associated with an increase in total nitric-acid extractable micronutrient content when compared to control conditions of a field cultivated with the common *Lolium* alone. In contrast, the more bioavailable (ammonium-acetate extractable) fraction of all micronutrients analysed, decreased slightly with large associated uncertainties. Possible reasons for this reduction include decreased inundation frequency in the *Festulolium* field (F), differences in pH, biomass or chelation. A more regularly inundated soil would remain wet for longer, leading to increased rates of dissolution from other micronutrient pools. This chemical action would act to increase the concentration of the bioavailable fraction in the *Lolium* field (C). This conclusion is based on a statistical correlation of soil moisture content and the ammonium acetate-extracted fraction of micronutrients.

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