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Multiscale modelling of plant nitrogen use efficiency

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Nitrogen fertilization is vital for productive agriculture and efficient land use. However, globally, approximately 50% of the nitrogen applied is lost to the environment, causing inefficiencies, pollution, and greenhouse gas emissions. Rainfall and its effect on soil moisture are the major components controlling nitrogen losses in agriculture. Thus, changing rainfall patterns could accelerate nitrogen inefficiencies. We first used the pore scale model from XCT to assess the effect of single fertiliser granule dissolution on soil pore scale N dissolution and microbial processes. Then we upscaled this model to the field scale and used a mechanistic modeling platform to determine how this influences field scale processes. Following this we used the plant N uptake model to determine how precipitation-optimal nitrogen fertilization timings and resulting crop nitrogen uptake have changed historically (1950–2020) and how they are predicted to change under the RCP8.5 climate scenario (2021–2069) in the South East of England. We found that that the interannual variation in precipitation-optimal uptake is projected to increase. Ultimately, projected changes in precipitation patterns will affect nitrogen uptake and precipitation-optimal fertilization timings. We argue that the use of bespoke fertilization timings in each year can help recuperate the reduced N uptake due to changing precipitation.

Participation

In-Person

References

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