

Below ground nitrogen of clover-grass mixtures and its residual nitrogen potential for subsequent crops

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Introduction: Estimates of symbiotic nitrogen fixation (SNF) in clover-grass mixtures usually take into account only the above ground clover N. Thus, this study aims at quantifying below ground N inputs from SNF by roots and N derived from rhizodeposition, their transfer to associated grass and their protection within soil organic matter pools as well as the residual N potentially available for subsequent crops.

Materials and methods: A microplot study with a *Trifolium pratense* – *Lolium perenne* mixture was performed within organic and conventional field plots of the DOK long-term experiment (Hammelehle *et al.* 2018). Clover was multiple ¹⁵N urea leaf labelled during two cultivation years. Quantification of SNF and fluxes of symbiotically fixed N in the soil plant system were done with a combination of ¹⁵N enrichment and natural abundance approaches. Results of the microplot study were scaled up using data from the DOK field plots.

Results: The mean SNF of clover across organic and conventional treatments was 37 g m⁻² in two years (Figure 1). At the end of the second cultivation year about 5% of this amount of total SNF was found in clover roots. Over the two years 50% of total SNF went into rhizodeposition from where it continued its flux to soil organic matter pools, microbial and soluble N (15% of total SNF) and the grass (35% of total SNF). At the end of the two years a residual N potential of SNF of 10 g m⁻² was built up. It consisted of clover roots (5% of total SNF), clover stubble (1% of total SNF), grass roots (6% of total SNF), and soil N pools (15% of total SNF).

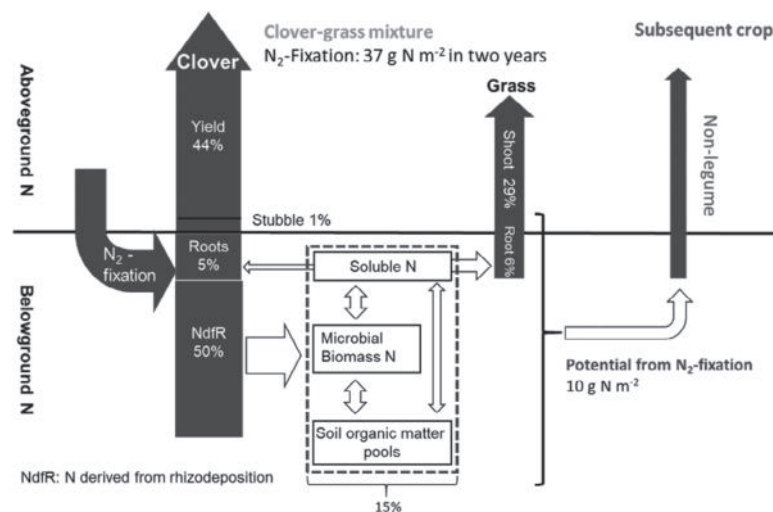


Figure 1. Partitioning of fixed clover N after two consecutive years of clover-grass mixture and its residual N potential for subsequent crops. Mean of organic and conventional (mineral N fertilised) DOK treatments.

Conclusion: A realistic estimation of N₂-fixation in clover-grass mixtures needs to take into account below ground N pools and fluxes.

Hammelehle A., Oberson A., Lüscher A., Mäder P. and Mayer J. (2018) Above- and belowground nitrogen distribution of a red clover-perennial ryegrass sward along a soil nutrient availability gradient established by organic and conventional cropping systems. *Plant and Soil* 425, 507-525.