Modelling of nitrogen allocation and partitioning within lucerne (*Medicago sativa*) shoot tissues during recovery from defoliation: an approach to estimate forage production and nitrogen composition

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Introduction Lucerne has been grown over centuries for forage. Its forage production is strongly correlated to the initial taproot and stubble N reserves (Avice *et al.,* 1996; Meuriot *et al.,* 2004). However, the influence of cutting management on the level of N storage and the contribution of these N reserves to forage production still remain unclear and need to be studied at the whole plant level. For this purpose, a deterministic model of N allocation within the different organs and partitioning within different biochemical N pools was developed for lucerne with high and low initial N status and cutting heights of 6 or 15 cm.

Materials and methods The model is based on the simple hypothesis that N allocation and partitioning are determined by local N supplies of nitrate and amino acids, and by the ability of the different organs or physiological functions to use these resources (Escobar–Gutiérrez *et al*., 1998). In a sink organ, the demand for N is the sum of three elementary demands: (i) structural associated N growth, (ii) metabolic associated N compounds, and (iii) N storage. The supply of N readily accessible for the organs only comes from the local stores of nitrate and amino acids. N flows in the network are determined by the source / sink activities of the different plant parts and by the local demand and supplies.

Results After optimisation of the parameter values, the model simulated satisfactorily the partitioning and allocation of N during regrowth after cutting (Figs 1 and 2). The model also showed that N supply to regrowing shoots is primarily due to nitrate and amino acid fluxes from stubble and taproot tissues. Moreover, the amino acids were fully depleted in the remaining tissues after cutting, but mobilisation of soluble proteins allowed maintaining an adequate shoot N supply. This mobilisation was more or less severe, depending of the plant initial N status and cutting height.

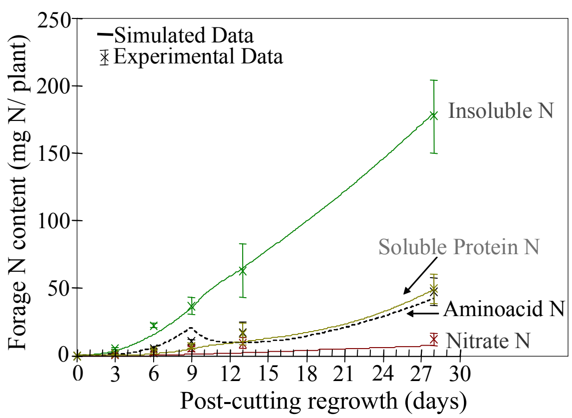

Figure 1 Forage N content during regrowth

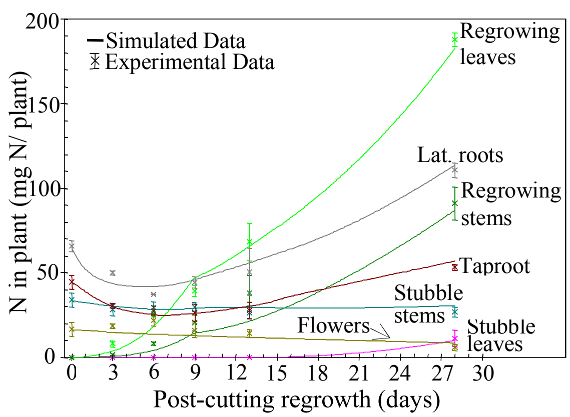

Figure 2 Total N in plant during regrowth

Conclusions The model allowed an accurate description of the N metabolism within the different plant tissues and biochemical N pools during post-cutting regrowth

References

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