White clover or nitrogen fertiliser for dairying under nitrate leaching limits?

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Abstract.

As the pressure intensifies to reduce nitrogen (N) losses to the environment from pasture-based dairy systems, interest in reducing N fertiliser inputs and returning to grass/clover mixtures, where more N for pasture growth is supplied by biological N fixation (BNF), has been revived. However, the question then arises: is BNF fundamentally different to fertiliser N with respect to N losses, especially nitrate-N leaching risk? This paper addresses this question by reviewing empirical evidence in the context of N cycling processes and the efficiency of N use for herbage production. Nitrate leaching data from studies comparing different sward treatments at the same level of total N inputs (fertiliser plus BNF) provide no evidence to suggest leaching differs when N is supplied solely by fixation in mixtures, by fixation plus fertiliser in mixtures, or solely as fertiliser to grass monoculture. Increasing clover content in mixed grass/clover pastures is likely to increase N leaching due to a lower ratio of soluble sugar and starch (SSS) to N in herbage compared with the common companion grass species perennial ryegrass, and therefore higher partitioning of N eaten to urine. Counteracting this effect, mixed grass/clover pastures may offer some potential for increasing N use efficiency and reducing the whole farm N surplus compared with grass-dominant pasture receiving relatively high rates of N fertiliser. While there are undeniable benefits for the productivity of dairy systems from maintaining strong grass/clover mixtures, it is the total amount of N entering the system, rather than the form of N (BNF or fertiliser), that influences nitrate leaching rates.