Effect of plant species, part and rate of application on the extent of litter decomposition

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The opportunity exists to accelerate C sequestration in soils under pasture through the selection of pasture species that contribute litter to soil that specifically slows plant litter decomposition rates. Research worldwide has focused on the parameters of leaf litter decomposition, but comparable studies for root litter decomposition are largely lacking despite reported high allocation of total annual production to below-ground plant parts (15% to 83%).

A 134 day laboratory incubation study was conducted to test the concept that plant species, and their associated traits, can influence the amount of residue C remaining after a period of decomposition. We evaluated the influence on CO2-C emissions of plant species (Lotus pedunculatus and Trifolium repens), plant part (shoot and root) and rate of application (2, 5, 10 mg C g OD soil-1). Three types of decomposition were observed: a very rapidly decomposed plant pool (0 - 19 days); a slower decomposed pool (19 – 134 days); and the basal activity.

Data was statistically analysed on the basis of CO2-C emitted as % of added C. For the period 0-19 days there is a very strong effect of plant species and plant part on CO2-C emitted as % of added C but not rate of application. As decomposition continues (19-134 days) the effect of plant species remains significant, with rate becoming significant in the root material. Over the full decompositon period (0-134 days) plant species and plant part have the major effect. The plant species and part effect were investigated further using litter chemical composition. 94% of the variation observed in the CO2-C emitted as % of added C could be explained by the lignin content and its metabolisable energy. A simple model for describing the separate decomposition of shoot litter and root material is presented.