

Tracing the transfer of recently assimilated carbon into root and soil respiration after in situ $^{13}\text{CO}_2$ pulse labelling of trees.

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The isotope compositions of trunk and soil CO_2 effluxes were continuously recorded on *Fagus sylvatica* 8-10 m trees by tuneable diode laser absorption spectrometer (TDLAS) during a 2-months chase period following a september short-term crown labelling enabling accurate assessments of time lags between photosynthetic assimilation by the labelled crown and CO_2 release in the trunk and the soil, as well as precise determinations of half-life of labelled carbon in respiratory effluxes.

Focusing on the soil compartment, the amount of label recovered in soil CO_2 respiration was around 10% of the assimilated $^{13}\text{CO}_2$. The isotope composition of CO_2 efflux was maximal 3 to 4 days after labelling, exhibiting a double exponential decay with a half life time of 3-5 and 17-32 days respectively suggesting the contribution of two components to the soil efflux: (1) a direct use of labelled photosynthate in respiratory metabolism rapidly diluted by recent unlabelled photosynthate and, when the supply of current photosynthesis do not support trunk and root respiration, (2) the use of stored carbohydrate that could be associated with the heterotrophic component of soil respiration corresponding to the decomposition of labelled organic substrate.