Seasonality in growth of ectomycorrhizal hyphae in *Fagus*, *Quercus* and *Pinus* in France

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ABSTRACT

Fine roots and associated mycorrhizal partners are the major pathway for uptake of water and nutrients into forest trees. In turn, fine roots and mycorrhizal structures contain significant amounts of carbon and nutrients but sound scientific research underpinning our understanding on the dynamics of production, maintenance and turnover of these structures is still limited. In particular, assessing how much carbon is allocated to the finest structures, i.e. mycorrhizal hyphal networks, for construction and maintenance, is still a key challenge for *in situ* research in forest ecosystems. In the present work, our objective is to quantify the production of ectomycorrhizal hyphal structures throughout the growing season in three forest sites with different tree cover, i.e. *Fagus sylvatica*, *Quercus petraea* and *Pinus pinaster*. At each of the study sites $^{13}CO_2$ labelling experiments [1] will be carried out by combining a canopy labelling chamber on trenched trees with a tuneable diode laser absorption spectrometry method to trace the fate of the ^{13}C in the trees and the soil. This will be done throughout 2009 using three different seasons for labelling. At each of the three labelling periods, ingrowth mesh bags (30 µm mesh filled with quartz sand) will be installed in the top soil around the labelled trees. Ectomycorrhizal hyphae that grow into the mesh bags will be evaluated upon retrieval after three months for biomass, length and ^{13}C signature. Preliminary data and their interpretation will be available in early summer 2009.

KEYWORDS: ectomycorrhizal hyphae, forest trees, growth dynamics, ingrowth bags, labelling

INTRODUCTION

Mycorrhizal hyphae associated with fine roots of trees may account for approximately 20–30% of the allocation of assimilates, and the fungal mantles and extramatrical mycelia of these mycorrhizal fungi are estimated to have a biomass of about 0.5-0.7 t/ha [2]. Knowledge on this pool and the fluxes through this pool are thus of major importance for ecosystem carbond budgets. The few studies reporting on this gave contradictory results. Staddon et al. (2003) using a 14C method showed that most ERM hyphae of AM fungi live on average 5 to 6 days, but Hawkes et al. (2008) reported that AM fungi could retain retain recently assimilated photosynthate carbon in lipids for at least 32 days. Here we combine a 13C labelling of tree canopies with ingrowth mesh bags in three tree species and through different moments in the growing season to study 1) the production of ectomyocorrhizal hyphae through the growing season (seasonility of growth); 2) the turnover of carbon through the ectomycorrhizal hyphae using the 13C signal in their tissues.

METHODS

Young trees of *Fagus sylvatica* (northeast France), *Quercus petraea* (central France) and *Pinus Pinaster* (southwest France) will be labelled with ^{13}C in three (*Fagus* and *Quercus*) to four (*Pinus*) growing seasons [1]. Ingrowth mesh bags (30 µm mesh filled with quartz sand; method adapted from Wallander et al. 2004) will be installed in the top soil around the labelled trees at each labelling. The whereabouts of ^{13}C isotopes in the aerial and belowground tissues of the tree and in the soil will be monitored intensively for 2 months. Half of the ingrowth bags will be retrieved after 1 month, the other half after 3 months. Ectomycorrhizal hyphae that grow in the mesh bags will be evaluated upon retrieval for biomass and length (Wallander et al. 2004, Bakker et al. 2009) and ^{13}C signature.

RESULTS AND DISCUSSIONS

First retrieval (after 1 month of hyphal growth into the ingrowth bags) is due for June 20th for the first site, for June 27th for the second site and for July 8th for the third site. Second retrievals (3 months after first labelling) are due for September and October 2009. Preliminary data will be presented on the poster, together will other data from the project [1] as far as these are availabe. We expect increasing quantities of hyphal structures in the ingrowth bags (between 1 and 3 months) against decreasing values of $\delta^{13}C$.

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