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Relative contribution of N reserve and N root uptake to new organs growth after budburst : an in situ 15N labeling approach on Quercus petraea.

Stéphane Bazot, Chantal Fresneau, Claire Damesin, and Laure Barthes

Université Paris-Sud, CNRS, AgroParisTech, UMR 8079, Laboratoire Ecologie Systématique et Evolution, Orsay, F-91405, Orsay, France

Studies investigating N sources used to fill storage compartments in autumn or to build new compartments in spring are scarce and mainly conducted under controlled conditions on young trees. The aim of the present study was to access the origin of nitrogen 1. forming reserves i.e. N remobilized from leaves or N uptake by roots, 2. the relative contribution of N reserves and N uptake by roots to new organs development after budburst.
Three 15N labeling procedures (in spring, autumn and winter) were applied to six 15 years old trees in a French forest. Each labeling was carried out on two oaks with a $15NH415NO_3$ solution sprayed on the entire crown or on the ground. The crown labeling in spring 2009 aims to evaluate the contribution of leaf compartment to the reserve formation of the tree, soil labeling in autumn 2009 and in winter 2010 aims to evaluate the contribution of N root uptake in the production of new organs. The fate of absorbed 15N was followed into leaves, branches, trunk, phloem, xylem, roots, rhizospheric soil and microbial biomass. Spring crown labeling resulted in a rapid uptake of 15N by the leaves. The leaf labeling stayed stable until the end of August and drastically decreased at the end of September in favor of the root. It is assumed that this transfer corresponds to the synthesis of N reserves in roots. At the same time, 15N of soil and microbial biomass only slightly increase.
Autumn soil labeling reveals a significant 15N roots uptake and a rapid 15N uptake into the microbial biomass (40% of 15N was recovered in roots and more than 50 % was recovered in microbe 30 days after labeling). At the same time plant shoots 15N is very low, highlighting a very low transfer of soil N to aboveground part of the tree.
In spring 2010, in trees which were crown-labeled the previous year, 65 % of 15N is recovered in new leaves 8 days after budburst, As consequence, it is assumed that after budburst new organs are mainly constructed with internal N stored the previous autumn.
At spring 2010, only 4% and less than 1% of 15N were recovered in trees which were soil-labeled in autumn 2009 and in winter 2010. At this date, 15N is mainly recovered in microbial biomass (65% and 85 % of 15N recovered for trees labeled in autumn and in winter respectively). It confirms the major contribution of internal N to new organ N. This was only at the beginning of June that leaves of soil-labeled trees show an important % 15N recovery: 42 and 55 % for autumn and winter labeling respectively. Therefore root N uptake occurred later after budburst and was not involved in new organs development just after budburst.