Comparison of spring 15N uptake in oak and beech saplings submitted to shading and summer defoliation

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JESIUM 2008, Presqu'île de Giens, France, August 31-September 5
Final programme& abstract book, 3-P106, page 140

Session 3-Poster

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Tree species are characterized by a long-term and cyclic growth. The storage of reserves and their remobilisation is one of the major functions ensuring permanence facing a variable environment. A part of reserves will be consumed allowing trees to face to various abiotic and biotic stresses such as defoliation and to regenerate new structures. In this context, storage of reserves will be a fundamental process that depends on both nutrient availability and environmental factors as light. Light availability will be determinant for carbon and nitrogen uptake and growth. However, light demand vary with species: beech is tolerant to shading whereas oak prefers full light.
A summer defoliation (July 2004; removal of 70% of leaves) was simulated on two-year–old oak and beech trees grown either in full light or in shading conditions (40% of incident light) in a nursery at INRA (Champenoux, France). The following spring (year 3) at bud bursting, trees were watered twice a week with a complete nutrient solution enriched in ^{15}N ($^{15}NH_4{}^{15}NO_3$, ^{15}N > 99%; Spectra Stable Isotopes, Columbia, M.D., USA). Two hypotheses were tested 1) defoliation applied in summer would lead to a major N loss imposing an increase of ^{15}N uptake next spring to ensure new growth and 2) responses to defoliation would vary according to light tolerance of species.
Shading did not alter N accumulation (year 2) but increased ^{15}N uptake in spring (year 3) in both oak and beech. In contrast, responses to defoliation differed according species. Nitrogen storage was decreased in oak but not in beech (year 2) and N uptake (year 3) was increased in beech only.
As a consequence, defoliation created a N imbalance not compensated by an increase of uptake in oak trees whereas N stock of defoliated beech was restored at the end of the year 2 and ^{15}N uptake was increased the next spring. In forest conditions, changes in ^{15}N uptake due to sylvicultural practices such as thinning that modifies light environment are investigated too on 40-year-old oak trees.