

NITROGEN RECYCLING: A PERENNIAL PROBLEM

Benjamin A. Babst¹, Fei Gao¹, Mike Schueller², Fei He³ and Sergei Maslov^{2,3}

Since nitrogen (N) is often the most limiting nutrient for plant growth in terrestrial ecosystems, efficient use of N by trees is crucial to environmental and economic sustainability of bioenergy and forestry. Although perennial plants, such as trees, may recycle a large proportion of N by remobilizing N from senescing leaves, few of the transporters involved in N remobilization from leaves have been identified. We are developing a combination of computational and experimental phenotype screening approaches to identify genes, especially transporters, involved in nitrogen transport throughout the plant. Here, as a medium-throughput phenotype screen, we administered radioactive ¹³NH₃ tracer as a gas to leaves, which was incorporated into biological molecules, and we measured export of assimilated ¹³N from leaves. The high specific activity of ¹³N allowed administration of tracer well below the concentrations of NH₃ normally found in plant tissues. Using *Arabidopsis thaliana* for demonstration purposes, coexpression network analysis was used to winnow the list of candidate transporter-encoding genes from more than 1000 to fewer than 50. In the radiotracer screen, several mutants of these genes exhibited reduced ¹³N export from leaves, indicating that several of those candidate genes, whose functions were previously unknown, are necessary for normal export of N from leaves. We are currently working to apply this approach to genetically tractable trees, such as poplars, where N recycling is especially important in the context of seasonal growth and dormancy. Knowledge of the genes and systems underlying N recycling may present novel opportunities for breeding programs to maintain or improve N use efficiency in trees.

¹ School of Forestry and Natural Resources, University of Arkansas-Monticello, Monticello, AR

² Brookhaven National Laboratory, Long Island, NY

³ Institute of Genomic Biology, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL