Evaluation of Gene Expression Responses in Poplar Roots Following N Fertilization

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Members of the Salicaceae, such as poplar species, have a high demand for water and nutrients. This characteristic makes them especially suitable for the removal of soluble pollutants from the soil. The systematic planting of poplars as riparian buffers to remove the nitrates released from fertilized agricultural land is a promising approach. Hence, the aim of the present work was to document the effect of nitrogen supply on root metabolism, focusing on the gene level.

Rooted cuttings of *Populus trichocarpa* X *P. deltoides* H11-11 were maintained under standard greenhouses conditions during the experiment. The treatments consisted of daily applications of a water-soluble fertilizer where nitrogen (N) supplied as ammonium nitrate. We applied 0 g/L as the low N control and 5 g/L for high N; in order to evaluate the effects of contrasted conditions. Rapid physiological and developmental changes were induced after N fertilization.

Gene expression analyses were conducted using an in-house cDNA microarray comprising a total of 3400 genes. After seven days of nitrogen treatment, 56 genes were identified as differentially expressed in poplar roots. Several genes coding for enzymes involved in primary carbon and nitrogen metabolisms showed an increased level of transcripts after N fertilization. Interestingly, we found a second group of sequences with a modified expression that were related to enzymes involved in detoxification and osmotic regulation. A third group of genes represent enzymes participating in cell wall formation and lignin synthesis. Finally, several transcription factors had altered levels of transcripts which suggest that their activation or repression is affected by nitrogen availability.

Our results show that patterns of gene expression in roots of poplars are influenced by nitrogen supply. Our data may help to identify specific physiological pathways that are activated in response to high N availability. As poplars are becoming part of multi-purpose agrosystems, the plasticity of their responses for water and nitrogen conditions may provide evidences of unique adaptative mechanisms.