Nitrate reductase activity in 1+0 Juglans nigra L. seedlings with N fertilization

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RESULTS and DISCUSSION

- Nitrate reductase activity (NRA) is a measure of how quickly plant organs convert nitrate (NO₃⁻) into nitrite (NO₂⁻) as the beginning of the process that converts inorganic nitrogen (N) into forms of N that are useful to the plant. In the leaves, the energy required for NRA is produced by the products of photosynthesis, whereas, in the roots, NRA requires respiratory energy to function. NRA is also known to be NO₃⁻-inducible.

In this study, 2 forms of N (NH₄NO₃ and NaN₂O₃) were applied to half-sib 1+0 black walnut (Juglans nigra L.) seedlings at three different rates (0, 400, and 800 mg N per seedling). Plants were grown for 2 months after fertilization and NRA was measured using the in vitro technique. It was found that there were no significant differences between N forms, nor form by level, but that there were higher total NRA values for the highest treatment level. These values were higher but not significantly so in the middle treatment compared to the low and significantly higher in the high treatment. On average, the majority of NRA occurred in the roots (67.8%).

Future studies will be designed adding more replications, an additional form of N, and higher levels of fertilization. It is hoped that refinements and changes to the design will yield more significant results. From these findings, it seems that a significant amount of respiratory energy is required for NRA with NO₃⁻ treatment, so other forms of N fertilizer may make a more efficient use of energy. In this experiment, NRA occurred preferentially in the roots of black walnut seedlings. This signifies that more energy is likely expended in these seedlings to use the NO₃⁻ form of N than NH₄⁺ since NO₃⁻ requires more energy requiring steps to be assimilated into organic N that can be used by the plant. Our data also suggests that the level of NRA is increased with N addition. This makes sense since NRA is known to be induced de novo by NO₃⁻ addition (Ting 1982; Hoff et al. 1992).

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