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Growth response and nitrogen use physiology of Fraser fir (*Abies fraseri*), red pine (*Pinus resinosa*), and hybrid poplar under amino acid nutrition

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Abstract Plants can assimilate amino acids from soils. This has been demonstrated in controlled environments and soils of various forest ecosystems. However, the role of root-absorbed amino acids in plant nitrogen nutrition is still poorly understood. We investigated the agroecological performance and nutrient use physiology of two conifers (*Abies fraseri* and *Pinus resinosa*) and one hardwood species (hybrid poplar) under amino acid fertilization. Arginine fertilizer (arGrow® Complete) was applied at varying rates (0, 56, 112, 224, and 336 kg N/ha) and compared to an inorganic control treatment (ammonium sulfate 112 kg N/ha). Parameters monitored included tree growth response, foliar nitrogen concentration, and inorganic nitrogen leaching below the rootzone. Results obtained indicate a significant growth and foliar nitrogen response to amino acid treatments, with increasing amino acid application leading to greater growth and foliar nitrogen. However, rates two to three times higher than that of the inorganic control were necessary to provide similar growth and foliar nitrogen responses. These observations were suggested to be due to competition with soil microbes for organic nitrogen, growth inhibition due to the presence of large concentrations of amino acids, or adsorption to cation exchange sites. Amino acid applications did not increase the leaching of inorganic nitrogen due either to the binding of positively charged arginine cations to exchange sites or rapid mineralization followed by plant assimilation. Mineral nitrogen collected in leachate samples increased with the application rate suggesting at least some mineralization in high amino acid application rates. We conclude that growth response and nitrogen use physiology of these species when treated with arginine are largely controlled by soil processes including microbial competition and adsorption. Further studies are being conducted to confirm these hypotheses.

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