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Kim T. Everett^a; B. J. Hawkins^a; A. K. Mitchell^b

^a Centre for Forest Biology, University of Victoria, Victoria, British Columbia, Canada ^b Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia, Canada

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DOUGLAS-FIR SEEDLING RESPONSE TO A RANGE OF AMMONIUM: NITRATE RATIOS IN AEROPONIC CULTURE

Kim T. Everett,¹ B. J. Hawkins,¹ and A. K. Mitchell²

¹Centre for Forest Biology, University of Victoria, Victoria, British Columbia, Canada

²Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia, Canada

□ The objective of the experiment was to identify the most favorable nitrogen (N) source ratio of ammonium (NH_4^+) and nitrate (NO_3^-) for aeroponically-grown Douglas-fir when pH was maintained at pH 4.0. Seedlings were grown in controlled environments with solutions containing 0:100, 20:80, 40:60, 60:40, 80:20 or 100:0 $\text{NH}_4^+:\text{NO}_3^-$ ratios. Nutrient additions in the aeroponic culture units were controlled by solution conductivity set points. Seedling growth and nutrient allocation was observed for 45 days. Different $\text{NH}_4^+:\text{NO}_3^-$ ratios resulted in significant differences in the rate of N addition, growth, morphology, and nutrient allocation. Seedlings grown in solutions containing 60 or 80% NO_3^- were characterized by a combination of high growth and photosynthetic rates, high and stable internal plant N concentrations, and sufficient levels of other essential nutrients. High proportions of NH_4^+ in solution resulted in low rates of N addition, stunted lateral root growth, and may have been toxic.

Keywords: nitrogen, ammonium:nitrate ratio, *Pseudotsuga menziesii*, conifer seedling nutrition

INTRODUCTION

Nitrogen (N) availability often limits plant growth in natural systems (Forde and Clarkson, 1999) and lack of N constrains the growth of temperate and boreal forest plants more than any other soil nutrient (Vitousek and Howarth, 1991, Millard 1996, DesRochers et al., 2003). Inorganic N is available to plants as ammonium (NH_4^+) and nitrate (NO_3^-), but levels of NH_4^+ and NO_3^- in forest soils vary both temporally and spatially. Most undisturbed, northern coniferous forest soils are acidic with slow rates of organic matter decomposition and nitrification (Lavoie et al., 1992). However, following disturbance, changes in soil temperature, moisture, pH, nutrient availability,

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Address correspondence to B. J. Hawkins, Centre for Forest Biology, University of Victoria, P.O. Box 3020, STN CSC, Victoria, BC V8W 3N5, Canada. E-mail: bhawkins@uvic.ca