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INFLUENCE OF HEAT SUM AND FERTILIZATION ON PICEA MARIANA (MILL.) B.S.P. SEEDLINGS. PART 2. COLD HARDENING AND DEHARDENING

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One year old containerized black spruce seedlings were treated for 106 d in growth chambers under the following conditions on a 12 h:12 h basis: (1) 21:16°C (1749 Growing Degree Days with a 2°C temperature basis, GDD); (2) 19:14°C (1537 GDD) and (3) 17:12°C (1325 GDD). The photoperiod was maintained at 16 h with a photon flux of 250 µmol m^{-2} s^{-1}. Three fertilization regimes (12, 24, 48 mg N/cell) were applied using a 20-20-20 commercial fertilizer. At the end of the growing period, seedlings differed in shoot length, shoot and root biomass and mineral concentrations (Part I). They were then cold hardened under 8-h photoperiod with declining day:night temperature of 15:10°C, 10:5°C, and 5:5°C and finally at 2°, 0°, and -2°C without light for a total of 55 d. Afterwards, seedlings were dehardened under 16-h photoperiod at 20:15°C for 34 d in growth chambers, followed by 28 d in greenhouse. No additional fertilization was applied during hardening or dehardening.

Hardening of excised needles was influenced by conditions during the growing period. Seedlings grown with the 12 mg N regime (0.64% N, in shoots) did not harden. Those with the 24 mg N regime (0.86% N) showed a lesser degree of hardiness than the 48 mg N (1.28% N). During hardening, the stem diameter of seedlings increased. This increase was greater with 48 mg N than with 12 or 24 mg N. During that time, shoot dry weight decreased with the different treatment. No differences in the total number of primordium were observed between treatments. Bud break was not influenced by treatments. Following bud break, the increase in shoot length and shoot diameter was influenced by the nutritional regimes applied during the growing period.