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The effect of carbon and nutrient loading during nursery culture on the growth of black spruce seedlings: a six-year field study

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Abstract We tested the effects of exponential nutrient loading and springtime carbon loading during nursery culture on the field performance of black spruce (*Picea mariana* (Mill.) B.S.P.). Seedlings were grown from seed with a conventional, fixed dose fertilizer (10 mg N seedling⁻¹) or an exponential nutrient loading regime (75 mg N seedling⁻¹). The following spring, seedlings were exposed for two weeks to either ambient (370 ppm) or elevated levels of CO₂ (800 ppm) and then planted in the field; seedling growth was followed for the next six years. Exponential nutrient loading increased seedling height, stem diameter and leader growth, with the largest increases in height and leader length occurring in the first three years after outplanting. Carbon loading increased seedling height and leader length, but only in seedlings that had been exponentially nutrient loaded. A combination of carbon and nutrient loading increased shoot height 26%, stem diameter 37% and leader length 40% over trees that received neither treatment. These results demonstrate that the growth enhancement seen under exponential nutrient loading is maintained under field conditions for at least six years. Carbon loading just before outplanting was a useful supplement to nutrient loading, but was ineffective in the absence of nutrient loading.

Keywords Nitrogen · Exponential nutrient loading · Fertilizer · C O
Picea mariana

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