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Forest Ecology and Management

NPK fertilization at planting of three hybrid poplar clones in the boreal region of Alberta

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Received 9 February 2006: received in revised form 30 May 2006. accepted 4 June 2006

Abstract

Trees from three hybrid poplar clones (one *Populus Imisunrifrra x P simonii* clone and Iwo *P. deItoides x x petrowskyana* clones) were grown for 3 years in an agricultural field and fertilized at planting with 27 combinations of nitrogen (N), phosphorus (P) and potassium (K) fertilizers. Fertilizers used were granular ammonium nitrate (34.5-0-0) at three levels W. S and 16 g/tree). triple-super-phosphate (0-45-0) at three levels (0, 12.5 and 25 g/tree). and potassium sulfate (0-0-50) at three levels (0, 8 and 16 g /tree). Growth responses to N fertilization were negative during the first growing season: N fertilization reduced growth, net assimilation rate (A), stomata) conductance (G8, and increased the abundance of ^{l}'C in the leaves. These results might be related to the soil pH at the site which ranged from 7.7 to 8.1 and to the dry conditions that prevailed during the first growing season. Leaf N concentrations were unaffected by the fertilization level. Conversely, N fertilization decreased leaf P concentrations. which were in turn positively correlated with growth and negatively correlated with carbon isotopic composition $8^{1\,C}$. There were clonal differences in 8 C that varied between the first and second growing seasons in relation to the relative growth rates of the clones. Growth responses to fertilization at planting were nil or slightly positive during the second and third growing seasons. These results indicated that ammonium nitrate was unsuitable for fertilizing these hybrid poplar clones at planting. and that further study is required to test fertilization at planting with nitrate-N versus ammonium-N sources under these field conditions.

Keywords: Fertilization: Stable isotope; Hybrid poplar; Water-use efficiency; Ammonium nitrate; Mineral nutrition

I. Introduction

There is increasing interest in utilizing wood fiber front fast-growing high-yield plantations to reduce the exploitation pressure on Canadian native forests (Gordon. 2001). Unlike natural forests. plantations incur significant costs to establish and maintain until the trees are ready to harvest. Fertilization is typically one of the least expensive silvicultural treatments for increasing yields. The establishment of new plantations can he improved by fertilizing at the time of planting. to increase early growth rates, allowing the trees to overtop competing vegetation and form established stands sooner, ultimately reducing the time period between planting and harvest (Miller. 1981). Moreover, placing fertilizer in small holes adjacent to planted trees has been shown to increase growth by increasing access to nutrients (van den Driessche. 1999). Fertilizer placement also causes less promotion of competing vegetation growth. which is often one of the major obstacles to the success . fast-growing plantations (Rose and Ketchum 2002).