
Calcium addition at the Hubbard Brook Experimental Forest increases the capacity for stress tolerance and carbon capture in red spruce (*Picea rubens*) trees during the cold season

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Abstract

Red spruce (*Picea rubens*) trees at the Hubbard Brook Experimental Forest (HBEF) were treated with calcium (Ca) during the cold season (November to March) from 2009 to 2011. The Ca treatment was applied as a foliar spray and a soil application. The Ca treatment increased the concentration of Ca in the needles and stems of the trees, and this increase was maintained throughout the growing season (June to September). The Ca treatment also increased the concentration of Ca in the soil. The Ca treatment increased the concentration of Ca in the needles and stems of the trees, and this increase was maintained throughout the growing season (June to September). The Ca treatment also increased the concentration of Ca in the soil. The Ca treatment increased the concentration of Ca in the needles and stems of the trees, and this increase was maintained throughout the growing season (June to September). The Ca treatment also increased the concentration of Ca in the soil.

Keywords

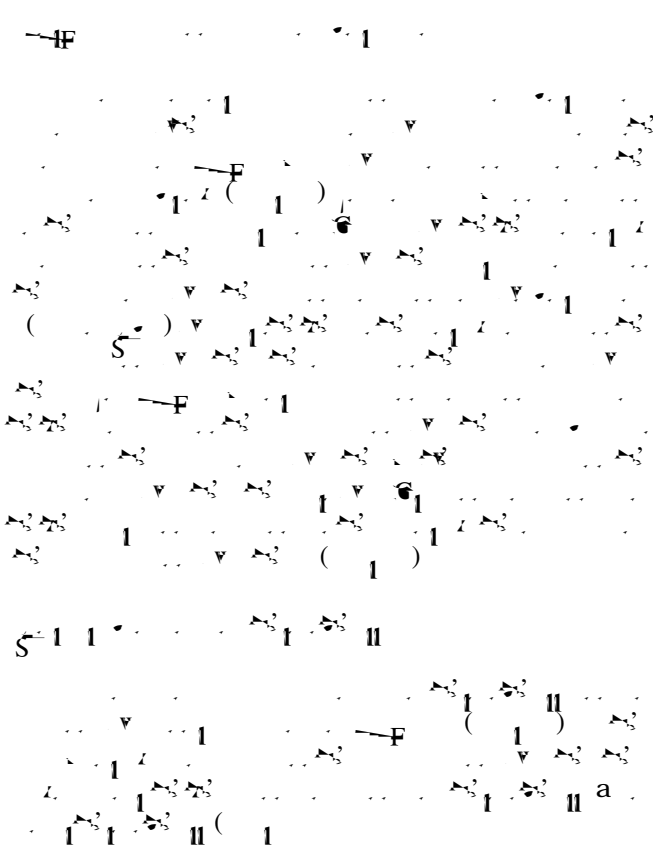
Calcium addition, red spruce, stress tolerance, carbon capture, Hubbard Brook Experimental Forest

Introduction

Red spruce (*Picea rubens*) is a dominant tree species in the northeastern United States and southeastern Canada. It is a highly shade-tolerant species that can grow in a wide range of soil conditions. However, red spruce is highly sensitive to acid rain and soil acidification. Calcium (Ca) is an essential nutrient for red spruce, and it plays a key role in many physiological processes. The Hubbard Brook Experimental Forest (HBEF) is a long-term research site where the effects of acid rain and soil acidification on forest ecosystems have been studied extensively. In a previous study, we showed that Ca addition to red spruce trees at the HBEF increased their growth and survival during the cold season (Schaberg et al. 2012). In this study, we investigate the effects of Ca addition on the capacity for stress tolerance and carbon capture in red spruce trees during the cold season.

• $\frac{1}{2} \int_{-\infty}^{\infty} \delta(x) dx = \frac{1}{2}$

Results



Handwritten notes in black ink, including mathematical symbols like $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, and some blue markings.

Handwritten notes in black ink, including mathematical symbols like $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$.

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Handwritten notes on a page, featuring mathematical symbols such as $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, along with various lines and arrows indicating relationships or derivations.

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Handwritten musical notation on a staff, including notes, rests, and bar lines. The notation is dense and appears to be a complex piece of music.

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