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REGULAR ARTICLE

Respiratory C fluxes and root exudation differ in two full-sib clones of *Pinus taeda* (L.) under contrasting fertilizer regimes in a greenhouse

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Abstract
Aims We investigated whether changes in respiratory C fluxes, soil CO_2 efflux, or root exudate quantity or quality explained differences in growth rates between closely related clones of *Pinus taeda* (L.).
Methods A factorial design with two clones, fertilized and control treatments, and four sequential harvests was installed in a greenhouse for 121 days.
Results The two clones did show significant differences in respiratory C fluxes, soil CO_2 efflux, and root exudation quantity and quality. While the clones also differed in growth rates, the C fluxes assessed in this paper did not explain how seedlings were able to allocate more C to stem growth in the months following fertilizer application. Changes in root exudation were not consistent with reduced heterotrophic soil CO_2 efflux, which does not appear to be a plant-mediated process.
Conclusions These results indicate that if single genotypes are deployed over large land areas in plantations, dramatic differences between clonal plant-soil interactions may require consideration in ecosystem C budgets. Further, the range of belowground fluxes observed implies that genotype-specific C allocation may make some clones better able to exploit a given resource environment than others.

Keywords Soil CO_2 efflux · Carbon allocation · Intensive silviculture · Varietal forestry

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Introduction

Pinus taeda (L.) plantations span some 13 million hectares across the southeastern United States (Conner and Hartsell 2002), and are responsible for production of a disproportionate amount of timber on a national basis (Adams et al. 2006). These plantations are often fertilized with N and P, with over 6 million hectares already fertilized over the last several decades (Albaugh et al. 2007). Increasingly clonal material is being planted in these plantations in order to increase productivity (Bettinger et al. 2009). An understanding of the ecophysiology of different clones under fertilizer regimes similar to those found in operational plantations is necessary both to understand varying observed clonal growth responses to fertilizer application (King et al. 2008), and to better understand the carbon cycling of this rapidly expanding intensively managed forest ecosystem. The purpose of this paper is to examine how respiratory carbon fluxes and root exudation change in