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## Seedling biomass and element content of *Pinus sylvestris* and *Pinus nigra* grown in sandy substrates with lignite

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### Abstract

Reclaimed mine soils in the Lusatian mining district (Eastern Germany) are often comprised of sandy materials containing high amounts of lignite. Lignite can absorb nutrients and water, but its high pyrite and Al content may restrict access of roots to these pools. We assessed the influence of lignite on growth, seedling shoot and root element content and root lengths of *Pinus sylvestris* L and *Pinus nigra* Am. in lignite-containing and lignite-free substrates. Rhizotrons were filled with mining substrate in which lignite was finely dispersed (L-substrate), a model substrate with alternating layers of quartz sand and lignite (SL-substrate), and a sandy substrate from a natural forest without lignite (S-substrate). After 11 months, shoot dry mass of *P. sylvestris* significantly decreased in the following order: S-substrate>SL-substrate>L-substrate, whereas root dry mass was similar in all substrates. *P. sylvestris* in S-substrate was characterized by high shoot and root contents of N and P, whereas plants grown on L-substrate had high shoot and root contents of Ca and a high root content of Al. In L-substrate, shoot dry mass of *P. nigra* was significantly greater than that of *P. sylvestris* and the Ca content in the roots of *P. nigra* was twice as high than in *P. sylvestris* roots ( $P < 0.1$ ). The high Ca content in the roots may explain the better growth of *P. nigra* in these mining substrates which are often characterized by high

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### 1. Introduction

Forestry is the dominating land use after lignite mining in Lower Lusatia (Eastern Germany). Approximately 60% of the 45,000-ha re-cultivated mine spoils (Stähr, 2003) have been afforested, mainly with pine (*Pinus sylvestris* L. and *Pinus nigra* Am.) (Prenfiner, 1998). After mining, the soils are a mixture of sandy overburden material of different geological ages (1996) and may contain up to 12.5% C (dry mass basis), the majority

of which is in the form of lignite (Neumann, 1999). Although the substrate is nutrient-poor (Heinsdorf, 1994) and contains low amounts of plant-available water (Preufner, 1998), pines grow well once they are established (Böcker et al., 1998; Katzur et al., 2000), indicating adequate water and nutrient supply. Lignite,

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