RESPONSE OF *PICEA ABIES* (L.) SEEDLINGS TO ELEVATED CO_2 CONCENTRATION AND NUTRIENTS

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Keywords

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ABSTRACT

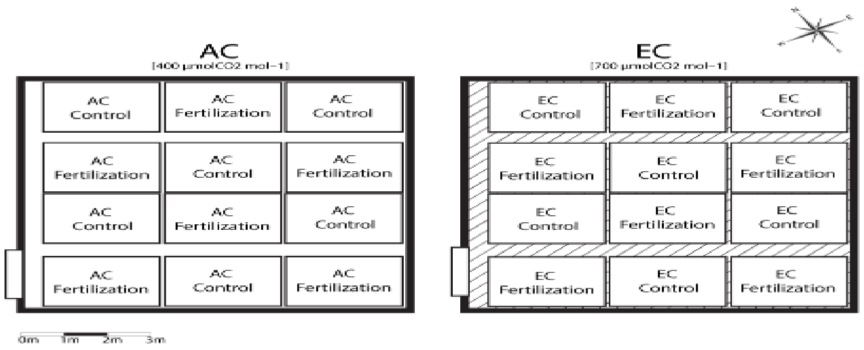
The annual rate of increase is about 1.5 ppm (0.4% yr^{-1}) and all representative concentration pathways (RCPs) scenarios predict levels of CO_2 in the atmosphere to rise between 421 ppm and 936 ppm at the end of this century (IPCC, 2013). Therefore, it is an urgent task to perform more studies examining the adaptive capacity of European tree species in the face of climate changes, because the forests regenerated today will have to adapt and cope with the climate conditions that will be present during the life of the trees in the stand. It is believed that the properties and productivity of the trees will be strongly affected by the increasing CO_2 concentration in the atmosphere and global mean temperature, and also by alteration in the water and nutrient cycle.

AIMS OF THE RESEARCH

The objective of the present study was to investigate the effects of (i) elevated CO_2 and (ii) nutrients on oven-dry wood density and aboveground biomass growth of Norway spruce seedlings. Moreover, the effects of elevated CO_2 on morphometric characteristics (height, diameter 5cm from the ground, cross-sectional area) are investigated. In this research, we grew coniferous seedlings of (*Picea abies* L.) and we hypothesized that the strength of the CO_2 “fertilization” effect will be modulated by the concentration of applied nutrients.

MATERIALS AND METHODS

(i) Sampling and Biometrical analysis
(ii) Oven-dry wood density



Each lamellar glass–domes contains 84 saplings. In the beginning of 2017, both lamellar glass–domes were split into plots (Fig. 1.) and planted with two-years old Norway spruce seedlings, experiment with fertilization start in 2018.

Figure 1: Experimental design scheme. AC – ambient CO_2 concentration, EC – elevated CO_2 concentration, Control – plots without N fertilization, Fertilization – plots with N fertilization.

PRELIMINARY RESULTS

All investigated aboveground morphological characteristics showed to be significantly ($p \leq 0.05$) affected positively or negatively by elevated CO_2, whereas fertilization had no statistically significant effect. Total aboveground biomass was higher by 1.81% in eCO_2 condition, however, there was no significant combinatory effect between eCO_2 and fertilization. Elevated CO_2 showed a statistically significant impact on height, diameter, and consequently cross-sectional area. In eCO_2 we observed a significant decrease of 5.29% in height (cm) of the seedlings and on contrary, an increase of 2.08% in diameter (mm), measured 5 cm from the ground, which will lead substantially to an increase of 14.71% in cross-sectional area. Overall, seedlings growing under eCO_2 had significantly higher densities (4%), nevertheless, there is no effect of fertilization or combination of eCO_2 × fertilization was observed.

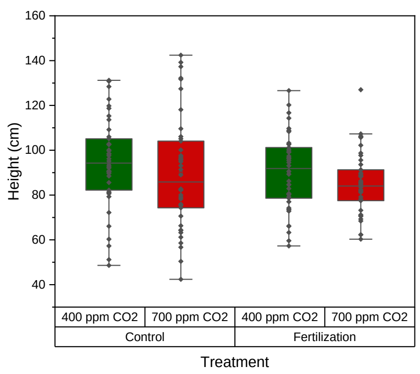


Figure 2: Changes in height of (*Picea abies* L.) seedlings treated under ambient (400 ppm CO_2) and elevated (700 ppm CO_2) and different nutrient supplies. The box boundaries mark the 25th and 75th percentiles.

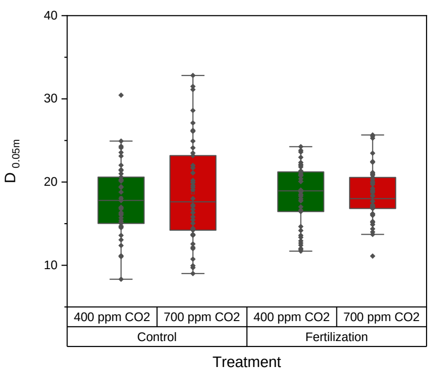


Figure 3: Changes in diameter 5 cm above the ground of (*Picea abies* L.) seedlings treated under ambient (400 ppm CO_2) and elevated (700 ppm CO_2) and different nutrient supplies. The box boundaries mark the 25th and 75th percentiles.

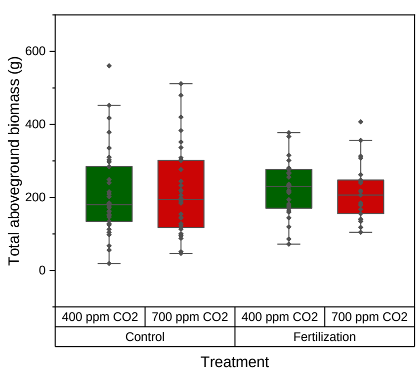


Figure 4: Changes in Total aboveground biomass of (*Picea abies* L.) seedlings treated under ambient (400 ppm CO_2) and elevated (700 ppm CO_2) and different nutrient supplies. The box boundaries mark the 25th and 75th percentiles.

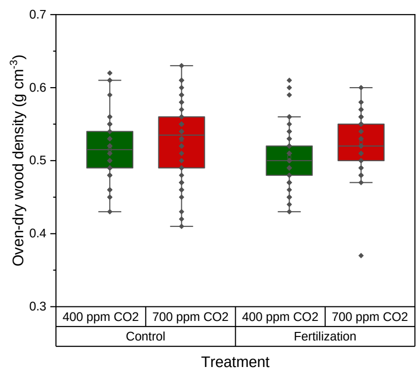


Figure 5: Changes in Over – dry wood density (g/cm^3) of (*Picea abies* L.) seedlings treated under ambient (400 ppm CO_2) and elevated (700 ppm CO_2) and different nutrient supplies. The box boundaries mark the 25th and 75th percentiles.

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Literature cited: IPCC, 2013. Climate change 2013: the physical science basis. Fifth assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA