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Down to Earth

Book of Abstracts

Editors
MSc Annika Mikomägi and MSc Kadri Vilumaa
Effects of elevated atmospheric humidity on leaf gas exchange: a study in hybrid aspen

Aigar Niglas, Arne Sellin

Institute of Ecology and Earth Sciences, Department of Botany, University of Tartu, Tartu, Estonia,
aigar.niglas@ut.ee

Climate change scenarios predict an increase in air temperature and precipitation at high latitudes; this means higher air humidity as well. Our goal was to determine how does the rising atmospheric humidity affect leaf photosynthesis and water fluxes through stomata. Gas exchange characteristics were measured in hybrid aspens (*Populus tremula* × *P. tremuloides*) grown in an experimental forest plantation at the Free Air Humidity Manipulation (FAHM) site, Eastern Estonia, in summer of 2011. Sample trees were selected from control and humidified plots, in which the relative air humidity was increased by 7-8% over the ambient level.

The mean stomatal conductance (*g*₅) was higher, while intrinsic water-use efficiency (WUE) and relative stomatal limitation of photosynthesis (*L*₅) were lower in leaves from the humidification plots. Net photosynthesis (*A*₅), maximum rate of carboxylation by Rubisco (*V*₅₉₅₉) and maximum rate of electron transport (*J*₅₉₉₉) did not differ between the treatments. When the characteristics were analysed separately for drier and moister soil conditions, significant differences became evident between the treatments: *A*₅, *g*₅, *V*₅₉₅₉ and *J*₅₉₉₉ in the humidification treatment were higher and WUE lower in moister soil. There were no differences in these characteristics between the treatments in dry soil. *L*₅ in the humidification treatment was lower than in control in drier soil conditions and the difference diminished in moister soil.

In conclusion, the effect of higher atmospheric humidity depends on soil water availability. At low soil water potentials, there is no effect of higher humidity on gas exchange characteristics due to strict stomatal control over water loss and the effect of low soil water availability outweighs that of higher atmospheric humidity. Under moister conditions high atmospheric humidity changes photosynthetic capacity and stomatal responses significantly. Plants grown under high atmospheric humidity have higher CO₂ assimilation rate because of higher photosynthetic capacity and stomatal openness.

Keywords: net photosynthesis, stomatal conductance, water-use efficiency, photosynthetic capacity