Abstract

This Master thesis deals with the effect of elevated atmospheric carbon dioxide concentration ([CO_2]) and irradiation on the content of nonstructural carbohydrates of European beech (*Fagus sylvatica* L.) leaves and Norway spruce (*Picea abies* Karst.) needles. Nonstructural carbohydrate content reflects the balance between carbon assimilation and utilization. Elevated [CO_2] usually causes increase in the assimilation rate and changes in processes, in which assimilated carbon is utilized. These changes are often accompanied by increase of nonstructural carbohydrate levels – soluble carbohydrates and starch.

Material used in this thesis comes from experimental site of the Global Change Research Institute (GCRI) AS CR at Bílý kříž in the Beskydy mountains. Juvenile European beech and Norway spruce trees grown in a closed canopy were treated by elevated [CO_2] (700 ppm) for six growing seasons. The samples were taken in two different times of the vegetation season from sun exposed and shades leaves and needles. The carbohydrate content and spectra were determined using high performance liquid chromatography. Supplemental short-term experiment focused on the diurnal dynamics of nonstructural carbohydrate content was performed using juvenile spruce trees growing for four weeks in fully controlled conditions in phytotrons of GCRI.

Neither long-term elevated [CO_2] nor irradiation caused significant increase of total content of soluble sugars and starch content in both species studied. However, irradiance significantly influenced soluble carbohydrate spectra regardless [CO_2] treatment. Short-term phytotron experiment revealed significant changes of starch day dynamics in elevated [CO_2]: in trees grown under elevated [CO_2] the diurnal dynamic in starch content was absent.

Even though leaf soluble carbohydrate content of beech and was not increased by elevated [CO_2], beech displayed signs of photosynthetic downregulation. However, photosynthetic downregulation did not occur in spruce needles. Therefore, based on these observations, I suppose that spruce benefits from elevated CO2 more than beech. In this thesis the changes of carbohydrate dynamics caused by elevated [CO_2] in needles of evergreen conifer, Norway spruce, are presented for the first time.

Key words: elevated CO_2, nonstructural carbohydrates, soluble carbohydrates, starch, *Fagus sylvatica, Picea abies*, photosynthesis, downregulation of photosyntheris