

Age- and size-related changes in physiological characteristics and chemical composition of *Acer pseudoplatanus* and *Fraxinus excelsior* trees

ABSTRACT

Forest growth is an important factor both economically and ecologically, and it follows a predictable trend with age. Generally, growth accelerates as canopies develop in young forests and declines substantially soon after maximum leaf area is attained. The causes of this decline are multiple and may be linked to age- or size-related processes, or both. Our objective was to determine the relative effects of tree age and tree size on the physiological attributes of two broadleaf species. As age and size are normally coupled during growth, an approach based on grafting techniques to separate the effects of size from those of age was adopted. Genetically identical grafted seedlings were produced from scions taken from trees of four age classes, ranging from 4 to 162 years. We found that leaf-level net photosynthetic rate per unit of leaf mass and some other leaf structural and biochemical characteristics had decreased substantially with increasing size of the donor trees in the field, whereas other gas exchange parameters expressed on a leaf area basis did not. In contrast, these parameters remained almost constant in grafted seedlings, i.e., scions taken from donor trees with different meristematic ages show no age-related trend after they were grafted onto young rootstocks. In general, the results suggested that size-related limitations triggered the declines in photosynthate production and tree growth, whereas less evidence was found to support a role of meristematic age.

Keyword: Age-related properties, Ash, Gas exchange, Grafting, Sycamore, Water relations