Abstract

One of the manifestations of global climate change is an increase in extreme temperatures and drought waves, while forecasts of future development indicate deepening negative impacts. The effect of these abiotic stress factors is reflected in the physiological state of the vegetation. It is therefore necessary to find suitable stress indicators that will help detect the worsening of physiological state of vegetation in time series. Indicators can be detected not only by physiological methods, but also optical ones, for further use of vegetation monitoring by remote sensing methods. Forest beech (Fagus sylvatica L.) is a native tree in our context, currently widely used in forestry for planting more species-varied communities of trees that are more resistant to the effects of climate change. The aim of the thesis was to study the responses of beech to drought stress using physiological and optical indicators.

Beech seedlings (planting material from the nursery) were placed in containers in the experimental greenhouse for two experimental seasons, water supply was mediated by drip irrigation. The experimental material was divided into three groups with graded irrigation (control, moderate drought and drought). The watering regime consisted of three periods of drought and recovery phases with uniform, sufficient watering.

The responses of forest beech seedlings to drought stress were evaluated by two types of stress indicators – physiological and optical ones. As part of the physiological indicators, the concentration of photosynthetic pigments, the ratio of carotenoids to chlorophyll, water content in leaves, proline content and specific leaf area were determined, as well as the values of photosynthetic parameters based on fluorescence and gasometric measurements. Optical indicators of stress impact included the evaluation of spectral reflectance curves and vegetation indices. Considering the non-destructive nature and the possibility of measurement at different hierarchical levels of the stand, this group of stress indicators is considered promising for future applications.

From the wider spectrum of parameters studied, based on statistically significant values that were recorded in response to the shortage of watering in periods of drought, the most suitable were chlorophyll content, photosynthetic parameters measured on the basis of fluorescence and vegetation indices related to chlorophyll content (Vogelmann, Datt2, NDchl and RMSR). The effect of regeneration, i.e. the changes in parameter values that occurred after the end of the drought treatment in the period with equal watering for all groups of plants, was also monitored.

Key words

European beech (*Fagus sylvatica* L.); chlorophyll content; chlorophyll fluorescence; climate change; drought stress; nonspecific stress indicators; optical properties; photosynthesis; specific leaf area; vegetation indices