Abstract

Drought is currently one of the most significant stress factors affecting agricultural production worldwide. For this reason, various methods are being investigated to mitigate the effects of this stressor on plants. One of the possibilities how to achieve this is exogenous application of brassinosteroids, a group of plant hormones influencing diverse biological processes in plants. However, the results of studies dealing with this topic are rather variable. The aim of my work was to investigate the role of different aspects such as intraspecific variability, developmental stage of plants, the timepoint of brassinosteroid application (before/during exposure of plants to drought) and the drought intensity, which could cause the differences in results of individual studies investigating the relationship between brassinosteroids and plant exposure to drought.

I selected two contrasting maize genotypes with different sensitivity to this stress factor - the susceptible genotype 2023 and the tolerant genotype CE704 – as an experimental material. I applied the 24-epibrassinolide solution to the plants in the form of a whole plant spray at two time points - either before the start of the stress period or during this period (after 7 or 14 days of drought simulation), while the total length of the stress period was either 14 or 21 days. I analyzed two leaves in developmentally different stages - the older leaf, which was already fully developed at the beginning of the drought, and the younger leaf, which was still developing at this timepoint.

The results of my experiments have indeed shown that the abovementioned experimental factors can influence the resulting effects of brassinosteroids on plants (analyzed using various morphological, physiological and biochemical/biophysical measurements). A different response of different leaves was shown: the older leaf of genotype 2023 showed a slightly negative effect of brassinosteroid application on the condition of these leaves. On the other hand, in younger leaves of 2023 and in the genotype CE704, either a slightly positive influence of brassinosteroid application resulting in mitigation of the drought effects was observed, or there was no influence at all (in case leaves were not strongly affected by drought). The drought-susceptible genotype 2023 generally responded to brassinosteroid treatment more than the drought-tolerant genotype CE704. The effect of the brassinosteroid application also was not dependent as much on the exposure of plants to drought as on the timepoint in which the treatment was performed (again associated with the developmental stage of plants). I analyzed also leaf proteome; however, its changes were related mainly to the exposure of plants to drought than associated directly with brassinosteroid treatment, which influenced the abundance of only a few proteins. Interestingly, brassinosteroid application significantly affected the endogenous levels of these phytohormones, the contents of which changed very dynamically and were also dependent on drought exposure, genotypic and developmental factors. Overall, the investigated aspects of brassinosteroid application to plants were proven to be truly important ones, which is necessary to consider during the evaluation / interpretation of brassinosteroid/drought studies and also during potential application of brassinosteroids in agricultural practice.

Keywords

Brassinosteroids, drought, intraspecific variability, maize, plant development, proteome, stress