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Climate Change and Food –Effects of Increased CO2 Concentrations and Drought Stress on the Metabolic Profile of Soybeans

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Plants are exposed to rising CO2 concentrations, which are increasing by 1.5-2.0 ppm annually in the atmosphere. At the same time, more and more plants are experiencing further challenges due to water scarcity. These changing living conditions require most organisms to make corresponding physiological adaptations.

Although science and politics have been tracking the effects of such exogenous factors for more than three decades, it is not yet clear what influence climate change will have on the composition of our food in the long term. The results of previous studies are not always clear in this regard and seem to depend heavily on the plant genera or species considered, with the results sometimes being contradictory.

In view of this diffuse data situation, soybean plants were cultivated under different CO2 and water contents in the present study. Leaves were examined at regular intervals to analyze gas exchange. In addition, the metabolic profile of the soybeans was analyzed using high-resolution mass spectrometry (LC-ESI-IM-QTOF, non-targeted metabolomics) and then evaluated by means of various multivariate evaluation strategies.

The gas exchange measurements showed that the CO2 uptake rate increases at elevated CO2 concentrations and decreases under drought stress. The transpiration rate decreases under drought stress, but does not respond to increased CO2 concentration in the atmosphere. While the drought stress conditions did not have strong effects on the metabolic profile of soybeans, numerous differences in the metabolome could be observed in the plants cultivated at different CO2 concentrations. These differences particularly affected the lipid composition of the soybeans.

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