ALTERATION OF THE COUPLING BETWEEN PHOTOSYSTEM II ELECTRON TRANSPORT AND CO_2 ASSIMILATION IN *TRITICUM AESTIVUM* L. UNDER WATER DEFICIT

Nicolai PLATOVSCHII *, Nina ZDIORUK
Institute of Genetics, Physiology and Plant Protection, Moldova State University, Chisinau, Republic of Moldova

*Corresponding author: nicolai.platovschii@sti.usm.md

https://doi.org/10.52757/bsd26.51

Background: Water deficit is one of the major factors limiting the photosynthetic productivity of plants. Under drought conditions, the decline in CO_2 assimilation may result not only from stomatal limitations, but also from impaired coordination between photochemical reactions and carboxylation processes.

The aim of the present study was to assess changes in the relationship between electron transport in photosystem II (ETR) and net CO_2 assimilation (*A*) across different genotypes of *Triticum aestivum* L. under contrasting water supply conditions.

Materials and Methods: Plants of the wheat cultivars Moldova 5 and Meleag were grown in 10-L vegetation pots under two soil moisture regimes: 70% of full water capacity (control) and 35% of full water capacity (water deficit). The functional state of photosystem II was assessed using a PAM-2100 chlorophyll fluorometer by determining the effective quantum yield and electron transport rate (ETR). Gas exchange was assessed based on the rate of net CO_2 assimilation using a PTM-48A portable photosynthesis system. Plants were grown at a photosynthetically active radiation (PAR) level of 100-120 µmol m^{-2} s^{-1} under a 16 h light/8 h dark photoperiod. Soil moisture was monitored using ZTS-3000-TR sensors calibrated for the substrate used and the pot volume.

Results: Under optimal water supply (70% FWC), both cultivars maintained a positive relationship between ETR and CO_2 assimilation, indicating coordinated functioning of photochemical reactions and carbon fixation processes. In cv. Moldova 5, ETR ranged from 20 to 27 µmol $e^-m^{-2}s^{-1}$, while *A* varied from 3.2 to 3.8 µmol CO_2 $m^{-2}s^{-1}$; in cv. Meleag, the corresponding values were 21-27 and 3.3-3.8 µmol m^{-2} s^{-1}, respectively.

Under water deficit conditions (35% FWC), both cultivars exhibited a sharp decline in CO_2 assimilation, whereas the decrease in ETR was less pronounced. In cv. Moldova 5, *A* decreased to 0.8-1.1 µmol CO_2 m^{-2} s^{-1}, while ETR declined by 9-12 µmol e^- m^{-2} s^{-1}; in cv. Meleag, *A* ranged from 0.9 to 1.4 µmol CO_2 m^{-2} s^{-1}, where as ETR decreased by 11-13 µmol e- m^{-2} s^{-1}. This was accompanied by an increase in the ETR/*A* ratio, reflecting the apparent electron requirement for CO_2 fixation: in cv. Moldova 5, it increased from 6.2-7.1 in the control to 10.9-11.2 under water deficit, and in cv. Meleag from 6.3-7.1 to 9.2-12.2.

Conclusions: Thus, water deficit weakens the functional coupling between electron transport in photosystem II and CO_2 assimilation. The increase in the ETR/*A* ratio indicates that, under limited water availability, carbon assimilation is more strongly constrained than the photochemical generation of electron flow. This points to a disruption in the coordination between photochemical reactions and carbon fixation and likely increases the importance of photoprotective mechanisms in maintaining the stability of the photosynthetic apparatus. These results highlight the value of combining chlorophyll fluorescence and gas exchange analyses for assessing the physiological response of wheat to water deficit.

Keywords: PSII, ETR, real assimilation CO_2

Acknowledgements: The research was carried out within the sub-programme 011101 **"**Genetic and biotechnological approaches to management of agroecosystems in the conditions of climate change", funded by the Ministry of Education and Research.