PROJECT: WheatNitroDrought

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PROJECT TITLE

Role of nitrogen supply in growth, photosynthetic and molecular responses to soil drought stress in bread wheat

CONSORTIUM

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SUMMARY OF THE REPORT

WheatNitroDrought is a high-throughput project investigating the interplay between nitrogen (N) supply and the growth, physiological and photosynthetic responses of wheat plants to induced drought. In addition, the project will deliver information on the combinatorial “N x water stress” effect on some grain yield and quality traits. The experiment was set up with two genotypes, three levels of N supply (deficient, optimal and high) and two levels of water supply (well-watered and drought stress), in total 12 variants, each consisting of 9 plants/replications. The plant material included two Bulgarian bread wheat varieties differing in their genetic background – a modern semi-dwarf N-responsive variety, carrier of a combination of two height-reducing (*Rht*) genes, and an old local variety of tall stature, N-non-responsive. The experiment followed the proposal with some modifications and additions. Plants entered the phenotyping installation at early tillering stage on 01.07.2021, and received four doses of N by the end of week 3 after loading. Starting from week 4 after loading half of the plants were deprived from water supply until the plants slowed down their photosynthetic rate and considerably lost their turgor. Then the droughtened plants were re-hydrated. The automatic phenotyping started from week 1 (RGB scans + chlorophyll fluorescence imaging) twice per week, or from week 3 (VNIR/SWIR hyperspectral imaging + chlorophyll fluorescence imaging) once per week and was completed by the end of week 7 after plants loading (by 16.08.2021). In total 9,720 images were collected during the automated phenotyping. In parallel, manual measurements were performed to evaluate specific photosynthesis-related traits.

As agreed with the host, Prof. Marian Brestic, all plants remained in the installation until the plants reached seed maturity (mid of October 2021). At the end of the extended experiment, spikes from each variant were collected to evaluate yield related components. Later, seed samples will be taken and send to Bulgaria to determine the grain total N concentration/protein content.

The forthcoming analysis of the comprehensive data set combining input from the automated phenotyping, manual measurements of photosynthetic traits, grain yield and quality traits will aid our understanding how wheat plants of different genetic constitution integrate water and nutrient exogenous signals. Such knowledge has the potential to help optimizing the resources use, while minimizing the adverse environmental impacts.