PROJECT TITLE

Dissection of the metabolic response to drought stress conditions in Nordic spring wheat

CONSORTIUM

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SUMMARY OF THE REPORT

The global demand for cereals is expected to increase during the coming decades due to population and income growth [1, 2]. In addition, abiotic stress puts further pressure on agriculture production with consequences such as stagnating yields [3] and reduced grain quality.

Water scarcity reduces plant biomass and causes a downregulation of the photosynthetic machinery. However, the severity of yield loss depends on the developmental stage of the plant, level and duration of the stress. Thus, understanding plant responses and adaptations to abiotic stress will be crucial for the development of stable crop varieties that can produce high grain yields of sufficient quality also under prolonged periods of stress.

Metabolomics is a promising approach for studying the cellular and biochemical mechanisms at play during abiotic stress. Several metabolites have been suggested to be potential biomarkers for drought stress tolerance, e.g. allantoin and the amino acids His, Val, Trp and Ile.

In order to investigate the metabolic differences between plants grown under well-watered and water limited conditions, a pre-screening study with 50 breeding lines from breeding programs in Denmark, Finland, Norway and Sweden was conducted. These lines were selected based on their behaviour in the field during the severe drought year 2018. The 50 lines were tested for drought tolerance in the APPP-B platform, where drought stress was induced between DAS 22 and 45.

Based on this pre-screening, twelve contrasting lines were selected for a time-course study. Drought was induced during the same time as in the first experiment and samples for metabolite analysis were taken at four times points, T1 – early drought, T2 – mid drought, T3 – severe drought and T4 – recovery phase. The samples are currently stored in -80 C until further analysis. Imaging was performed daily and photosynthesis measurements were taken at four time points (DAS 35, 41, 44 and 48).

Morphological traits and yield components like plant height, ear length, plant biomass, straw and grain weight, harvest index, number of fertile and infertile spikes, spikelet number, grain number per plant and per ear (main ear), number of seeds per fertile spikelet, TKW and seed analysis traits from MARVIN will be taken once the plants have matured.