PROJECT TITLE

Exploration of historical breeding progress in Norwegian spring wheat by combining high throughput sensor based and physiological phenotyping methodologies

CONSORTIUM

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SUMMARY OF THE REPORT

Breeding progress is achieved by crossing cultivars and breeding lines with complementary traits, followed by screening the offspring for individuals showing promising phenotypes. This phenotypically driven method can be considered somewhat a “black box” – most often the progress is achieved without knowing its exact physiological or genetic basis. A deeper insight in it is needed on both scientific and practical planes: in the applied dimension, it can be determined which of the traits the progress had relied on and which features still show room for future improvement (phenomics), which genetic structures were associated with the advances (genomics) and how the physiological architecture is arranged and related to the breeding outcome. Such knowledge, especially when combined, can provide directions for future breeding programs by enabling direct selection at different omics level, thereby accelerating genetic gains, and reducing the required workload.

The project aimed to determine if the historic yield increase in Norwegian spring wheat (*T. aestivum* L.) can be explained at physiological and metabolomic levels through combining novel HTP (high-throughput phenotyping) and semi-HTP biochemical methodologies offered at PhenoLab, University of Copenhagen. The main goal was to study the differences in crop canopy development, photochemical performance and multispectral patterns supplemented with cell physiolological (metabolomic/phytohormone) signatures over the vegetation period in a set of spring wheat cultivars representing 5 decades of breeding progress in Norway. Results provide multi-level knowledge of the basis of the yield progress: on cell physiological level (enzymatic signatures, phytohormones) and the whole plant level (multispectral) as well as high-dimensional data on temporal dynamics of growth and development at the single plant level.

The project was carried out as planned with some changes due to the pandemic, which did not affect the outcome.

Data and samples gathered in the project are being analyzed and integrated to provide a multi-level understanding of the progress present over the last five decades in Norwegian spring wheat breeding.