IPPS 2022 Conference Book

7th International Plant Phenotyping Symposium

'Plant Phenotyping for a Sustainable Future'

Wageningen, the Netherlands
September 26-30, 2022

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The International Plant Phenotyping Symposium is a conference jointly organized by:

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The Netherlands Plant Eco-phenotyping Centre (NPEC)

A PHENOTYPER'S VISION FOR IMPROVING PHOTOSYNTHESIS AND YIELD OF C3 CROPS UNDER RISING CO2 LEVELS

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Atmospheric [CO2] will soon have doubled compared to pre-industrial levels while temperatures rise. C3 crops do not fully use the potential benefits of elevated [CO2] (e-CO2) for greater C assimilation. A main bottleneck is sink limitation reducing photosynthesis (acclimation). More vigorous and plastic sinks throughout the life cycle (branching, organ number and potential size) can increase biomass and yield. Recent evidence also suggests that adaptive plasticity of specific leaf area can improve utilization of e-CO2 and high radiation levels. Phenotyping and genetic analysis of such traits will open opportunities for grain, biomass, and also root production contributing to soil C sequestration ("4p1000") and drought avoidance. Natural variation and synthetic traits (e.g., via T6P-based sink modification) should be systematically explored.

As CO2 becomes more abundant, we also propose a renewed focus on light interception and quantum efficiency (QE). As QE is greater at sub-saturation, enhanced photosynthetic contribution of lower leaf strata would be efficient, namely in high-LAI crops. Such traits already contributed to the Green Revolution but may be revisited with respect to pigment (antenna) distribution in the canopy and electron transport efficiency. Lower canopy strata also benefit heat avoidance via transpiration cooling and partial shading. Crop microclimate thus deserves more attention in tackling global warming.

This vision of desirable adaptations calls for improved functional-structural models that may guide new phenotyping strategies, genetic research, and ultimately quantitative concepts for ideotypes addressing future crop environments.