MSc. internship/thesis

Uncovering the genetics of photosynthetic limitations using natural variation

Institute: Jan Ingenhousz Institute

Theme: Quantitative genetics

Type of experiment: Plant phenotyping

Location: Radix/NPEC

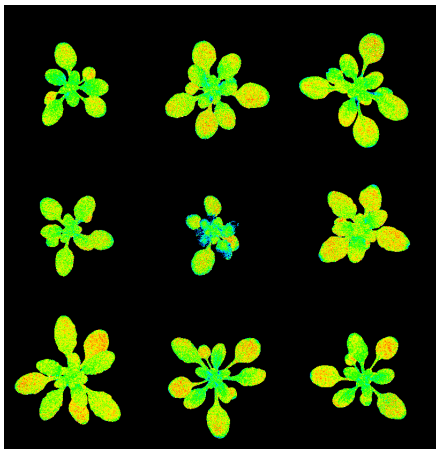
Background & aim

Photosynthesis is the basis of plant productivity, yet in crops it operates well below its theoretical maximum. The conversion of captured light energy into biomass is controlled by many genes and strongly influenced by the environment. During this process, photosynthesis and biomass accumulation can be limited by different factors, such as Rubisco carboxylation, electron transport or the use of assimilates for growth. Which process is limiting can shift between genotypes, environments and developmental stages. As a result, photosynthetic traits measured at a single time point often correlate poorly with biomass. Natural genetic variation is a powerful resource for uncovering these limitations and their genetic basis, provided that photosynthesis can be measured non-invasively and repeatedly on many plants.

Time-resolved chlorophyll fluorescence phenotyping makes this possible: by screening a genetically diverse Arabidopsis population, we can follow how photosynthetic performance and growth develop over time. Growing plants under different conditions, such as elevated CO_2 and higher temperature, can reveal genotype-specific physiological shifts that remain hidden under control conditions. The aim of this thesis is to map QTL for photosynthetic efficiency, growth and biomass across environments and over time. Ultimately, this work will help identify genomic regions that control variation in photosynthetic performance and its conversion into biomass, providing starting points for further physiological and genetic studies.

Your tasks

- Designing and running large-scale phenotyping experiments
- Processing time-resolved chlorophyll fluorescence, thermal, absorbance and biomass data
- QTL mapping within and across environments, including QTL × environment interaction





Jan IngenHousz Institute

The Jan IngenHousz Institute (JII) is an open science research institute dedicated to improving photosynthesis to enhance global crop productivity, sustainability, and climate resilience. JII brings together expertise in engineering, data science, plant biology, biophysics, genetics, and breeding. We develop innovative sensors, research methods, and data analysis platforms that enable collection and interpretation of real-time field measurements of photosynthesis.

Located on the campus of Wageningen University, JII offers a dynamic, interdisciplinary environment where curiosity meets impact. If you're a student eager to apply your knowledge to photosynthetic efficiency challenges, this is your opportunity!

What you will learn

You will learn to work with large, time-resolved datasets from high-throughput plant phenotyping, from raw measurements to biological interpretation. You will gain experience in statistical genetics using R, including mixed models, QTL mapping and the analysis of genotype × environment interactions.



For more information, contact **Julia Damen** (julia.damen@jii.org)

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