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PlantScreen™ Compact System for automated phenotyping of up to 220 small- and mid-size scale plants in controlled environment.

PlantScreen™ Modular System for automated phenotyping of 270 plants up to 1.5 m in height in greenhouse environment.

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PSI Plant Phenotyping Research Center (PPRC) is to provide state-of-art infrastructure for plant cultivation and automated high-throughput phenotyping of wide range of plant traits.

We offer access to cutting edge instruments and provide professional support of highly skilled technical and scientific personnel. PPRC infrastructure is available for use by visiting scientists and on fee-for-service basis for a wide range of phenotyping experiments.

Materials and Methods

Lettuce reaction to drought stress: high-throughput automated phenotyping of growth and photosynthetic performance

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Materials and Methods

Fresh water shortages is a major concern all over the world, not only for human consumption, but also for agriculture. Leafy vegetables, like lettuce, have high leaf water content and can be particularly susceptible to drought stress. In the present study, drought resistance of two different cultivars of Lettuce cultivar, was investigated and its growth performance and photosynthetic performance with PlantScreen™, a high-throughput non-invasive imaging platform developed at Photon Systems Instruments (PSI, Czech Republic). A range of morpho-physiological traits was monitored every second day to verify and compare the different reactions of the two accessions to a mild drought stress.

Here we present the data of the two cultivars Aquino (green butterhead) and Barlach (red butterhead), whose growth and photosynthetic performance were measured for a period of 30 days.

Results

Phenotyping protocol started on the same day (1 DAS (Days of Phenotyping)) and consisted of RGB images of the top of the plants (morphological and growth analyses), chlorophyll fluorescence measurement (photosynthetic performance) and weighing and watering of the pots. The measurement started in the morning, around 9 am, and continued until late afternoon. Plants were manually placed into the PlantScreen™ Compact System in a random order. Plants were kept for 15 minutes in the dark, after adaptation chamber, then moved under the FytoCam, under the RGB2 camera and eventually to the Watering and Monitoring System.

Fig. 2: Plants were grown in Walk-in FytoScreen FS-MI and phenotyped in PlantScreen™ Compact System. Phenotyping protocol in PlantScreen™ Compact System included RGB images for morphological and growth analyses, Chlorophyll Fluorescence (ChlF) measurement for photosynthetic performance analysis and automated watering and weighing of the pots.

Fig. 3: The two cultivars performed similarly in both control and drought conditions.

Fig. 4: A reduction in projected top area measured in number of green pixels is present in both cultivars as consequence of drought stress.

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Conclusions

Here we present the phenotypic data quantitatively characterising area increase and photosynthetic Pn performance in two different cultivars of Lettuce lettuce measured over a period of 30 days.

The analysis of RGB and ChlF images of the plants, taken every second day for the entire duration of the trial, shows that the two varieties perform similarly, both in control and in stress conditions.

However, some differences between the two cultivars are present:

• at the end of the trial, Barlach plants reached higher area values than Aquino ones, both in control and in stress conditions;

• significant differences regarding between control and stressed plants showed earlier in Barlach plants (20th day of phenotyping) than in Aquino ones (50th day of phenotyping).

Light curve protocol was used to address light use efficiency of the two cultivars. Interestingly, we observed a rapid decline in PSI II operating efficiency already 3 days upon mild drought stress initiation. Nevertheless, there was no obvious difference in the performance between the two cultivars.