High throughput phenomics infrastructure enhances student project

Challenge

Globally, at least 77 million ha of agricultural land is currently affected by salinity[1].

Since salinity reduces the grain yield of cereal crops worldwide, new crop varieties with improved salinity tolerance are needed to increase crop productivity in saline soils.

How did the facility help?

The Plant Accelerator®, South Australian node of the Australian Plant Phenomics Facility (APPF), located on the Waite Campus of the University of Adelaide, provided PhD student Rhiannon Schilling with access to novel technologies to accelerate her research into salinity tolerance in barley.

Rhiannon, who is completing her PhD studies at the Australian Centre for Plant Functional Genomics (ACPFG), undertook two experiments using the high-throughput phenomics platform of the APPF in Adelaide to investigate the performance of transgenic barley lines under salt conditions.

The projects confirmed results from previous work undertaken in hydroponics and provided new ideas for follow on projects. Supported by four co-supervisors with expertise in the areas of salinity, nitrogen use and phosphorus uptake in plants, Rhiannon went on to address these follow on projects in her PhD. This also involved testing the transgenic barley lines at a saline field trial in Western Australia.

The Plant Accelerator® offers automated greenhouses that are fitted with high-throughput plant phenotyping infrastructure where plants are grown in different environments (e.g. saline soils) on conveyor systems, able to transport them to automated watering and imaging stations. The images taken during plant growth are analysed and translated into data that provides researchers with information on plant performance over time.

Outcome

The measurements of shoot biomass and leaf sodium from Rhiannon's field work are consistent with those collected in her greenhouse experiments and Rhiannon's research findings have recently been published in the Journal of Plant Biotechnology.[2]

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[1] *Munns and Tester 2008, http://onlinelibrary.wiley.com/doi/10.1111/pbi.12145/full#pbi12145-bib-0024*

Rhiannon is looking forward to a research career aimed at developing better performing crop varieties to support sustainable farming.

> *"The Plant Accelerator enabled me to undertake large scale projects using non-destructive shoot imaging and automatic watering of pots. Without this technology, I would not have been able to accurately measure the growth rates of several hundred transgenic plants under salt stress and, as a consequence, I would have had less insight into the salt tolerance of these transgenic barley lines."*
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> *Rhiannon Schilling, PhD Student, Australian Centre for Plant Functional Genomics*

Background

The Australian Plant Phenomics Facility (APPF) was established in 2007 under the NCRIS 2006 program. As a world leading centre for innovative plant phenomics research, the APPF helps accelerate the development of new and improved crops, healthier food and more sustainable agricultural practice.

With nodes in Adelaide and Canberra, the APPF facilitates new research programs in plant and agricultural science by providing access to high quality plant growth facilities and state-of-the-art automated phenotyping capabilities in controlled environments and in the field. The facility offers high level consultation and expertise in plant phenomics including project design, statistics, automated imaging, image analysis and data management.

The APPF employs a multi-disciplinary team of experts (30 FTE) in the fields of plant science and biotechnology, mechatronic engineering, bioinformatics and computational science, horticulture, business management and equipment maintenance.

The facility is available to publicly funded and commercial organisations worldwide and to date has provided access to phenotyping services to 25 universities and public research organisations from Australia, Germany, Mexico, USA, the Philippines, Canada, Saudi Arabia, Scotland, as well as ten agribusinesses from Australia, France, Switzerland, Belgium, Germany and the USA.

Commonwealth funding for the APPF has included $14.85 million over the period 2007/08 to 2011/12 under the NCRIS 2006 program, $3.28 million for the period June 2013 to December 2014 under the Collaborative Research Infrastructure Scheme, and $3.44 million for the 12 months 2014-2015 under the NCRIS 2013 program.

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[2] *Schilling RK, Marschner P, Shavrukov Y, Berger B, Tester M, Roy SJ, Plett DC (2013) Expression of the Arabidopsis vacuolar H+-pyrophosphatase gene (AVP1) improves the shoot biomass of transgenic barley and increases grain yield in a saline field. Plant Biotechnology Journal online article PDF*