CSIRO PUBLISHING

Functional Plant Biology, 2014, **41**, v–vi
http://dx.doi.org/10.1071/FPv41n3_ED

Editorial

Protocols and phenotyping: new wikis and manuals

Protocols and phenotyping are of central importance for research and for physiological breeding. Quantitative measurements are essential for identifying traits. Gene discovery and QTL analysis depends on accurate phenotyping.

This issue of *Functional Plant Biology* features a protocol for a widely used and well regarded analytical tool in physiological research: measurements of photosynthesis using the LI-COR 6400 leaf gas exchange instrument (Evans and Santiago 2014). This protocol was prepared by two experts in the area of photosynthesis, experts both in conceptual and practical applications of the technique. The protocol was first published in *PrometheusWiki* (http://prometheuswiki.publish.csiro.au). After favourable comments by users, and thousands of downloads later, this protocol has been awarded the Gold Leaf standard and upgraded from a wiki to a citable publication with a doi (http://dx.doi.org/10.1071/FP10900).

PrometheusWiki: PROtocols, METHods, Explanations and Updated Standards Wiki is a web-based, free-content resource built primarily from volunteer contributions (Sack *et al*. 2010). *PrometheusWiki* presents an exciting and novel approach to sharing knowledge in the fields of plant physiology and the environmental sciences. It is an open access, fully searchable web resource that contains protocols and methods for plant physiology, crop physiology and ecology. The site is aimed at students and emerging researchers who are looking to develop new research directions, as well as providing a high quality open space for established researchers to debate and develop consensus tools in the field.

In the 3 years since its launch *PrometheusWiki* has achieved the highest regard from colleagues in the field and has more than 1300 registered users, with contributing authors from most countries around the globe. The site hosts more than 500 protocols and expert summaries – the equivalent of many journals in the same timeframe. The site receives an average of 800 unique visitors each week with the most highly accessed protocols receiving more than 3000 visits since posting.

Plant scientists are being called upon to solve global problems: looming food crises and the pressure to predict and respond to global change being foremost among these issues. To advance the field most effectively, the latest methods should be shared collaboratively and immediately. *Prometheus Wiki* is a unique resource that combines the best elements of a traditional journal: peer review and oversight by an expert Editorial Board. It uses the cutting edge of new media and wiki technology, and an intuitive, interactive, customisable interface for discussion and debate. While many traditional journals publish methods papers and many sites provide methods advice, only *PrometheusWiki* brings together the reputability of a journal and the immediacy of a wiki in one place.

Phenotyping for physiological breeding: two new manuals from CIMMYT

A two-part manual on 'Physiological Breeding' has recently been published by the International Maize and Wheat Improvement Center (CIMMYT), Mexico. The two volumes focus on wheat, although the principles and methodologies would be relevant to most crop species and even model plants. This provides up-to-date practical information for plant scientists and physiological breeders seeking to apply tried and tested phenotyping approaches in their own programs. While making use of the rapid advance in plant genomics and molecular marker technology, much of wheat breeding is still conducted at the whole plant level using field based protocols. The manual is therefore very relevant to all who work towards crop improvement in wheat and other cereals in particular those working for hot or water-limited environments and regions vulnerable to climatic change.

The two volumes outline the criteria for choice of reliable phenotyping methods in the context of the major environmental factors to which crops must adapt. Methods include use of both simple and complex instruments, and the design of large experimental populations to facilitate gene discovery, and of high throughput phenomics platforms.

The first volume (http://libcatalog.cimmyt.org/download/cim/96140.pdf) presents the theory for applying diverse phenotyping tools. It contains chapters on the application of physiology in plant breeding for increases in yield potential, in phosphorus and nitrogen use efficiency, and for the maximum water-limited yield in hot and dry environments. The principles of phenotyping include gas exchange and chlorophyll fluorescence, plant water relations, and genetic diversity in root traits.

The second volume (http://libcatalog.cimmyt.org/download/cim/96144.pdf) provides an overview of diverse wheat phenotyping techniques and provides detailed protocols for applied in-field crop research, with an emphasis on the methods commonly used at CIMMYT's phenotyping platform. This volume provides detailed guidance on the accurate and reliable measurement of physiological traits throughout the wheat crop cycle, along with in-depth notes and advice to assist the reader to use physiological breeding techniques with confidence. Methods and protocols are provided for several single-plant measurements such as photosynthesis, stomatal conductance and carbon-isotope discrimination, and for canopy measurements such as canopy temperature, ground cover and spectral reflectance.

PrometheusWiki protocols complement those describe in this manual, in particular a field-based 'megaprotocol' for experimental plot sampling, handling and processing of cereal experiments (Rebetzke *et al*. 2012).

The editors of *PrometheusWiki* invite you to visit the site (http://prometheuswiki.publish.csiro.au), search for a protocol

using the excellent keyword search, place a comment against an existing protocol, or submit a protocol of your own.

Functional Plant Biology will regularly publish other protocols that have reached a Gold Leaf *PrometheusWiki* standard: a minimum of 500 downloads per month over 2 years, with enthusiastic recommendations from users.

Rana Munns
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