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# Functional Plant Biology

## Contents

**Volume 41 Issue 3 2014**

*Editorial:* Protocols and phenotyping: new wikis and manuals
***Rana Munns*** v–vi

PrometheusWiki Gold Leaf Protocol: gas exchange using LI-COR 6400
***John R. Evans and Louis S. Santiago*** 223–226
This leaf gas exchange protocol enables light or $CO_2$ response curves using a LI-COR LI-6400 portable photosynthesis system. The protocol originates in PrometheusWiki where it has been tested and verified, and has received favourable user reviews. This reformatted and non-editable version is published as a Gold Leaf Protocol.

Identification of stay-green and early senescence phenotypes in high-yielding winter wheat, and their relationship to grain yield and grain protein concentration using high-throughput phenotyping techniques
***Sebastian Kipp, Bodo Mistele and Urs Schmidhalter*** 227–235
Maintenance of green leaf area is important for maximum yield formation and for high grain protein concentration. A high-throughput phenotyping method to identify stay-green and early senescence phenotypes was developed. The findings contribute to a better understanding of senescence processes.

Assessment of cultivated and wild, weedy rice lines to concurrent changes in $CO_2$ concentration and air temperature: determining traits for enhanced seed yield with increasing atmospheric $CO_2$
***Lewis H. Ziska, Martha B. Tomecek and David R. Gealy*** 236–243
One means to select crops that are adapted to rising atmospheric carbon dioxide ($CO_2$) is to determine which varieties can best convert $CO_2$ into seed yield at higher temperatures. We did this for rice, and found that although all lines responded with more seed yield as $CO_2$ increased, the weedy line, 'Stg-S' increased seed yields even at day/night temperatures up to 33/25°C. Our results suggest that including novel genes from weedy lines could help in adapting crops like rice to future climate change.

Drought-induced mortality selectively affects Scots pine trees that show limited intrinsic water-use efficiency responsiveness to raising atmospheric $CO_2$
***Ana-Maria Hereş, Jordi Voltas, Bernat Claramunt López and Jordi Martínez-Vilalta*** 244–256
Drought-induced tree mortality mechanisms are yet to be fully understood. We found that co-occurring now-dead and surviving Scots pines increased their intrinsic water-use efficiency over time, although the former increased it at significantly lower rates than the latter in the period prior to death. Warmer/drier climatic conditions could increase tree mortality in the Mediterranean: our results provide a possible approach to identify vulnerable pines.

*Cover illustration*: Measuring light response curves of *Ruscus microglossum* using the LI-COR 6400 (see Evans and Santiago pp. 223–226). Photograph supplied by Alexandria Pivovaroff.

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| Conservative water use under high evaporative demand associated with smaller root metaxylem and limited transmembrane water transport in wheat<br>***Rémy Schoppach, Diego Wauthelet, Linda Jeanguenin and Walid Sadok*** | 257–269 | Wheat yields are increasingly limited by drought events occurring at a global scale, making it important to identify drought-tolerance mechanisms. Here we report an investigation into the basis of the exceptional drought tolerance capability exhibited by an elite breeding line (RAC875) that is being used in several international breeding programs. Our data suggests that this line owes its drought tolerance to a water-saving strategy, provided by specific root anatomical and functional features that restrict water loss by transpiration under high evaporative demand. |
| Hydraulic conductance differences among sorghum genotypes to explain variation in restricted transpiration rates<br>***Sunita Choudhary and Thomas R. Sinclair*** | 270–275 | Drought causes yield loss in sorghum, as in virtually all crops. This research was done to understand water transport in sorghum plants as a mechanism to regulate water loss and to increase yield under drought. Genetic variation for plant water transport properties was found. This variation corresponded to variation in plant water loss under dry-air conditions, indicating that it may be possible to breed sorghum varieties with low water transport properties to increase drought tolerance. |
| Root growth and anchorage by transplanted 'Tifgreen' (*Cynodon dactylon* × *C. transvaalensis*) turfgrass<br>***Jeffrey S. Amthor and James B Beard*** | 276–286 | Rapid turfgrass establishment from transplanted sod is economically and aesthetically important. Anchoring of hybrid *Cynodon* (bermudagrass or couch) sod to underlying soil by new roots was strongly affected by transplantation date in springtime and by soil texture, but not by N-P-K fertilisation; irrigation overcame any effects of dry soil on root elongation rate. This new understanding of root growth by transplanted *Cynodon* sod can improve turfgrass cultural practice strategies. |
| Seasonality of foliar respiration in two dominant plant species from the Arctic tundra: response to long-term warming and short-term temperature variability<br>***Mary A. Heskel, Danielle Bitterman, Owen K. Atkin, Matthew H. Turnbull and Kevin L. Griffin*** | 287–300 | Rapid warming in the Arctic is causing cascading changes, many of which influence how carbon is cycled and stored. Photosynthesis and respiration, the leaf-level processes that control the capture and release of $CO_2$, can vary across species and under long-term warming, which is important, considering the warmer tundra of the future. The results present alterations in physiological processes and can inform predictive models of carbon cycling in this region. |
| Interspecific variation in functional traits in relation to species climatic niche optima in Andean *Polylepis* (Rosaceae) tree species: evidence for climatic adaptations<br>***Johanna M. Toivonen, Viviana Horna, Michael Kessler, Kalle Ruokolainen and Dietrich Hertel*** | 301–312 | High elevation plants show genetically determined adaptations and phenotypically plastic acclimations in their functional traits as a response to environmental conditions. We found that 7 of 14 studied traits that enable Andean *Polylepis* trees to withstand cold and dry conditions show genetically determined variation among the nine species that were studied. This suggests that these traits have been important targets of selection during the evolution of high-Andean *Polylepis* species. |
| Chemical composition of cuticular waxes during fruit development of Pingguoli pear and their potential role on early events of *Alternaria alternata* infection<br>***Yongcai Li, Yan Yin, Songjiang Chen, Yang Bi and Yonghong Ge*** | 313–320 | The cuticle of a plant has a dual role (prevention or facilitation of fungal invasion) in the process of infection. Changes in chemical composition of wax during fruit development of Pingguoli pear and their role in *Alternaria alternata* infection were evaluated in this study. Results showed that the infection processes of *A. alternata* was prevented or stimulated depending on the chemical composition of the wax. These findings may offer new light on the chemical basis for wax involvement in fungal infection. |

Characterisation of *DGAT1* and *DGAT2* from *Jatropha curcas* and their functions in storage lipid biosynthesis
***Ronghua Xu, Tianquan Yang, Ruling Wang and Aizhong Liu*** 321–329

Two key enzyme DGAT genes for lipid biosynthesis, *JcDGAT1* and *JcDGAT2*, were cloned and characterised from the potential biodiesel plant *Jatropha curcas*. The functional divergence of *JcDGAT1* and *JcDGAT2* in lipid biosynthesis was demonstrated by comparing the oil content and fatty acid compositions in both the transgenic yeast and tobacco systems. *JcDGAT2* exhibited an obvious linoleic acid substrate preference in both transgenic yeast and tobacco systems.

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**Corrigendum to**:
Metabolomic characterisation of the functional division of nitrogen metabolism in variegated leaves
***Guillaume Tcherkez, Florence Guérard, Françoise Gilard, Marlène Lamothe, Caroline Mauve, Elisabeth Gout and Richard Bligny*** 330
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