

# Functional Plant Biology

## Contents

Volume 45    Issue 8    2018

*Review: Roles of hydrogen gas in plants: a review*  
**Changxia Li, Tingyu Gong, Biting Bian**  
*and Weibiao Liao*

783–792

Hydrogen gas (H<sub>2</sub>) – a unique signal molecule – has broad application prospects in biology. Here, we focus on the fact that H<sub>2</sub> has positive effects on various developmental processes and abiotic stresses through enhancing antioxidant defense system and regulating related genes in plants. With its promising application in plants, hydrogen agriculture will be welcomed in the near future.

Differential protein expression reveals salt tolerance mechanisms of *Desmostachya bipinnata* at moderate and high levels of salinity

**Hina Asrar, Tabassum Hussain, Bilquees Gu,**  
**M. Ajmal Khan and Brent L. Nielsen**

793–812

Saline soils limit crop productivity worldwide and highlight the need to study plants of arid-saline lands. The mechanism of survival of *Desmostachya bipinnata* through proteomic analysis was determined by shortlisting 103 plant proteins involved in energy and salt stress regulation systems. Results may help in developing a salt tolerant crop that could enhance productivity under saline conditions.

Phosphorus deficiency alters scaling relationships between leaf gas exchange and associated traits in a wide range of contrasting *Eucalyptus* species

**Nur H. A. Bahar, Paul P. G. Gauthier,**  
**Odhran S. O'Sullivan, Thomas Brereton,**  
**John R. Evans and Owen K. Atkin**

813–826

Leaf and soil phosphorus have been identified as key factors modulating metabolic rates at leaf and ecosystem levels. We investigated the effect of phosphorus deficiency on leaf trait relationships within a single genus (*Eucalyptus*). Our results highlight the importance of phosphorus availability in determining relationships between metabolic performance and leaf structural and chemical composition traits in a genus widespread across the Australian continent.

Mild preflowering drought priming improves stress defences, assimilation and sink strength in rice under severe terminal drought

**R. N. Bahuguna, A. Tamilselvan, R. Muthurajan,**  
**C. A. Solis and S. V. K. Jagadish**

827–839

Drought stress is a major constraint for global rice production. Short-term mild drought priming could improve CO<sub>2</sub> assimilation and sink strength under severe drought. Priming can be considered as an effective strategy in rice to reduce severe yield penalties under drought stress.

Improved leaf nitrogen reutilisation and Rubisco activation under short-term nitrogen-deficient conditions promotes photosynthesis in winter wheat (*Triticum aestivum* L.) at the seedling stage

**Jingwen Gao, Feng Wang, Hang Hu, Suyu Jiang,**  
**Abid Muhammad, Yuhang Shao, Chuanjiao Sun,**  
**Zhongwei Tian, Dong Jiang and Tingbo Dai**

840–853

Superfluous N is consumed during wheat cultivation, causing environmental problems. Thus N fertiliser applications must be reduced without decreasing yield, which can be achieved by characterising the mechanism of adaptation to low N and breeding N-efficient cultivars. We found that under short-term N-deficient conditions, tolerant cultivars can efficiently reuse stored NO<sub>3</sub><sup>-</sup> and photorespiration-released NH<sub>4</sub><sup>+</sup> to maintain Rubisco content, and promote Rubisco activation to improve photosynthesis, which could help develop long-term N-deficiency tolerance.

*Cover illustration:* Two H<sub>2</sub> production pathway in organisms: nitrogenase and hydrogenase are viewed as the main productive routes of H<sub>2</sub> in organisms (see Li *et al.* pp. 783–792).

Rising [CO<sub>2</sub>] changes competition relationships between native woody and alien herbaceous Cerrado species

*Nayara M. J. Melo, Rayete S.-E. G. Rosa,  
Eduardo G. Pereira and João Paulo Souza*

854–864

Rising [CO<sub>2</sub>] is likely to influence plant functioning as well as structure and composition of native ecosystems. Results demonstrated that rising CO<sub>2</sub> will improve biomass allocation to vegetative organs responsible for acquiring crucial resources for growth. The shift in the pattern of biomass allocation would improve the competitive capacity of woody over herbaceous species and potentially change important ecological relationships in the savanna ecosystem of Cerrado.

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Diurnal variation in gas exchange and nonstructural carbohydrates throughout sugarcane development

*Amanda P. De Souza, Adriana Grandis,  
Bruna C. Arenque-Musa and Marcos S. Buckeridge* 865–876

To further increase sugarcane yield, it is necessary to understand the dynamics of carbohydrate accumulation and whole-plant partitioning. This paper presents the diurnal variation in gas exchange and nonstructural carbohydrates in the leaves, culm and roots of sugarcane during different stages of development in a field experiment. It gives insights into how the environment and development control sugar and biomass accumulation.

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