

# Functional Plant Biology

## Contents

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Review: Physiological perspectives of reduced tillering and stunting in the tiller inhibition (*tin*) mutant of wheat  
**Tesfamichael H. Kebrom and Richard A. Richards**      977–985

Understanding tiller inhibition in the wheat *tin* mutant provides the opportunity to improve crop yield by manipulating tillering. The aim of this review was to demonstrate that both tiller inhibition and stunting in *tin* were associated with early internode development. Therefore, research on tillering should also focus on internode development and its regulation by environmental, developmental and genetic factors.

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Early increased expression of a cyclin-dependant protein kinase (*LtCDK1;1*) during inflorescence initiation of the long day grass *Lolium temulentum*  
**Greg F. W. Gocal and Rod W. King**      986–995

Understanding flowering is important for manipulating growth, seed production and yield of grasses and cereals. A feature of the floral transition is large increases in cell division at the shoot apex, but little is known about expression of cell cycle-related genes. In the grass *Lolium temulentum*, expression of one such regulatory gene, *LtCDK1;1*, increases 6 h after the end of a florally inductive long day which precedes by 12–24 h that of an AP1 gene homologue involved in floral organ specification.

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Production of high oleic rice grains by suppressing the expression of the *OsFAD2-1* gene  
**Ella Simone Zaplin, Qing Liu, Zhongyi Li, Vito M. Butardo Jr, Christopher L. Blanchard and Sadequr Rahman**      996–1004

Fatty acid composition is critical for the quality of rice bran oil and storage of brown rice. Suppressing the expression of the *OsFAD2-1* enzyme increases the content of oleic acid at the expense of linoleic and palmitic acid in rice grains. Oil from the transgenic rice is expected to be highly stable. The low linoleic acid content should improve the stability of rice oil and brown rice during storage.

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The involvement of the mitochondrial peroxiredoxin PRXIIF in defining physiological differences between orthodox and recalcitrant seeds of two *Acer* species  
**Ewelina Ratajczak, Elke Ströher, Marie-Luise Oelze, Ewa M. Kalembe, Stanisława Pukacka and Karl-Josef Dietz**      1005–1017

Peroxiredoxines (PRXs) function as thiol-dependent peroxidases and modulate redox-dependent signalling during plant development and adaptation to environmental conditions. PRXIIF was investigated during progressive desiccation of orthodox and recalcitrant *Acer* seeds and decreased protein amounts, incomplete phosphorylation and alternation at the transcript level were detected in desiccation-sensitive seeds. Seed development, maturation, dormancy and germination are accompanied by production of reactive oxygen species, PRXs undergo phases of oxidation and participate in defining the physiological differences between contrary category seeds.

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*Cover illustration:* Tiller inhibition in the *tin* mutant of wheat is associated with enlarged or ‘gigas’ above-ground organs including thick leaves and stem, a large spike, more and larger grains per spikelet and a higher harvest index. Tiller inhibition in *tin* has been mapped to a single gene on chromosome 1AS. Understanding tiller inhibition in the *tin* mutant of wheat is potentially useful for improving the yield of cereals by manipulating tillering. The cover features Australian wheat variety Banks without the *tin* gene (left) and with the *tin* gene (right). In this issue, Kebrom and Richards (pp. 977–985) provide perspectives for the physiological basis of the *tin* phenotype and suggest the direction of research in the future. Photographs by Carl Davies (CSIRO, Division of Plant Industry).

Estimation of the steady-state cyclic electron flux around PSI in spinach leaf discs in white light, CO<sub>2</sub>-enriched air and other varied conditions  
**Jiancun Kou, Shunichi Takahashi, Riichi Oguchi, Da-Yong Fan, Murray R. Badger and Wah Soon Chow**

1018–1028

The relationship between temperature depression in the ears of wheat and flower development stage under heat and drought stress was examined. The early stages of anthesis were associated with a lower ear temperature than later stages, indicating that temperature.

Transcriptome analyses and virus induced gene silencing identify genes in the Rpp4-mediated Asian soybean rust resistance pathway  
**Aguida M. A. P. Morales, Jamie A. O'Rourke, Martijn van de Mortel, Katherine T. Scheider, Timothy J. Bancroft, Aluizio Borém, Rex T. Nelson, Dan Nettleton, Thomas J. Baum, Randy C. Shoemaker, Reid D. Frederick, Ricardo V. Abdelnoor, Kerry F. Pedley, Steven A. Whitham and Michelle A. Graham**

1029–1047

In photosynthesis, electrons derived from water are driven uphill in a linear fashion as well as in a loop or cycle, both flows helping to convert CO<sub>2</sub> into sugars. This study estimates the hitherto elusive rate of cyclic flow in leaves in CO<sub>2</sub>-enriched air. Estimates of cyclic flow will help to assess its role and elucidate its regulation in efficient photosynthesis.

Overexpression of *GsCBRLK* from *Glycine soja* enhances tolerance to salt stress in transgenic alfalfa (*Medicago sativa*)  
**Xi Bai, Jing Liu, Lili Tang, Hua Cai, Ming Chen, Wei Ji, Ying Liu and Yanming Zhu**

1048–1056

Much existing irrigated land is threatened by salinisation, so breeding high salt-tolerant plants is necessary to improve land use efficiency. In order to breed high salt-tolerant plants, transgenic alfalfa plants overexpressing *GsCBRLK* are generated, and the salt tolerance is significantly increased. Transgenic alfalfa grew well under high salinity conditions, so we hope transgenic alfalfa can be used to ameliorate salt-affected soils.

The source of nitrogen (NH<sub>4</sub><sup>+</sup> or NO<sub>3</sub><sup>-</sup>) affects the concentration of oxalate in the shoots and the growth of *Atriplex nummularia* (oldman saltbush)  
**Hussein Al Daini, Hayley C. Norman, Paul Young and Edward G. Barrett-Lennard**

1057–1064

High concentrations of oxalate in leaves can lower the nutritive value of halophytic fodder plants. We studied the effects of nitrogen source on oxalate in a clone of oldman saltbush (*Atriplex nummularia*). After 24 days growth, plants supplied with ammonium instead of nitrate had 75% lower concentrations of oxalate in shoots, but also 57% less shoot dry mass.

A segmentation procedure using colour features applied to images of *Arabidopsis thaliana*  
**Ruben Ispiryan, Igor Grigoriev, Wolfgang zu Castell and Anton R. Schäffner**

1065–1075

The major challenge in plant phenotyping based on image analysis lies in the difficulty to discriminate relevant features from unimportant background information. We propose two approaches solving this problem, one applying methods from machine learning and a second one allowing user interaction. Although the approaches are presented for phenotyping of *Arabidopsis thaliana*, they can likewise be applied to feature extraction of digital images in other contexts.

External heat-pulse method allows comparative sapflow measurements in diverse functional types in a Mediterranean-type shrubland in South Africa  
**Robert P. Skelton, Adam G. West, Todd E. Dawson and Jenny M. Leonard**

1076–1087

Divergent responses of coexisting species to short- and long-term climatic conditions may be significant in diverse floras, particularly those occurring in highly pulse-driven environments. Our aim was to test the efficacy of miniature external sapflow gauges for capturing physiological response of diverse coexisting functional types, including small monocotyledonous species. Our data show that the gauges approximate measures of transpiration well and that they will allow important fundamental ecophysiological questions to be investigated in future studies.

Corrigendum to:

Sap-flux density measurement methods: working principles and applicability  
**Maurits W. Vandegehuchte and Kathy Steppe**  
[Vol. 40, No. 3 (2013) pp. 213–223]

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