

# Functional Plant Biology

## Contents

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|--|----------------|---|
| <p>Grapevine varieties exhibiting differences in stomatal response to water deficit<br/><b>Joaquim M. Costa, Maria F. Ortuño, Carlos M. Lopes and Maria M. Chaves</b></p>  | <p>179–189</p> | <p>Knowledge on variety traits underlying responses to water stress remains scarce in grapevine, limiting irrigation and breeding strategies to optimise water use. We aimed at characterising different grapevine varieties on the basis of leaf temperature (<math>T_{\text{leaf}}</math>) and water potential (<math>\Psi_{\text{pd}}</math>) to better understand stomatal regulation. We show that different genotypes had different <math>T_{\text{leaf}}</math> for similar water potential suggesting variation in stomatal control. This should be accounted for when managing irrigation.</p> |
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| <p>Effects of drought and high temperature stress on synthetic hexaploid wheat<br/><b>Gautam P. Pradhan, P. V. Vara Prasad, Allan K. Fritz, Mary B. Kirkham and Bikram S. Gill</b></p>   | <p>190–198</p> | <p>Drought and high temperatures cause significant yield losses in wheat. Independent and combined effects of drought and high temperature stress were quantified on synthetic wheat genotypes. Combined effects of drought and high temperature stress were more detrimental than the individual stresses. Stress tolerant synthetic wheat genotypes identified in this study can be used to improve drought and high temperature tolerance in wheat.</p>  |
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| <p>The impact of winter flooding with saline water on foliar carbon uptake and the volatile fraction of leaves and fruits of lemon (<i>Citrus × limon</i>) trees<br/><b>Violeta Velikova, Tommaso La Mantia, Marco Lauteri, Marco Michelozzi, Isabel Nogues and Francesco Loreto</b></p> | <p>199–213</p> | <p>The combination of winter flooding with saline water heavily, yet transiently, damages the primary metabolism of a high-value lemon orchard, whereas it enhances emission and content of abundant foliar and fruit volatiles. These results suggest the unexpected resilience of sensitive crops to salinity coupled with flooding, and also indicate a qualitative change in secondary metabolites of importance for pollination and induced plant self-defence, and for the quality of fruit production.</p>   |
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| <p>Physiological and morphological factors influencing wear resistance and recovery in <math>C_3</math> and <math>C_4</math> turfgrass species<br/><b>Filippo Lulli, Marco Volterrani, Nicola Grossi, Roberto Armeni, Sara Stefanini and Lorenzo Guglielminetti</b></p>                  | <p>214–221</p> | <p>Wear resistance and recovery are the most sought after characteristics in turfgrass species for most applications. Therefore, <math>C_4</math> turfgrass wear resistance and recovery was tested in a controlled environment and the results were plotted against main plant tissue constituents. Lignin and carbohydrate concentrations proved to be the compounds most closely correlated with wear resistance and recovery respectively, with a species-specific equilibrium.</p>   |
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*Cover illustration:* Light microscope image of leaf abaxial epidermis of *V. vinifera* Syrah (left side) (200×); visible and false coloured infrared images of canopies of three grapevine varieties Syrah (SYR), Cabernet Sauvignon (CAB) and Touriga Nacional (TOU) (right side) (see Costa *et al.* pp. 179–189). Plants were measured at early afternoon (1300–1530 hours) in August 2007 (air  $T_{\text{max}} = 36.8^\circ\text{C}$ , air  $\text{RH}_{\text{min}} = 13\%$ ), at a commercial vineyard (Monte Seis Reis), Estremoz, South Portugal. Aluminium markers were used to assist selection of leaves of interest in the infrared images.

Preliminary characterisation of two early meiotic wheat proteins after identification through 2D gel electrophoresis proteomics

**Kelvin H. P. Khoo, Amanda J. Able,  
Timothy K. Chataway and Jason A. Able**

222–235

Proteomics is a powerful tool for identifying novel protein species. By using 2D gel electrophoresis, five proteins differentially expressed during meiosis in bread wheat were identified; two were characterised as DNA-binding proteins. This study shows the potential of proteomics as a protein discovery tool in plant species, even where the genome is not completely sequenced. The preliminary characterisation of the two novel DNA-binding proteins earmarks these candidates for further study.

Arbuscular mycorrhisation with *Glomus irregulare* induces expression of potato PR homologues genes in response to infection by *Fusarium sambucinum*

**Youssef Ismail and Mohamed Hijri**

236–245

Arbuscular mycorrhizal fungi form symbiosis with roots of a wide range of plants improving their growth by increasing mineral uptake. These fungi induce defense responses in potato plants to protect against infection with the pathogen *Fusarium sambucinum*. As a result, arbuscular mycorrhizal fungi significantly suppressed disease severity of *Fusarium sambucinum* on potato plants compared with those infected and non-mycorrhizal plants.

Tomato response to legume cover crop and nitrogen: differing enhancement patterns of fruit yield, photosynthesis and gene expression

**Tahira Fatima, John R. Teasdale, Jim Bunce  
and Autar K. Mattoo**

246–254

Crops can distinguish between organic and inorganic sources of nitrogen (N), one of the most important nutrients required by plants. Tomato responses at the whole-plant (yield), leaf (photosynthesis) and molecular (gene expression) levels to the legume cover crop, hairy vetch, were shown to be a result of cues by molecules other than just N. These findings suggest that N management by on-site production of legume cover crops in sustainable cropping systems offer additional physiological advantages to crops than those derived from inorganic N alone.

Responses to low phosphorus in high and low foliar anthocyanin coleus (*Solenostemon scutellarioides*) and maize (*Zea mays*)

**Amelia Henry, Surinder Chopra,  
David G. Clark and Jonathan P. Lynch**

255–265

Anthocyanin accumulation is a common response of leaves to phosphorus deficiency, although the utility of this response is unknown. We evaluated red and green leafed phenotypes of maize and coleus under phosphorus deficiency, and found no clear physiological benefit from anthocyanins. More research is needed, for example comparing constitutive and induced anthocyanin biosynthesis, to understand how anthocyanin production might help protect nutrient-deficient plants.