

Functional Plant Biology

Contents

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Editorial: Update on Functional Plant Biology

Rana Munns iii

Differential shrinkage of mesophyll cells in transpiring cotton leaves: implications for static and dynamic pools of water, and for water transport pathways
Martin Canny, Suan Chin Wong, Cheng Huang and Celia Miller 91–102

All leaves lose water on hot dry days and thin ones often wilt (e.g. pumpkin) because their cells shrink. This study of cell shrinkage in cotton leaves after considerable water loss has shown that they have a mass of cells that do not shrink, thus helping the leaf resist wilting. It is likely that many similar leaves may resist wilting by this mechanism.

Hydraulic connectivity from roots to branches depicted through sap flow: analysis on a *Quercus suber* tree
Teresa S. David, Jorge S. David, Clara A. Pinto, Jan Cermak, Valery Nadezhdin and Nadezhda Nadezhdina 103–115

The study of xylem connections in a cork oak tree showed that above ground xylem was sectorially connected to crown parts on the same orientation, whereas roots were connected to the whole crown. The sectoriality of aboveground xylem limits the spread of embolisms, but the integration in roots favours resource acquisition though allowing the spread of root diseases.

Water use, water use efficiency and drought resistance among warm-season turfgrasses in shallow soil profiles
Yi Zhou, Christopher J. Lambrides, Ryan Kearns, Changrong Ye and Shu Fukai 116–125

Maintaining functional turfgrass under limited water resources can be achieved by using species with drought resistance. Under shallow soil profiles typical of urban environments, water use characteristics of four commercial turfgrass species were evaluated and the bermudagrasses were found to have the best drought resistance. This research suggests that bermudagrasses may be preferable where water resources are limiting in urban environments.

Ecotypic responses of switchgrass to altered precipitation
Jeffrey C. Hartman, Jesse B. Nippert and Clint J. Springer 126–136

Climate change is projected to alter precipitation patterns, creating new environments for plants. This research sought to determine the responses of different ecotypes of switchgrass to changes in precipitation, with results showing differences in physiological responses between ecotypes and biomass responses to precipitation changes. The interactions between ecotype and precipitation suggest it may not always be necessary to consider localised adaptation when predicting species responses across a large geographic gradient.

Cover illustration: Transverse face of a cryo-fixed leaf of cotton, planed and viewed still frozen in the cryo-SEM (see Canny *et al.* pp. 91–102). Two sub-stomatal cavities are evident on the upper side, where the palisade cells are loosely packed. Away from the stomata the palisade cells are tightly packed (matrix cells). Palisade cells stand upon cells of the spongy mesophyll as seen at the right side, and on bundle sheath cells as at the centre. During transpiration the cavity cells and the spongy mesophyll cells shrink, but the matrix cells retain their full water content. Bar = 150 μm . Micrograph by Martin Canny.

<p>Internode elongation pattern and differential response of rice genotypes to varying levels of flood water <i>Annamalai Anandan, Govindrajan Rajiv, Akkisetty Ramarao and Muthu Prakash</i></p>	137–145	<p>Rising sea level, erratic heavy rainfall and impeded drainage leads to inundation of low-lying paddy fields. This study showed the response of rice cultivars from different ecosystems varied predominantly in internodal length, blade and sheath length under varying levels of floodwater. Therefore, breeding rice varieties with specific adaptation mechanisms to their relevant flood-prone environment is necessary to improve grain yield.</p>
<p>Production of small starch granules by expression of a tandem-repeat of a family 20 starch-binding domain (SBD3-SBD5) in an amylose-free potato genetic background <i>Farhad Nazarian-Firouzabadi, Luisa M. Trindade and Richard G. F. Visser</i></p>	146–155	<p>Starch granule size is a very important parameter in food and non-food applications. In this study, transgenic potato plants capable of producing small starch granules were generated, using genetic engineering approaches. Due to intrinsic purity of potato starch, small starch granules produced in this study may make them particularly suitable for making starch noodles and films in industry.</p>
<p>Metabolite profiling of wheat flag leaf and grains during grain filling phase as affected by sulfur fertilisation <i>Christian Zörb, Dorothee Steinfurth, Victoria Gödde, Karsten Niehaus and Karl H. Mühling</i></p>	156–166	<p>Increasing prices for wheat products and the decrease of atmospheric sulfur emissions by industry call for an adjusted agricultural management to maintain yield and product quality. We evaluated the effects of sulfur fertilisation including apparent sulfur deficiency and a novel late application on the composition of metabolites in flag leaves and grain. A considerable influence of sulfur fertilisation not only on sulfur rich amino acids but also on the sugar metabolism was detected and late sulfur fertilisation can help to prevent sulfur deficiency.</p>
<p>Multivariate associations of flavonoid and biomass accumulation in white clover (<i>Trifolium repens</i>) under drought <i>Wouter L. Ballizany, Rainer W. Hofmann, M. Z. Zulfiqhar Jahufer and Brent A. Barrett</i></p>	167–177	<p>Drought impairs biomass production of white clover and increases the levels of flavonols. The responses of a white clover population to drought reveal that quercetin glycoside accumulation is associated with the retention of biomass production. The underlying potential genetic variation for quercetin glycoside accumulation, linked to herbage yield, will enhance selection in breeding programs for improving white clover drought performance.</p>