

# Functional Plant Biology

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Volume 44      Issue 6      2017

Use of multicolour fluorescence imaging for diagnosis of bacterial and fungal infection on zucchini by implementing machine learning

**Mónica Pineda, María Luisa Pérez-Bueno, Vanessa Paredes and Matilde Barón**

563–572

Remote sensing has become an essential tool in phenotyping and precision agriculture to minimise the impact of cultural management on environment and human health. Several imaging techniques are currently in use for the detection of plant stress, but the information generated requires of increasingly advanced mathematical tools. Multicolour fluorescence imaging appears as a promising tool as data provider to feed mathematical models classifying healthy and infected zucchini plants.

Photosynthetic acclimation to elevated CO<sub>2</sub> concentration in a sweet pepper (*Capsicum annuum*) crop under Mediterranean greenhouse conditions: influence of the nitrogen source and salinity

**Manuel E. Porras, Pilar Lorenzo, Evangelina Medrano, María J. Sánchez-González, Ginés Otálora-Alcón, María C. Piñero, Francisco M. del Amor and M. Cruz Sánchez-Guerrero**

573–586

An increased CO<sub>2</sub> concentration in the atmosphere improves yield of the horticultural crops but its efficiency is reduced after long-term exposure. We studied the evolution of the sweet pepper crop response to CO<sub>2</sub> enrichment in Mediterranean greenhouse conditions under different salinity levels. The study revealed the crop phase when high CO<sub>2</sub> concentration acclimation occurs and, thus, the point when removal of the CO<sub>2</sub> supply could improve its efficiency.

Annual patterns of xylem embolism in high-yield apple cultivars

**Barbara Beikircher and Stefan Mayr**

587–596

Winter and spring are crucial periods for long-lived woody species of temperate regions because of the considerable impact on the plants' water relations. In this study on high-yield apple cultivars, we show which climatic and species-specific factors are primarily responsible for the impairment of the water transport system in winter as well as its restoration in spring. Our findings contribute to the general knowledge about tree hydraulics but are also of relevance for fruit growers.

On the induction of injury in tomato under continuous light: circadian asynchrony as the main triggering factor

**Aaron I. Velez-Ramirez, Gabriela Dünner-Planella, Dick Vreugdenhil, Frank F. Millenaar and Wim van Ieperen**

597–611

Unlike other species, tomato plants need to 'sleep' 8 h a day to remain healthy; that is, continuous light injures tomatoes. We experimentally tested many proposed explanations for this enigma and discarded all but one, which suggest that the presence of a light – normally a 'day' signal – when the internal circadian clock indicates 'it's night-time' is central to this disorder: we call this conflict 'circadian asynchrony'. These findings help in understanding the complex co-ordination between metabolism, light and time.

Morpho-physiological responses to dehydration stress of perennial ryegrass and tall fescue genotypes

**Reihaneh Shahidi, Junko Yoshida, Mathias Cougnon, Dirk Reheul and Marie-Christine Van Labeke**

612–623

Climate change will shift the adaptive regions of most forage grasses. We investigated the responses of two tall fescue genotypes and one perennial ryegrass to increasing drought and found that at the physiological and metabolic levels drought was imposed more slowly in tall fescue. Tall fescue may fit into future demands for forage grasses due to its good drought resistance.

*Cover illustration:* Images of standard control and *Podosphaera fusca*-infected zucchini leaves at 1, 3 and 7 days post inoculation (dpi) representing the fluorescence ratio F520/F680 (see Pineda *et al.* pp. 563–572). The false colour-scale used is as shown. Image by M. Pineda.

Evaluation and application of a targeted SPE-LC-MS method for quantifying plant hormones and phenolics in *Arabidopsis*

**Florence Guérard, Linda de Bont,**

**Bertrand Gakière and Guillaume Tcherkez**

624–634

The quantitation of plant hormones by LC-MS remains challenging because they belong to different chemical classes with contrasted analytical imperatives, and matrix effects often compromise reliable measurements. Here we present a technique based on accurate-mass LC-MS taking advantage of matrix elimination by solid phase extraction before analysis. This method is applied to *Arabidopsis* samples and as expected, shows that abscisic acid is accumulated under drought and that mutants affected in aspartate oxidase have an increased content in salicylate.

Endosperm-specific OsPYL8 and OsPYL9 act as positive regulators of the ABA signaling pathway in rice seed germination

**Ziqiang Chen, Lan Kong, Yun Zhou, Zaijie Chen,**

**Dagang Tian, Yan Lin, Feng Wang**

**and Songbiao Chen**

635–645

Pyrabactin resistance-like (PYL) proteins were identified as receptors of the plant hormone ABA, but the functions of many PYLs remains to be elucidated. In this work, we determined that rice OsPYL8 and OsPYL9 are specifically expressed in the endosperms. Analyses of transgenic rice plants overexpressing OsPYL8 or OsPYL9 further showed that the two OsPYLs function as positive regulators of ABA signaling pathway in rice seed germination.

Proton and anion transport across the tonoplast vesicles in bromeliad species

**Paula Natália Pereira, James Andrew Charles Smith,**

**Eduardo Purgatto and Helenice Mercier**

646–653

Although Crassulacean acid metabolism (CAM) has been well studied in the family Bromeliaceae, the relationship between CAM activity and vacuolar organic-acid transport at night has not. We investigated ATP- and PPi-dependent proton transport in the tonoplast membrane vesicles of seven bromeliad species. We found that tonoplast ATP-driven H<sup>+</sup> activity is greater than tonoplast PPi. Our results demonstrate a close correlation between CAM rhythm and the intrinsic properties of vacuolar membranes.