

Functional Plant Biology

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Drought resistance of cotton (*Gossypium hirsutum*) is promoted by early stomatal closure and leaf shedding

Ximeng Li, Renee Smith, Brendan Choat and David T. Tissue

91–98

Knowledge about water relations of crops is critical for sustaining productivity and irrigation scheduling. Here, the coordination between embolism and leaf gas exchanged was measured for cotton plants, and results show that the hydraulic integrity of stem and roots was prioritised over canopy carbon gain during drought stress. These results demonstrate the hydraulic strategy of this important crop species, and suggest that irrigation should be applied shortly following stomatal closure to ensure canopy photosynthesis during and after water deficit.

Harnessing leaf photosynthetic traits and antioxidant defence for multiple stress tolerance in three premium indigenous rice landraces of Jeypore tract of Odisha, India

Debabrata Panda, Biswajeet Mohanty, Prafulla K. Behera, Jijnasa Barik and Swati S. Mishra

99–111

Precise physiological assessments provide information about the extent of genetic variability, which helps in effective breeding programs. In the present study we compared the effects of different abiotic stress (drought, salinity and submergence) on growth, photosynthesis and antioxidant defence in three rice landraces to evaluate their performance under multiple abiotic stresses and possible opportunity of using in pre-breeding programs against drought, salinity and submergence, which show the adaptive fitness of genotype.

Low root *PIP1-1* and *PIP2* aquaporins expression could be related to reduced hydration in ‘Rangpur’ lime plants exposed to aluminium

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112–121

Aluminium (Al) is toxic to most plants, including ‘Rangpur’ lime plants, which is an important rootstock for *Citrus* industry. Al is believed to cause inhibition of root growth leading to low gas exchange in leaves. Here we found Al-induced decrease in gene expression of water channels in plasma membrane responsible for water transport, called aquaporins. This opens a different interpretation for Al toxicity symptoms in plants exposed to Al.

The effect of zinc fertilisation and arbuscular mycorrhizal fungi on grain quality and yield of contrasting barley cultivars

Ahmed A. Al Mutairi, Timothy R. Cavagnaro, Shi Fang Khor, Kylie Neumann, Rachel A. Burton and Stephanie J. Watts-Williams

122–133

Mycorrhizal fungi can improve the yield and nutrition of important agricultural crops including barley, but it is unknown whether they affect other aspects of grain quality. This study addresses whether soil zinc fertilisation (directly) and mycorrhizal fungi (indirectly) affect the grain quality of contrasting malting barley cultivars. The results of the study suggest that barley cultivar choice and, to a lesser extent, zinc fertilisation, are determinants of grain quality; mycorrhizal fungi affect some quality traits such as starch, but not others.

Nitrogen fertilisation influences low CO₂ effects on plant performance

André G. Duarte, Fred J. Longstaffe and Danielle A. Way

134–144

This work focused on understanding how nitrogen availability influenced plant growth in past environments when atmospheric CO₂ concentrations were lower than modern values. We found that nitrogen availability can alter how stomatal and photosynthetic traits, and N-isotope discrimination are affected by growth at low CO₂. Such effects may confound interpretations of plant responses to past low CO₂ environments as well as the use of nitrogen isotopes as paleo-indicators.

Cover illustration: Root oxygen release as depicted by blue colour in the roots of two sensitive and two tolerant rice varieties grown in excess Fe²⁺ media for 10 days and thereafter incubated for 24h in an oxygen-free media containing 5% agar and reduced methylene blue (clear). As roots release oxygen in the media, the methylene blue oxidizes and the blue colour develops. Image by Dorothy Akinyi Onyango.

Mechanistic understanding of iron toxicity tolerance in contrasting rice varieties from Africa: 2. Root oxidation ability and oxidative stress control

Dorothy A. Onyango, Fredrickson Entila, James Egdane, Myrish Pacleb, Meggy Lou Katimbang, Mathew M. Dida, Abdelbagi M. Ismail and Khady N. Drame

145–155

Excessive iron concentrations can cause toxicity in rice plants, and dramatically reduce its performance. A good understanding of the mechanisms used by rice to withstand the high iron in its environment can help improve rice tolerance to iron toxicity. We report key traits associated with these tolerance mechanisms such as well-developed aerenchyma, radial oxygen loss restricted to the root cap as well as strong activation of anti-oxidative enzymes.

Effects of palmitic acid (16:0), hexacosanoic acid (26:0), ethephon and methyl jasmonate on the cuticular wax composition, structure and expression of key gene in the fruits of three pear cultivars

Xiao Wu, Yangyang Chen, Xinjie Shi, Kaijie Qi, Peng Cao, Xueying Liu, Hao Yin and Shaoling Zhang

156–169

It is currently unclear whether treating with a precursor and spraying of exogenous hormones can influence the cuticular wax of pear fruits. The wax profiles of palmitic acid, hexacosanoic acid-, ethephon- and methyl jasmonate-treated fruits of three pear cultivars were analysed by GC-MS and FESEM. Results showed that the different treatments induced various changes in the cuticular wax of the three pear cultivars.

Improved reproductive growth of euhalophyte *Suaeda salsa* under salinity is correlated with altered phytohormone biosynthesis and signal transduction

Jianrong Guo, Chaoxia Lu, Fangcheng Zhao, Shuai Gao and Baoshan Wang

170–183

Reproductive growth is very important for plant survival and population establishment under saline conditions. The mechanisms underlying the effect of salinity on plant reproduction remains unknown. NaCl markedly increased the GA₃, GA₄, IAA and ZR contents in flowers with the co-ordinated upregulation of gene expression level involving in phytohormone biosynthesis and signal transduction. Unravelling the mechanism of plant salt tolerance during the reproductive growth will be helpful for improving agricultural production.