

Functional Plant Biology

Contents

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Perspective: Of growing importance: combining greater early vigour and transpiration efficiency for wheat in variable rainfed environments
P. B. Wilson, G. J. Rebetzke and A. G. Condon 1107–1115

Two independent physiological traits in wheat, greater early vigour and higher transpiration efficiency, have been shown to have varied effects on yield in water-limited environments. We discuss the potential benefit to yield of combining these traits and the physiological basis of their interaction with different environments. Finally, we suggest a phenotypic screening strategy for managing the complex genetics underpinning early vigour and transpiration efficiency when selecting both traits in commercial wheat breeding programs.

Relationships between biomass allocation, axis organogenesis and organ expansion under shading and water deficit conditions in grapevine
Benoît Pallas and Angélique Christophe 1116–1128

Relationships between whole-plant growth and morphogenetic processes under abiotic stresses are still partly unknown limiting the predictive capacity of plant models. In this paper we investigated the effects of soil water deficit and shading on grapevine shoot growth. This study provides new experimental data to improve the formalisms used to simulate plant morphogenesis processes in source–sink plant models.

Exogenous salicylic acid-triggered changes in the glutathione transferases and peroxidases are key factors in the successful salt stress acclimation of *Arabidopsis thaliana*
Edit Horváth, Szilvia Brunner, Krisztina Bela, Csaba Papdi, László Szabados, Irma Tari and Jolán Csizsár 1129–1140

Using chemicals such as salicylic acid (SA) as a pretreatment agent may alleviate subsequent salt stress-triggered damages in *Arabidopsis thaliana*. Exogenous SA fine-tunes the production of reactive oxygen species and, in a proper concentration, increases antioxidant peroxidase and glutathione transferase (GST) activity, and enhances the transcript level of several GST genes. Induction of *AtGSTU24* and *AtGSTU19* genes by SA can be an important part of priming and salt stress acclimation.

Hydrogen-rich water-alleviated ultraviolet-B-triggered oxidative damage is partially associated with the manipulation of the metabolism of (iso)flavonoids and antioxidant defence in *Medicago sativa*
Yanjie Xie, Wei Zhang, Xingliang Duan, Chen Dai, Yihua Zhang, Weiti Cui, Ren Wang and Wenbiao Shen 1141–1157

External administration of hydrogen-rich water (HRW) benefits plants from multiple environmental stimuli, whereas the corresponding mechanisms are still elusive. Our findings illustrated that HRW confers tolerance to UVB-induced oxidative damage, partially by the manipulation of (iso)flavonoids metabolism and antioxidant defence in *Medicago sativa*. These studies could provide some theoretical basis of the potential relievable strategy for UVB-induced oxidative stress in plants.

Cover illustrations: Effects of hydrogen-rich water (HRW) pretreatment on ultraviolet-B radiation-induced lipid peroxidation (upper four panels) and loss of plasma membrane integrity (lower four panels) in the leaves of *Medicago sativa* (see Xie *et al.* pp. 1141–1157). Fourteen-day-old seedlings were pretreated with or without 50% HRW for 12 h, and then exposed to 0 or 10.8 kJ m⁻² ultraviolet-B radiation. After irradiation, seedlings were transferred to the normal growth conditions for another 5 days. Seedling leaves were stained with Schiff's reagent (upper four panels) or Evan's blue (lower four panels). Seedlings without irradiation were set as a control (Con). Images by Yanjie Xie.

Impact of arbuscular mycorrhizal fungi (AMF) on cucumber growth and phosphorus uptake under cold stress

Jun Ma, Martina Janoušková, Yansu Li, Xianchang Yu, Yan Yan, Zhirong Zou and Chaoxing He

1158–1167

Symbiosis with arbuscular mycorrhizal fungi improves plant phosphorus uptake and tolerance to environmental stresses. Short-term cold stress, relevant in some agricultural production conditions, reduced the benefits provided by mycorrhiza to cucumber plants, although they still benefited from being mycorrhizal by increased phosphorus uptake. The dependence of mycorrhizal effects on temperature must be taken into account when introduction of the fungi into production systems is considered.

Native hemiparasite and light effects on photoprotection and photodamage in a native host

Robert M. Cirocco, Melinda J. Waterman, Sharon A. Robinson, José M. Facelli and Jennifer R. Watling

1168–1178

Parasitic plants use suckers to feed off other plants and may reduce the levels of leaf pigments that protect against harsh light conditions. We explored whether a native parasite was reducing these levels in a native plant in high or low light and found that they were not compromised under either of the test conditions. This discovery helps explain why native plants with this native parasite avoid light stress to survive in nature.

The influence of shoot and root size on nitrogen uptake in wheat is affected by nitrate affinity in the roots during early growth

Jiayin Pang, Stephen P. Milroy, Gregory J. Rebetzke and Jairo A. Palta

1179–1189

Efficient capture of N by the root system is important in deep sandy soils, where we determined whether the similarity in N uptake in genotypes with different biomass was associated with differences in the affinity of the root system for nitrate uptake. Genotypes with less root growth and proliferation than the vigorous genotypes have a higher affinity for nitrate.