

Functional Plant Biology

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Contents

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Review: Hydraulics of plant growth

John S. Boyer and Wendy K. Silk

761–773

The review deals with the way water and solutes move to growing plant cells after leaving the xylem and phloem. Because the topic involves transport physics that can become quite complex, the authors have related the findings in terms that can be easily understood without knowledge of the mathematics. The underlying principles and their consequences are described together with some ideas for future research.

NaCl salinity affects lateral root development in
Plantago maritima

Michael Rubinigg, Julia Wenisch, J. Theo M. Elzenga

and Ineke Stulen

775–780

This paper describes the effects of NaCl on root growth and architecture of the halophyte *Plantago maritima*. Primary-root length increased at all NaCl concentrations tested, but total lateral-root length, if affected, increased at lower concentrations and was considerably reduced at 200 mM. NaCl concentrations that did not affect relative growth rate or total lateral-root length severely affected root branching pattern, indicating that the decrease in total lateral-root length at 200 mM was the consequence of inhibited development rather than reduced length growth.

Changes in photosynthetic pigment composition and
absorbed energy allocation during salt stress and
CAM induction in *Mesembryanthemum crystallinum*

David H. Barker, Jeff Marszalek, Jeff F. Zimpfer and

William W. Adams III

781–787

The changes in photosynthetic pigments, both diurnal cycling of the xanthophyll cycle as well as long-term acclimatory changes, which accompany transition in the photosynthetic pathway are detailed. This paper is unique in that the authors have addressed the consequences of salt stress and CAM induction on plant performance and accompanying pigment changes, rather than CAM-specific functions. In this way CAM is highlighted as part of a suite of stress responses with consequences for plant performance that require adjustment in plant protective mechanisms to ensure survival.

Low temperature effects on grapevine photosynthesis:
the role of inorganic phosphate

Luke Hendrickson, Wah Soon Chow and

Robert T. Furbank

789–801

This paper describes the role of end-product limitation and orthophosphate (P_i) recycling to the chloroplast in the photosynthetic response of grapevine leaves (*Vitis vinifera* cv. Riesling) to low temperature. Photosynthesis in grapevine leaves was severely restricted at low temperature by non-stomatal mechanisms and the return of P_i to the chloroplast plays an important role in this limitation, but a coordinated set of regulatory processes maintained a homeostasis of phosphorylated sugar levels.

Cover illustration: Water potential distribution from the soil to the tip of a growing maize leaf. The growth zone at the base of the leaf has a water potential much lower than that of the protoxylem (X) running through it, providing evidence for a growth-induced water potential. Water potentials in the shoot during the day (orange) are lower than during the night (black) because of transpiration (blue). Adapted from Tang and Boyer (2002), see Boyer and Silk pp. 761–773.

Effects of lincomycin on PSII efficiency, non-photochemical quenching, D1 protein and xanthophyll cycle during photoinhibition and recovery

Kristine Mueh Bachmann, Volker Ebbert, William W. Adams III, Amy S. Verhoeven, Barry A. Logan and Barbara Demmig-Adams 803–813

Parthenocissus quinquefolia leaves were treated with lincomycin, subjected to high light, and allowed to recover. Lincomycin affected D1 protein levels, xanthophyll-cycle operation, and thermal energy dissipation. The latter was apparently through maintenance of a high trans-thylakoid proton gradient. In accompanying experiments with spinach and pumpkin in low light, lincomycin triggered PSII core degradation, but did not induce zeaxanthin formation or non-photochemical quenching.

The lutein epoxide cycle in vegetative buds of woody plants

José I. García-Plazaola, Koldobika Hormaetxe, Antonio Hernández, José M. Olano and José M. Becerril 815–823

The lutein epoxide (Lx) cycle was measured in vegetative buds of many woody plant species and its presence had a high fidelity at the family level, but its occurrence in unrelated taxa suggests that this character has appeared independently in several plant groups. Light attenuation by bud scales inhibited the daily operation of the Lx cycle, suggesting that it is not involved in short-term reversible photoprotection.

Effects of UV irradiation on barley and tomato leaves: thermoluminescence as a method to screen the impact of UV radiation on crop plants

Matthias Gilbert, Jiri Skotnica, Ilka Weingart and Christian Wilhelm 825–845

The effect of UV on barley and tomato leaves was investigated by thermoluminescence and fluorescence measurements. Barley was more sensitive than tomato and the donor side of PSII was the major target site of UV inhibition. These results were in agreement with differing epidermal UV transmittances of both plants.

De novo protein synthesis in relation to ammonia and proline accumulation in water stressed white clover

Tae-Hwan Kim, Bok-Rye Lee, Woo-Jin Jung, Kil-Yong Kim, Jean-Christophe Avice and Alain Ourry 847–855

This paper describes the use of ^{15}N to trace protein synthesis from newly-absorbed N in white clover (*Trifolium repens*). Incorporation of N into protein was reduced in water-stressed plants, while the concentration of proline increased in leaves and roots, along with that of $\text{NH}_3\text{--NH}_4^+$ in roots, suggesting that proline accumulation might be a sensitive biochemical indicator of plant water status and of the dynamics of *de novo* protein synthesis in response to stress.