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Functional Plant Biology

Contents

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Goldacre Review: Root renovation: how an improved understanding of basic root biology could inform the development of elite crops that foster sustainable soil health
Johanna W.-H. Wong and Jonathan M. Plett 597–612

One of the penultimate aims in farming is to grow high yielding crops in a sustainable way. One of the main issues facing breeders, however, is how to balance plant immunity with improved nutrient use efficiency and other value-added attributes. Here we review some of the recent advances in understanding plant–microbe symbioses, and propose how these data may help future breeding effort to produce stronger crop varieties that require fewer inputs while maintaining high productivity.

Transportation or sharing of stress signals among interconnected ramets improves systemic resistance of clonal networks to water stress
Qing Wei, Qian Li, Yu Jin, ShulanWu, Lihua Fan, Ningfei Lei and Jinsong Chen 613–623

Stress signals induced by ABA can improve a plants' resistance to water stress. We investigated the effects of transportation of stress signals among interconnected ramets on resistance response of clonal plant *Centella asiatica* subjected to water stress. Our results demonstrate that transportation of stress signals among interconnected ramets improved systemic resistance and growth performance of whole clonal fragments.

Drought tolerance traits do not vary across sites differing in water availability in *Banksia serrata* (Proteaceae)
Ximeng Li, Chris J. Blackman, Brendan Choat, Paul D. Rymer, Belinda E. Medlyn and David T. Tissue 624–633

Natural populations may exhibit phenotypic plasticity in response to variable climate conditions. Hydraulic traits conferring drought tolerance, measured on three populations of *Banksia serrata* (Proteaceae) native to sites characterised by contrasting climates, were generally invariable. *B. serrata* has limited capacity to adjust hydraulic architecture and therefore is susceptible to longer dry periods predicted with future climate change.

Short-term temperature dependency of the photosynthetic and PSII photochemical responses to photon flux density of leaves of *Vitis vinifera* cv. Shiraz vines grown in field conditions with and without fruit
Dennis H. Greer 634–648

Ample evidence verifies that fruit upregulates photosynthesis of horticultural plants to meet the high sink demand but how fruit affects photosynthetic light responses remains uncertain. For Shiraz vines, those with fruit had assimilation rates biased towards higher temperatures while vines without fruit were biased towards lower temperatures. Demand for photoassimilates, therefore, induced an acclimation response, suggesting dynamic control to match demand with climate.

Cover illustration: Conceptual diagram describes a hypothetical model whereby a diverse array of effectors secreted by microbes of contrasting lifestyles could differentially modulate a common plant signalling pathway through interaction with one protein complex (i.e. a 'hub' protein) (see Wong and Plett pp. 597–612). Emerging technologies and novel research strategies will better our understanding on this complex plant-microbial interaction network, and ultimately improve future crop breeding practices. Image by Johanna Wing-Hang Wong (created with BioRender).

Sex-specific structural and functional leaf traits and sun–shade acclimation in the dioecious tree *Pistacia vera* (Anacardiaceae) ***C. Korgiopoulou, P. Bresta, D. Nikolopoulos and G. Karabourniotis***	649–659	Understanding sexual dimorphism in dioecious plants is critical for assessing sex-specific ecophysiological performance. We report intersexual differences in leaf traits of *Pistacia vera* under sun and shade conditions. Females invested more in high xylem efficiency and C gain; males invested more in defence-protection. Each sex displayed a different strategy to attain optimisation to light variation but the degree of plasticity was similar. These differences may reflect the sex-specific strategies resulting from the different reproductive investments and could produce sex-related differences in tolerance.
Stomatal conductance responses to evaporative demand conferred by rice drought-yield quantitative trait locus $qDTY_{12.1}$ ***Amelia Henry, Hilary Stuart-Williams, Shalabh Dixit, Arvind Kumar and Graham Farquhar***	660–669	Understanding the physiology underlying yield under drought can help pinpoint strategies for crop improvement. By characterising mechanisms related to transpiration efficiency, we observed that higher rice yield under drought was due to a response not only to soil moisture, but also to light, humidity, and temperature. Therefore both soil and atmospheric conditions should be characterised to define a target environment for crop improvement.
Comparative transcriptome analysis reveals unique genetic adaptations conferring salt tolerance in a xerohalophyte ***Wei-Wei Chai, Wen-Ying Wang, Qing Ma, Hong-Ju Yin, Shelley R. Hepworth and Suo-Min Wang***	670–683	Xerohalophytes such as *Zygophyllum xanthoxylum* have evolved unique strategies adapting to salinity and are more appropriate than glycophytes in studying salt tolerance. Here we used RNA sequencing to compare the different gene expressions between *Z. xanthoxylum* and *Arabidopsis thaliana* under NaCl treatment. Results showed that many genes related to ion transport, reactive oxygen species scavenging, hormone biosynthesis and response in *Z. xanthoxylum* responded to NaCl more actively than *A. thaliana,* and these may play important roles in salt resistance of *Z. xanthoxylum.*
Effect of temporally heterogeneous light on photosynthetic light use efficiency, plant acclimation and growth in *Abatia parviflora* ***Camilo Rey-Sanchez and Juan M. Posada***	684–693	In theory, plants have evolved to maximise the efficiency with which they use light (maximise photosynthesis per unit light), yet there is limited empirical evidence to show that efficiency can have strong effects on plant growth. By exposing plants to different distributions of light in the day, we demonstrated that low efficiency can reduce plant growth by nearly 50%. Thus, we found clear support for the general expectation that light use efficiency is a central determinant of plant performance.