10.1071/FPv37n7toc

Functional Plant Biology

Contents

Volume 37 Issue 7 2010

Research Front: Improving Adaptation to Saline Environments

Foreword: Developing saline agriculture: moving from traits and genes to systems
E. G. Barrett-Lennard and T. L. Setter iii–iv

Viewpoint: Scaling up: the essence of effective agricultural research
J. B. Passioura 585–591

What determines whether an idea succeeds or fails in producing a useful product? Successful scaling up from laboratory research to application in the field depends on constraints and interactions that arise as scaling up proceeds, from genes to cells to organs and to plants at the field scale.

Viewpoint: Hormonal regulation of source–sink relations to maintain crop productivity under salinity: a case study of root-to-shoot signalling in tomato
Francisco Pérez-Alfocea, Alfonso Albacete, Michel E. Ghanem and Ian C. Dodd 592–603

Salinity decreases crop yield by reducing growth and assimilate production. Hormonal regulation of source–sink relations during the osmotic phase affects growth maintenance, root function and ion homeostasis. This viewpoint emphasises that simultaneously maintaining growth and delaying early leaf senescence is necessary to increase crop yield in salt-affected soils.

Review: Evolution of halophytes: multiple origins of salt tolerance in land plants
Timothy J. Flowers, Hanaa K. Galal and Lindell Bromham 604–612

Salt tolerance in plants is a complex trait that has evolved a number of times. Understanding the ways in which this occurred should inform attempts to enhance the salt tolerance of current crops necessary to prevent yield losses as salinity spreads across agricultural land.

Review: Soil processes affecting crop production in salt-affected soils
Pichu Rengasamy 613–620

This essay describes different categories of salt-affected soils on the basis of soil solution composition and different types of salinisation processes. It also discusses the soil processes such as soil water dynamics and soil structural stability – all affecting plant responses to increased osmotic pressure or specific ion concentrations.

The response of barley to salinity stress differs between hydroponic and soil systems
Ehsan Tavakkoli, Pichu Rengasamy and Glenn K. McDonald 621–633

Growing barley either in hydroponics or in soil affected responses to salinity in two barley varieties with different levels of salt tolerance. Genetic differences in tolerance were not expressed in hydroponics but were in soil. The relative contribution of sodium exclusion and osmotic tolerance to salinity tolerance varied with the level of salt stress.

Cover illustration: Levels of organisation in crop plants are shown as a loop in which clockwise flow represents reduction, the search for mechanistic understanding at finer and finer scales, and anti-clockwise flow represents functional integration, the roles of various structures and processes in transmitting genes to the next generation. It is *anticlockwise* flow that captures the essence of biology, for unless the loop is closed none of the structures and processes that comprise it would have evolved. This point is an underlying sentiment of *Functional Plant Biology* (see Passioura pp. 585–591).

Dynamic quantitative trait loci for salt stress components on chromosome 1 of rice ***Tanveer Ul Haq, John Gorham, Javaid Akhtar, Nasim Akhtar and Katherine A. Steele***	634–645	Diverse rice varieties have different physiological responses to salinity. This study applied the stress gently to test an indica/japonica mapping population and revealed some quantitative trait loci on chromosome 1, which are specific to particular leaf tissues and time points. The findings highlight the complexity of the system.
The effect of saline hypoxia on growth and ion uptake in *Suaeda maritima* ***Anne M. Wetson and Timothy J. Flowers***	646–655	*Suaeda maritima* appears well adapted to tolerate hypoxic conditions of saline waterlogging and fluctuating salt and oxygen concentration of the tidal salt marsh and shows equally good growth with NO_3^- or NH_4^+ as nitrogen source. However, severe hypoxia reduces root and shoot growth and net K^+ uptake while increasing Na^+ and Cl^- uptake.
Wheat cultivars can be screened for NaCl salinity tolerance by measuring leaf chlorophyll content and shoot sap potassium ***Tracey Ann Cuin, David Parsons and Sergey Shabala***	656–664	This work assesses a large number of physiological and agronomical characteristics that can be potentially used as a screening tool in plant breeding for salinity tolerance. It reports that combined measurements of leaf chlorophyll content and shoot sap potassium can be recommended to breeders as the combination with the highest prognostic value.
Cl^- uptake, transport and accumulation in grapevine rootstocks of differing capacity for Cl^--exclusion ***Joanna M. Tregeagle, Judy M. Tisdall, Mark Tester and Rob R. Walker***	665–673	Chloride (Cl^-) exclusion in rootstocks of grapevine was studied using a strong Cl^--excluding rootstock (140 Ruggeri) and a poor Cl^--excluding rootstock (K 51–40). Five-fold lower total shoot Cl^- in salt-treated 140 Ruggeri than in K 51–40 was unrelated to cumulative water use. Restricted entry of Cl^- to xylem and lower root to shoot Cl^- transport are implicated in the Cl^- exclusion mechanism.
Sensitivity to high salinity in tetraploid citrus seedlings increases with water availability and correlates with expression of candidate genes ***Wafa Mouhaya, Thierry Allario, Javier Brumos, Fernando Andrés, Yann Froelicher, François Luro, Manuel Talon, Patrick Ollitrault and Raphaël Morillon***	674–685	The salt stress tolerance between two diploids (2×) of trifoliate orange (*Poncirus trifoliata* (L.) Raf.) and willow leaf mandarin (*Citrus deliciosa*), their respective doubled diploids (4×) and their allotetraploid was analysed. A high correlation was observed between phenotype of sensitivity to stress and gene expression changes.