

# Functional Plant Biology

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### Research Front: Root Systems for Dry Environments

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*Viewpoint:* Large root systems: are they useful in adapting wheat to dry environments?

**Jairo A. Palta, Xing Chen, Stephen P. Milroy, Greg J. Rebetzke, M. Fernanda Dreccer and Michelle Watt**

347–354

This paper intends to answer the question of whether a large root system is useful in adapting wheat to water-limited environments. It claims that individual root traits for water uptake do not describe a root system as large or small. Vigorous root systems that have large root biomass and length and root length density describe a root system as large.

Development of a novel semi-hydroponic phenotyping system for studying root architecture

**Ying L. Chen, Vanessa M. Dunbabin, Art J. Diggle, Kadambot H. M. Siddique and Zed Rengel**

355–363

A novel semi-hydroponic system was developed to provide an efficient phenotyping platform for studying root architecture. Its reliability and efficiency was evaluated using *Lupinus angustifolius*. This phenotyping system is a desirable tool for examining root architecture of deep root systems and large sets of plants in a relatively small space.

Combined effects of contrast between poor and rich patches and overall nitrate concentration on *Arabidopsis thaliana* root system structure

**Manuel Blouin and Ruben Puga-Freitas**

364–371

The root system response to different contrasts between poor and rich patches (null, weak, strong heterogeneity) crossed with variations in overall  $\text{NO}_3^-$  concentration (deficient, optimal, excessive) was studied. Ramification density was increasing with heterogeneity in deficient situations, but it was decreasing with increasing heterogeneity in excessive situations.

Partial rootzone drying improves almond tree leaf-level water use efficiency and afternoon water status compared with regulated deficit irrigation

**Gregorio Egea, Ian C. Dodd, María M. González-Real, Rafael Domingo and Alain Baille**

372–385

Partial rootzone drying (PRD) and regulated deficit irrigation (RDI) were compared in field-grown almond trees. Both groups of trees had similar midday leaf gas exchange and water status characteristics, but PRD trees had higher water status than RDI trees in the afternoon and improved daily leaf-level water use efficiency.

Net carbon exchange in grapevine canopies responds rapidly to timing and extent of regulated deficit irrigation

**Julie M. Tarara, Jorge E. Perez Peña, Markus Keller, R. Paul Schreiner and Russell P. Smithyman**

386–400

Whole-canopy rates of photosynthesis in grapevines under regulated deficit irrigation respond within 1 day to irrigation events and to the amount of water applied in sandy soil. Results confirm previous observations in grapevine; that rates of photosynthesis are coupled closely to stomatal conductance, particularly under moderate water stress.

*Cover illustration:* Rooting patterns of the synthetic derivative wheats AUS33687, AUS33435 and AUS33684 measured at ear emergence (Z59) in the field at Wongan Hills, WA (see Palta *et al.* pp. 347–354). Credit: Jairo A. Palta.

A mutation in the purine biosynthetic enzyme ATASE2 impacts high light signalling and acclimation responses in green and chlorotic sectors of *Arabidopsis* leaves

**Nick S. Woo, Matthew J. Gordon,**

**Stephen R. Graham, Jan Bart Rossel,**

**Murray R. Badger and Barry J. Pogson**

401–419

Investigation of the *Arabidopsis* ATASE2 mutant reveals that perturbed purine biosynthesis affects several aspects of light signaling, including photoprotection and leaf variegation. However, this study also gives evidence that systemic signaling pathways influence chloroplast development and gene induction in response to light.

Can yield potential be increased by manipulation of reproductive partitioning in quinoa (*Chenopodium quinoa*)? Evidence from gibberellic acid synthesis inhibition using Paclobutrazol

**M. B. Gómez, P. Aguirre Castro, C. Mignone and H. D. Bertero**

420–430

The application of the gibberellin acid synthesis inhibitor Paclobutrazol to two quinoa accessions increased reproductive partitioning, seed yield and seed number and reduced plant height, but biomass accumulation and seed weight were not affected. This offers a promising avenue for yield increase in this highly nutritive crop.

Quantifying abortion rates of reproductive organs and effects of contributing factors using time-to-event analysis

**A. M. Wubs, E. Heuvelink, L. F. M. Marcelis and L. Hemerik**

431–440

The time to a specific event is often a variable of interest. In this paper, we show how time-to-event data can be analysed with time-to-event analysis, also called survival analysis. As a case study, we use data on abortion of reproductive organs in sweet pepper. With time-to-event analysis, the abortion rate and the effect of contributing factors are quantified.