

Functional Plant Biology

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EcoMeristem, a model of morphogenesis and competition among sinks in rice. 1. Concept, validation and sensitivity analysis

Delphine Luquet, Michael Dingkuhn, HaeKoo Kim, Ludovic Tambour and Anne Clement-Vidal 309–323

EcoMeristem, a model of morphogenesis and competition among sinks in rice. 2. Simulating genotype responses to phosphorus deficiency

Michael Dingkuhn, Delphine Luquet, HaeKoo Kim, Ludovic Tambour and Anne Clement-Vidal 325–337

This pair of papers introduce (part 1) and apply (part 2) a new plant model that aims to give rise to a new generation of tools integrating developmental biology with agro-ecology and genetics. The authors argue that organogenesis, driven by meristem behaviour, is a succession of growth ‘commitments’ generating demand functions, which interact with supply (resource acquisition). Reserve dynamics and senescence (recycling) serve as buffers for temporary disequilibria. The result is a self-adjusting system simulating adaptive, phenotypic plasticity with a small number of genotypic parameters. The main conclusion of part 1 is that parameters governing internal management of demand impact as much on growth as do the (much better known) parameters of supply, such as RUE. The main conclusion of part 2 is that developmental and morphological adaptations to phosphorus deficiency (a stress having strong morphogenetic effects) are probably the result of specific growth inhibitions in the shoot, which in turn liberate additional resources for root growth and feed back on development processes.

Functional characterisation of *OsAMT1.1* overexpression lines of rice, *Oryza sativa*

Anshuman Kumar, Brent N. Kaiser, M. Yaeesh Siddiqi and Anthony D. M. Glass 339–346

Following on from a previous FPB publication (Hoque *et al.* 2005), which described NH_4^+ uptake in transgenic rice plants, These authors studied NH_4^+ transport in both wild type and transgenic lines (Jarrah and Taipei) overexpressing the high-affinity NH_4^+ transporter *OsAMT1.1* by use of ^{13}N and ^{15}N . These tracers allowed high-affinity influx to be measured in both low- and high-N plants (^{13}N) and NH_4^+ efflux to be measured in low-N plants (^{15}N). Overexpression of *OsAMT1.1* in Jarrah (but not Taipei) increased NH_4^+ influx without increasing NH_4^+ efflux relative to the wild type controls.

Optimisation of tobacco rattle virus-induced gene silencing in *Arabidopsis*

Changchun Wang, Xinzhong Cai, Xuemin Wang and Zhong Zheng 347–355

This paper reports an optimised procedure for virus-induced gene silencing (VIGS) in *Arabidopsis*. VIGS overcomes some of the limitations of mutation-based approaches for gene function analysis; it is rapid, taking only a few weeks from infection to silencing, and does not require the development of stable genetic transformants. These authors optimised gene silencing mediated by tobacco rattle virus through direct delivery of the viral vector into *Arabidopsis*, and report consistent and efficient silencing of phytoene desaturase and actin genes in seven *Arabidopsis* ecotypes.

Cover illustration: The images of a microarray, a meristem and a schematised plant architecture represent the three different scales integrated by the new modelling approach used in *EcoMeristem*. (See Luquet *et al.* and Dingkuhn *et al.* pp. 309–323 and 325–337.)

Seawater stress applied at germination affects mitochondrial function in durum wheat (*Triticum durum*) early seedlings

Zina Flagella, Daniela Trono, Marianna Pompa, Natale Di Fonzo and Donato Pastore 357–366

Salinity through the intrusion of seawater into soil is an increasing problem, as irrigation water continues to become more saline. These authors present a novel evaluation of the effect of salt stress during germination on mitochondrial oxidative phosphorylation using durum wheat seedlings as a model system. They demonstrate that seawater stress may differently affect mitochondrial ATP synthesis in relation to the substrate oxidised and stress level inducing both adaptive response and damage.

Effects of nitrogen source and ectomycorrhizal association on growth and $\delta^{15}\text{N}$ of two subtropical *Eucalyptus* species from contrasting ecosystems
Susanne Schmidt, Linda L. Handley and Tanuwong Sangtuan 367–379

In this study, two *Eucalyptus* species from contrasting Australian ecosystems (rainforest and wallum) were assessed for the effect of ectomycorrhizal associations on plant N source use. The authors investigated whether plant and ectomycorrhizal $\delta^{15}\text{N}$ levels are affected by the chemical type and concentration of the N source, and whether these observations enable the use of foliar $\delta^{15}\text{N}$ for interpreting N relations of *E. grandis* and *E. racemosa* in natural forests.

Cloning and expression analysis of *TSK1*, a wheat *SKP1* homologue, and functional comparison with *Arabidopsis ASK1* in male meiosis and auxin signalling
Chijun Li, Yu Liang, Changbin Chen, Junhua Li, Yunyuan Xu, Zhihong Xu, Hong Ma and Kang Chong 381–390

Plants possess multiple homologues of the *SKP1* gene encoding an essential subunit of the SCF ubiquitin ligases, but only two from *Arabidopsis* have been characterised. This paper describes the isolation and expression analysis of a wheat *SKP1* homologue gene (*TSK1*) and the functional comparison of *TSK1* with *Arabidopsis ASK1* in male meiosis and auxin signalling. It suggested a degree of functional conservation of SKP1 proteins between monocots and eudicots.

Branch roots of young maize seedlings, their production, growth, and phloem supply from the primary root
Linda C. Enns, Margaret E. McCully and Martin J. Canny 391–399

This is another step forward in our quest for knowledge of the underlying controls on root anatomy and root system architecture. The authors followed branch root development on the primary root of maize seedlings for nine days after planting. This period includes the shift from seedling heterotrophy to autotrophy. Proliferation of basal branch roots in very young seedlings can have major advantages for successful seedling establishment in the field, and could be screened for without difficulty.

Research note: Avian gut passage reduces seed exit costs in *Sorbus aucuparia* (Rosaceae) as measured by a diametral compression test
Torbjørn R. Paulsen, Ommund Lindtjørn, Nils Roar Gjerdet and Göran Högstedt 401–406

Research on the effect of frugivory has shown the need to understand the changes that occur during seed gut passage and its consequences for seed germination. This study demonstrates that seed passage through the avian gut reduces seed coat resistance to diametral compression, leading to a decrease in seed-escape costs. This could explain advanced seedling emergence and increased seedling growth in *Sorbus aucuparia* L. following *Turdus* spp. ingestion. This is a new application of a standard method of testing tensile strength.