

Functional Plant Biology

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On the relationship between C and N fixation and amino acid synthesis in nodulated alfalfa (*Medicago sativa*)

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331–341

The combination of double C¹³ and N¹⁵ labelling and subsequent compound-specific analysis in amino acids showed the imbalance observed between CO₂ and N₂ fixation in nodulated alfalfa plants. It provided a novel conclusion about the use and importance of pre-existing reserves in the production of new organic matter during growth.

Overexpression of *AtbHLH112* suppresses lateral root emergence in *Arabidopsis*

Wen-Shu Wang, Jiang Zhu and Ying-Tang Lu

342–352

Lateral root emergence is tightly regulated, although molecular components involved in this process are still largely unknown. This study showed that overexpression of a basic/helix-loop-helix (bHLH) transcription factor *AtbHLH112* specifically suppresses lateral root emergence by decreasing the local auxin level and downregulating expression of cell-wall-remodelling (CWR) genes. Our results suggest that *AtbHLH112* may represent a novel repressor of cell separation during lateral root emergence.

Induction of high-affinity NO₃[−] uptake in grapevine roots is an active process correlated to the expression of specific members of the *NRT2* and *plasma membrane H⁺-ATPase* gene families

Youry Pii, Massimiliano Alessandrini, Katia Guardini, Anita Zamboni and Zeno Varanini

353–365

Understanding the biochemical and molecular determinants of nitrogen nutrition in grapevine is important for the quality of production and environmental protection. The nitrate uptake mechanism was studied in this crop for the first time, focusing on the high-affinity component and the need for energy coupling, highlighting nitrate induction in grapevine. The involvement of the *NRT2*, *NRT3* and *plasma membrane H⁺-ATPase* gene families in nitrate uptake by roots was evaluated.

Root hydraulics in salt-stressed wheat
Wieland Fricke, Ehsan Bijanzadeh, Yahya Emam and Thorsten Knipfer

366–378

Salinity is a globally increasing problem threatening agricultural production and affecting plant growth through an osmotic stress that affects root water uptake. This is a comprehensive analysis of root water uptake properties (hydraulic conductivity) in wheat (*Triticum aestivum* L.) in response to salinity. Salinity reduces the hydraulic conductivity of roots and appears to prevent developmental changes in root water uptake pathways from taking place as they occur in nonstressed plants.

Reliability of ion accumulation and growth components for selecting salt tolerant lines in large populations of rice

Tanveer Ul Haq, Javaid Akhtar, Katherine A. Steele, Rana Munns and John Gorham

379–390

Advanced molecular techniques require phenotyping of large rice populations. In this study, our aim was to identify useful indicators for reliable selection of rice genotypes for productivity in saline soil with minimal time and cost. The measure of Na⁺ exclusion (leaf Na⁺ concentration) was validated as the most reliable trait for salt tolerance, as long as the plants were grown for at least 3 weeks and moved past the osmotic-stress dominated phase. The most sensitive growth components were tiller number plant^{−1} and shoot water content (water g g^{−1} dry weight), and these were correlated significantly with leaf Na⁺ and injury scores.

Cover illustration: General trend of spikelet numbers per spike with its relation to growing degree days stages (see Alqudah and Schnurbusch pp. 424–436). Image by Ahmad M. Alqudah and Thorsten Schnurbusch.

Photosynthetic performance and biochemical adjustments in two co-occurring Mediterranean evergreens, *Quercus ilex* and *Arbutus unedo*, differing in salt-exclusion ability

Lina Fusaro, Simone Mereu, Cecilia Brunetti, Martina Di Ferdinando, Francesco Ferrini, Fausto Manes, Elisabetta Salvatori, Riccardo Marzuoli, Giacomo Gerosa and Massimiliano Tattini

391–400

Plants inhabiting Mediterranean coastal areas display contrasting strategies to cope with a wide range of stresses. Also, Mediterranean areas display a high level of biodiversity. Here we explored strategies adopted by two co-occurring woody evergreens when suffering from an excess of soil salinity. Species-specific leaf life-span and drought-tolerance strategies are tightly related with salt-exclusion mechanisms, which, in turn, greatly impacts upon salt-induced metabolic adjustments.

Shoot branching in nutrient-limited *Trifolium repens* is primarily restricted by shortage of root-derived promoter signals

Roderick G. Thomas and Michael J. M. Hay

401–410

The productivity and persistence of white clover are both dependent on shoot branching, so the negative effect of P deficiency on branching has profound effects. Regulation of branching in P-limited plants was shown to be via root-supplied promoter signal rather than by inhibitory signals or P nutrition. For clover, and possibly other stoloniferous species, P-deficiency indirectly inhibits branching by down regulating root-supplied promoter signal and the strigolactone pathway plays a minor role.

Circadian oscillation and development-dependent expression of glycine-rich RNA binding proteins in tomato fruits

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411–423

The circadian clock is the endogenous mechanism that adjusts physiology and metabolism to time of day. Glycine-rich RNA-binding proteins, which participate in the output signal of the circadian clock in source organs, exhibit circadian oscillations that depend on developmental and temperature signals in tomato fruit. Studies on the timing of the interactions and their effects on fruit growth and metabolism provide a molecular mechanism connecting oscillators with outputs in fruits.

Awn primordium to tipping is the most decisive developmental phase for spikelet survival in barley

Ahmad M. Alqudah and Thorsten Schnurbusch

424–436

Grain yield is closely associated with grain number in barley, and improved spikelet survival is therefore an important trait for increasing grain yield. We identified awn primordium to tipping as the most critical subphase related to spikelet abortion, regardless of growing conditions. Spikelet survival was highly genetically controlled and an in-depth analysis of this trait is a worthwhile target for increasing yield.

Differential physiological responses of different rice (*Oryza sativa*) cultivars to elevated night temperature during vegetative growth

Ulrike Glaubitz, Xia Li, Karin I. Köhl, Joost T. van Dongen, Dirk K. Hinch and Ellen Zuther

437–448

Asymmetric warming causes long-term reduction of diurnal temperature range with strong negative effects on plant growth and yield. Twelve rice cultivars were sorted by their high night temperature (HNT) response and sensitivity specific differences in growth parameters but not respiration rate were reported, while respiration rate and carbon depletion were excluded as primary sources of HNT sensitivity. Knowledge on HNT tolerant rice will support breeding of cultivars for changed global climate conditions.