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Effect of elevated CO₂ concentration and vapour pressure deficit on isoprene emission from leaves of *Populus deltoides* during drought

Emiliano Pegoraro, Ana Rey, Edward G. Bobich, Greg Barron-Gafford, Katherine Ann Grieve and Yadvinder Malhi Ramesh Murthy 1137–1147

In a large scale experiment conducted at the Biosphere 2 facility, the authors demonstrate that although isoprene emission was inhibited under elevated [CO₂], high VPD may counteract the effect of CO₂ by reducing C_i and consequently enhancing isoprene emission. Inhibition of isoprene emission by CO₂ became a long-term effect in plants growing under elevated [CO₂] and isoprene emission was much less sensitive to drought than photosynthesis. Limitation of isoprene emission from proliferating agriforest plantations by future increases in atmospheric [CO₂] may be off-set under projected global change scenarios by reduced precipitation.

Physiological and morphological responses to water stress in *Aegilops biuncialis* and *Triticum aestivum* genotypes with differing tolerance to drought

István Molnár, László Gáspár, Éva Sárvári, Sándor Dulai, Borbála Hoffmann, Márta Molnár-Láng and Gábor Galiba 1149–1159

Physiological and morphological responses to PEG-induced water stress were investigated in three *Aegilops biuncialis* (Vis.) genotypes differing in the annual rainfall of their habitat, and in three *Triticum aestivum* (L.) wheat genotypes, in order to determine whether *A. biuncialis* would be suitable for improving wheat drought tolerance through intergeneric crossing.

Resistance to water flow through leaves of *Coffea arabica* is dominated by extra-vascular tissues

Antonio Gascó, Andrea Nardini and Sebastiano Salleo 1161–1168

The manuscript deals with estimating the relative contribution of mesophyll cell membranes to the overall leaf hydraulic conductance. To this purpose, leaves were exposed either to chilling temperatures or to high temperatures for increasing time intervals. Data showed that leaf hydraulic conductance is a closely related to the functional integrity of membranes.

What determines rates of photosynthesis per unit nitrogen in *Eucalyptus* seedlings?

Charles R. Warren and Mark A. Adams 1169–1178

Species originating from xeric sites are characterised by slower rates of photosynthesis per unit nitrogen than species from mesic sites, but mechanisms underlying these differences are unexplained. Nitrogen allocation to Rubisco and chlorophyll, and photosynthetic characteristics were studied in nine *Eucalyptus* species from mesic to semi-arid habitats. All species allocated a large proportion of N to Rubisco with high in vivo specific activity, and all had small stomatal limitations. These characters in *Eucalyptus* seedlings probably arise from their ecological trait of germination and rapid early growth when water is abundant. There were significant differences in photosynthetic parameters and N allocation among species, but these were only weakly related to rainfall at the site of seed origin.

Cover illustration: Biosphere 2 Laboratory, where Cottonwood plantations were grown at 430, 800 and 1200 $\mu\text{mol CO}_2 \text{ mol}^{-1}$. Insert figures show measurement of isoprene emission and photosynthetic rates from a Cottonwood leaf and results obtained from the experiment. (See Pegoraro *et al.* pp. 1137–1147).

Spatial and age-dependent modifications of photosynthetic capacity in four Mediterranean oak species

Ülo Niinemets, John D. Tenhunen and Wolfram Beyschlag

1179–1193

These authors studied within-canopy and temporal patterns in foliage structure, chemistry and photosynthesis in four Mediterranean *Quercus* species to determine the role of within-canopy shading and leaf age on foliage function. A 2.5-fold within-canopy gradient in leaf dry mass per unit area was accompanied by a 3-fold range in leaf nitrogen content, photosynthetic electron transport capacity and maximum Rubisco carboxylase activity. The data demonstrate canopy and age-dependent controls on leaf structure, chemistry and photosynthetic potentials that should be included in photosynthesis simulations in Mediterranean climates.

A simple dynamic model of photosynthesis in oak leaves: coupling leaf conductance and photosynthetic carbon fixation by a variable intracellular CO₂ pool

Steffen M. Noe and Christoph Giersch

1195–1204

The paper is focused on the regulation of leaf photosynthesis taking into account an environmentally controlled leaf conductance and carboxylation rate. It shows a simple structured model that based on a source/sink scheme. This avoids additionally assumptions or measurements to gain information about the intercellular CO₂ pool. Thus, the model is able to track environmentally input data (light, VPD) and is able to predict leaf conductance, the intercellular CO₂ partial pressure and the net assimilation rate.

Planteose is a short-term storage carbohydrate in *Actinidia* leaves

Karin U. Klages, Helen L. Boldingh, Janine M. Cooney and Elspeth A. MacRae

1205–1214

The manuscript describes work demonstrating that *myo*-inositol is not an immediate product of photosynthesis in *Actinidia*, and that it turns over slowly in leaves. It demonstrates discovery of planteose for the first time in *Actinidia* and for the first time in any plant demonstrates that it acts as a short-term storage form of photosynthate and can be an important part of the dynamic leaf carbohydrate pool.

Greenhouse and field cucumber genotypes use different mechanisms to protect against dark chilling

Yan-Hong Zhou, Li-Feng Huang, Yao-Shun Du and Jing-Quan Yu

1215–1223

Growth and development of many tropical and subtropical crops are inhibited by chilling, and exposure to low temperatures at night can produce dramatic reductions in net photosynthesis that persist even when optimal temperatures are restored. This paper reports diurnal changes in photosynthetic gas exchange and chlorophyll fluorescence after night chilling in two cucumber genotypes and shows genotypic differences in the factors limiting CO₂ assimilation, and in the mechanism of photoprotection in response to night chill in cucumber.