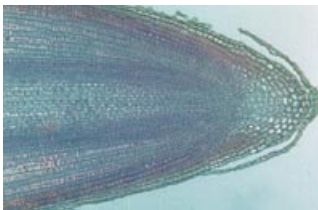


ContentSnapshots



Water-deficit-stress induced changes in gene expression

As shown by **Bray (pp. 803–811)**, more than 130 genes have altered expression in response to water deficit in the model plant *Arabidopsis*. Although the expression of these genes indicates multiple responses by the cell, a greater understanding of gene function is needed to understand the physiological and metabolic mechanisms that permit adaptation to water stress.



Proline from the endosperm keeps root tips osmoregulated

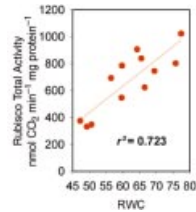
Proline plays a role in root-tip acclimation to water shortage in maize seedlings. **Raymond and Smirnov (pp. 813–823)** show that, although less proline is transported from the scutellum in drying conditions, more accumulates in the root tip because of slower oxidation and utilization in protein synthesis.



Drought tolerance of wild watermelon

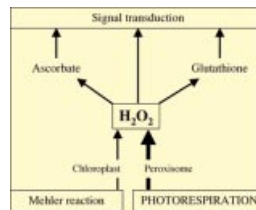
Many genes have been reported to render plants resistant to environmental stresses. However, there has been no report showing that these plants survive under severe natural environments. **Yokota et al. (pp. 825–832)** demonstrate that wild species, including wild watermelon, may have unique strategies to survive severe conditions in addition to basic

mechanisms typical of domesticated or overly protected plants.



Rubisco activity: effects of drought stress

The influence that tight-binding inhibitors exert on Rubisco activity during drought stress are assessed by **Parry et al. (833–839)**. While decreases in Rubisco activity under drought were often consistent with the presence of tight-binding inhibitors, Rubisco activity was found to decrease more than the amounts of known inhibitors; alternative explanations are discussed.



Hydrogen peroxide metabolism and photosynthesis

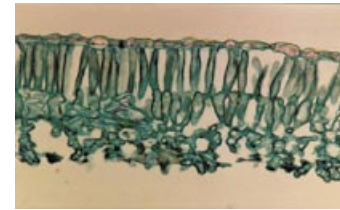
Noctor et al. (pp. 841–850) show that the photorespiratory pathway provides a high flux mechanism for the transport of redox signals from the chloroplast. Photorespiratory H₂O₂ production accounts for about 70 % of total H₂O₂ formed. H₂O₂ was only produced faster in the chloroplast than in the peroxisome at high CO₂. H₂O₂, ascorbate and glutathione have key roles in stress signaling during drought.



Photorespiration takes the strain out of water stress

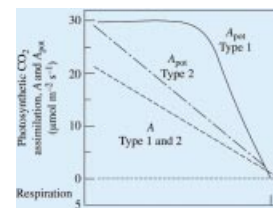
An analysis of the fate of light energy and photosynthetic electrons in dehydrating

leaves is shown by **Haupt-Herting and Fock (pp. 851–859)**. It points to photorespiration as being a much-enlarged sink for electrons while other outlets such as carbon fixation and the Mehler reaction are decreased. Photorespiration may therefore decrease injury caused by drying soil.



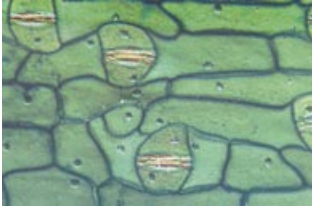
Photosynthesis without an epidermis

Water deficits inhibit photosynthesis but the contribution by metabolism and stomata is controversial. **Tang et al. (pp. 861–870)** removed an epidermis from leaf discs but a large inhibition remained, highlighting the importance of metabolism. The inhibition developed when the epidermis was absent during the water loss, eliminating the possibility that stomata close first and trigger the metabolic component.



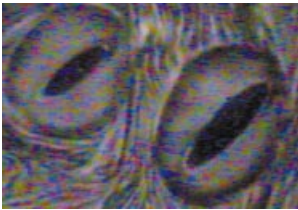
Stomatal and metabolic regulation of photosynthesis in water-stressed leaves

Water stress decreases photosynthesis. **Lawlor (pp. 871–885)** reviews the evidence for the relative importance of decreased stomatal conductance and metabolic capacity and analyses how stress affects mechanisms. Stomatal limitation decreases but metabolic limitation increases as stress rises. Photosynthetic metabolism is inhibited by decreased ATP synthesis, which has substantial effects on cell metabolism, including amino acid and protein synthesis.



Stomata hold sway in droughted dicot crops

Studies by **Cornic and Fresneau (pp. 887–894)** indicate that CO₂ shortage imposed by stomatal closure rather than damage to the photosynthetic carbon fixation machinery explains the first 20 % of the inhibition to net CO₂ uptake caused by drought stress in leaves of three C₄ species.



Stomatal regulation has the upper hand

Medrano et al. (pp. 895–905) re-analyse data from 10 years of experiments with grapevines, the results of a short experiment with Mediterranean sclerophyll shrubs, and data from the literature on various species. The outcome reveals that in C₃ species at least, stomatal conductance reflects photosynthetic changes in an almost universal manner, whereas the photosynthesis response to relative water content and/or leaf water potential is strongly influenced by genetic and environmental factors.



Mediterranean strategies for coping with water shortage

In a survey of contrasting species ranging from deep-rooted perennials, and winter or spring germinating annuals, **Chaves et al. (pp. 907–916)** suggest that methods of obtaining water rather than their reaction to water shortage are of primary importance. Adaptive fine-tuning of

metabolism is seen as being superimposed on foraging mechanisms.



Drought tolerance in sugar beet

Drought limits the productivity of crops worldwide, and sugar beet is no exception. **Ober and Luterbacher (pp. 917–924)** show that there is significant variation for tolerance to water deficits within sugar beet and related types, and that there are genotypes with greater drought tolerance than selected commercial varieties.



Drought in C3 Cereals: what to breed for?

Drought is the main abiotic constraint on cereal yield. **Araus et al. (pp. 925–940)** examine the physiological traits that may help in breeding for higher yield and stability under drought conditions. The use of integrative traits such as carbon isotope discrimination ($\Delta^{13}C$), canopy temperature depression (CTD) or spectroradiometrical-derived indices is highlighted.



Mapping QTLs in drought-stressed maize

The effects of genetic variation in morpho-physiological traits (e.g. root size and architecture) on a crop's yield under drought are still poorly understood.

Tuberosa et al. (pp. 941–963) present a comparative and critical review of the

results and opportunities provided by QTL analysis for unravelling the cause-effects relationships among a number of morpho-physiological traits and grain yield in drought-stressed maize.