Geophysical Research Abstracts
Vol. 13, EGU2011-7289, 2011
EGU General Assembly 2011

Keeping their cool: the impact of plant species' differential regulation of leaf temperature under soil water deficits – potential to decrease air temperatures?

Tijana Blanusa (1,2), Madalena Vaz Monteiro (2), Federica Fantozzi (2), and Ross Cameron (2)

(1) Royal Horticultural Society, Horticultural Sciences, Woking, United Kingdom (tijanablanusa@rhs.org.uk), (2) School of Biological Sciences, University of Reading, Reading RG6 6AS, United Kingdom

Plants provide cooling primarily by shading the surface over which they are growing, and - uniquely - by the process of evapotranspiration – ETp (water loss from the leaves through stomatal pores). This can be particularly important when attempting to increase human thermal comfort in the urban environments during prolonged periods of hot, dry weather. However, prevailing response of plants which are growing in drying soil is to close their stomata and decrease water loss by ETp. This, consequently, warms up their leaves. However, some species, particularly those which show a degree of adaptation to drought and high temperatures, can regulate their leaf temperatures through additional leaf morphological and anatomical features such as presence of leaf hairs, succulence or leaf colour. Overarching interest of our research is to identify the plants best suited to provide continuous cooling by ETp or other means under water limiting conditions. We are also interested in the impact of the temperature of the surfaces over which the plants are growing on the regulation of leaf temperature and plant ETp.

Here, we are reporting results from two sets of experiments. One was investigating the response of Stachys byzantina, a Mediterranean herbaceous perennial plant with silvery and hairy leaves, to water deficits. In the glasshouse experiments, leaf temperatures (as assessed by IR thermography) of drought stressed S. byzantina were as cool as in the optimally watered plants. Leaves of drought stressed Stachys plants were also significantly cooler than those of other broad leaf perennial or succulent plants we tested. In our second experiment, London Plane trees (Platanus xhispanica) were grown over 'cooler' (turf) and 'warmer' (gravel) surfaces, and subjected to optimal or suboptimal irrigation. Even under optimal watering, leaves growing over warmer surface had similar temperatures as those of the stressed plants over a cooler surface. This can have implications on plant and municipal water use.

We are currently working on understanding the impact of these differences in plant surface temperatures on air temperatures, and the scale required to effect a measurable reduction in air temperatures.