The effects of water availability on plant growth in *Sesleria albicans* – dominated grasslands in the Burren, Co. Clare

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Introduction The Burren is a karstic region in the west of Ireland characterised by large areas of exposed limestone pavement with sparse vegetation. Despite the prevailing oceanic climate and high rainfall, substrate volumetric water content values are similar to those of semi-arid habitats due to high run-off. As a consequence, plants growing on the pavement regularly experience water deficit during the summer months. *S. albicans*, a species reported to be tolerant of water deficits, is one of the most abundant species growing on the limestone pavement. The objective of this study was to determine the impact of water availability on the plant performance of a number of species commonly occurring on the limestone pavement.

Materials and methods Substrate volumetric water content, rainfall and substrate/air temperature were recorded at half hour intervals and logged. The physiological responses of a number of species grown in a glasshouse (under ambient conditions of light, heat and relative humidity), including *S. albicans*, T*eucrium scorodonia* and *Corylus avellana*, exposed to differing substrate volumetric water content were examined using fluorescence and gas-exchange techniques. In addition, measurements were carried on plants growing in the field during the period May 2004 – December 2004 (concentrating on *T.scorodonia*) to examine the impact of variations in water availability on plant performance.

Results Substrate volumetric water content (%) was observed to follow a cyclical pattern associated with rainfall events and subsequent run off (Figure 1). All of the plants examined showed a marked physiological response to changes in substrate volumetric water content, with *T. scorodonia* having a three-fold increase in maximum photosynthetic rate as a result of a 6% increase in substrate VWC (Figure 2). *S. albicans*, *T. scorodonia* and *C. avellana* showed similar responses to water deficit with significant reductions in maximum photosynthetic rate and smaller changes in fluorescence parameters, associated with decreased substrate volumetric water content.

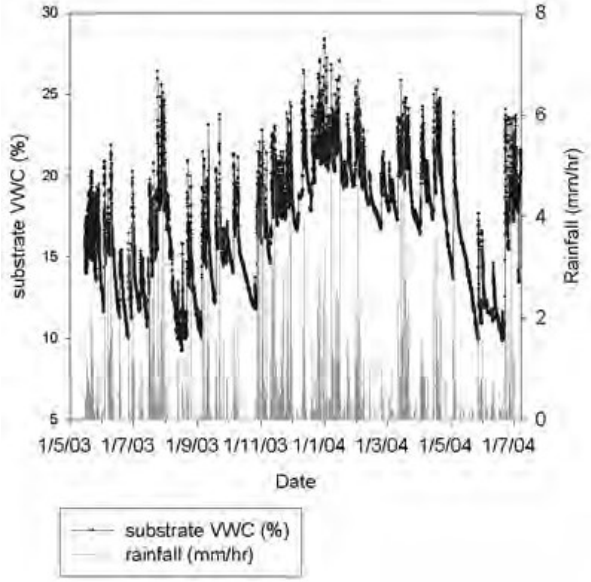

Figure 1 Variation in substrate volumetric water content with rainfall

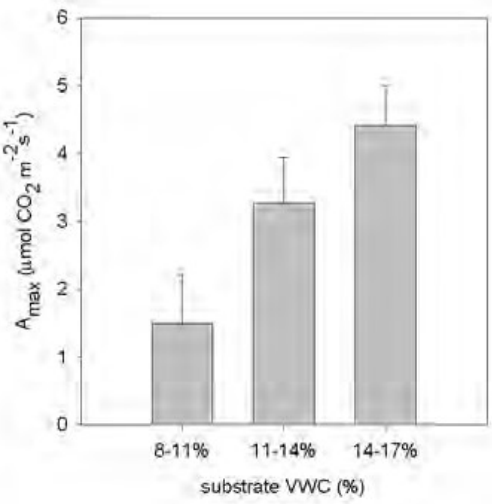

Figure 2 Variation in maximum photosyntetic rate (A_{max}) of T. scorodonia (µmol CO_2 $m^{-2}s^{-1}$) with variation in substrate volumetric water content (%)

Conclusions Cyclical variations in water availability result in corresponding alterations in photosynthetic performance. Of the species examined, *S. albicans* showed the smallest response to variations in water availability indicating that its success under these conditions is related to internal or morphological adjustments that result in the maintenance of plant water balance.