

COMPARISON BETWEEN ULTRASONIC ACOUSTIC EMISSION (UAE)
AND HYDRAULICALLY MEASURED LOSS OF HYDRAULIC
CONDUCTANCE IN *Eucalyptus* spp. CLONE GU210

P. MANOHARAN^{1*} AND N. W. PAMMENTER²

¹Department of Botany, Faculty of Science, Eastern University of Sri Lanka,
Vantharumoolai

²School of Life and Environmental Sciences, University of KwaZulu-Natal,
Durban 4041, South Africa

* Corresponding author (E-mail: prikok@yahoo.com)

ABSTRACT

This study was undertaken to compare and validate the Ultrasonic Acoustic Emission (UAE) method with that of traditional hydraulically assessed method of cavitation detection in *Eucalyptus* spp. clone (GU210) grown for 12 months in pots. Vulnerability of xylem cavitation to the main stem was assessed as the leaf water potential corresponding to the maximum rate of acoustic emissions per hour (ψ_L , EPH_{max}), and as the critical water potential triggering cavitation events, calculated as the mean of the water potentials of data points lying between 5% and 10% of the total accumulated ultrasonic acoustic emissions (ψ_{CAV} , $cUAE\%$). When measured hydraulically the water potential corresponding to 50% loss of conductivity (PLC_{50}), or the water potential corresponding to the initiation of conductivity loss was used.

The hydraulic vulnerability curve was not sigmoidal in nature; rather it showed an increase in stem conductance loss with decreasing leaf water potential that could be described by a second order polynomial. But, $cUAE\%$ curve was almost sigmoidal in shape. Vulnerability curves of $UAE\%$ vs. water potential, and of PLC vs. water potential did not overlay, and the water potentials corresponding to PLC_{50} and $cUAE\%_{50}$ differed. One possible reason for this is that hydraulically measured PLC_{50} generally occurs at lower water potentials than estimates from acoustic methods and therefore, it is clear that the acoustic data cannot be used directly to assess the degree of conductivity loss. Acoustic methods do not directly measure the influence of cavitation events on hydraulic conductance and therefore, assessment of vulnerability using these methods is more subjective. However, the relationship

established between percentage loss in hydraulic conductivity (PLC) and cumulated UAE (cUAE) values corresponding to common water potentials showed a linear relationship between PLC and cUAEs, with the total cUAEs corresponding to about 80% of the PLC.

Keywords: Eucalyptus, stem xylem cavitation, ultrasonic acoustic emissions, hydraulic method