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| **Detecting the Short-Term Effects of Water Stress on Radiata Pine Physiology Using Thermal Imagery** |
| **Several research works had been conducted to characterize the impacts of water stress on plant physiology using thermal imagery [1-5]. However, limited studies had been undertaken specifically on plantation-grown conifers such as radiata pine [6-8]. In this study, thermal imagery has been utilized to determine the impact of short-term water stress in key physiological traits of radiata pine. This had been carried out via collection of canopy level thermal images using FLIR A655SC and GFS-3000 measurements of leaf stomatal conductance (gs), transpiration rate (E), and assimilation rate (A) from a pot trial where water was withheld from radiata pine over a nine-day period. Results show a consistently high volumetric water content in the well-watered control treatment over the course of the experiment (0.47–0.48 m3 m−3) but a rapid decline from 0.47 m3 m−3 at 0 days after treatment (DAT) to 0.04 m3 m−3 at 9 DAT in water-stressed radiata pine. No significant differences in the physiological traits were observed for the control and water-stressed groups at 0 DAT. However, by 1 DAT, significant differences in physiological traits between the two groups were apparent, and these differences continued diverging with values in the control treatment exceeding those of trees in the water stress treatment at 9 DAT by 42, 43 and 61%, respectively, for gs, E and A. Furthermore, the relationships between the normalized canopy temperature, defined as canopy temperature - air temperature (Tc-Ta), and the three physiological traits were highly significant as early as 1 DAT onwards. The strength of the relationships between Tc–Ta and the three physiological traits increased markedly over the duration of the water stress treatment, reaching a maximum coefficient of determination (R2) at 7 DAT when values were, respectively, 0.87, 0.86 and 0.67 for gs, E and A. The early detection of changes in tree physiology from 1 DAT onwards suggests that thermal imagery may be useful for a range of applications in field-grown radiata pine such as the detection of water stress and identification of drought-tolerant radiata pine genotypes.****Keywords: drought; normalised canopy temperature; Pinus radiata; thermal imagery; radiata pine; water stress** |

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