

TITLE OF ABSTRACT: A COMPARISON OF PLANT TEMPERATURES AS MEASURED BY THERMAL IMAGING AND INFRARED THERMOMETRY

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ABSTRACT

The temperature of leaves and canopies of plants has long been recognised to be an indicator of plant water stress and can be assessed by a variety of different techniques. These techniques, however, have, to the best of our knowledge, not been directly compared, and such information is strongly needed for enhancing high-throughput phenotyping. In this study, we compared the potential of high-resolution thermography and infrared (IR) thermometry to discriminate among stress treatments (control, drought, salt and combined salt and drought) and cultivar effects in large container-based experiments that mimicked field conditions. Direct leaf measurements with a thermistor as by-product of cuvette-based stomatal conductance measurements were further included. Canopy and leaf surface temperatures were related to leaf water potential and biomass parameters. Differences among treatments and between cultivars, with differences varying between 1-9 °C and 0-2 °C, respectively, were in dense crop stands best and comparably well ascertained by IR thermometry and thermograph, with similar results for processed and unprocessed thermal images. The soil influence was more pronounced in early as compared to later growth stages. Using thermography and IR thermometry, highly significant and close relationships were established between canopy temperature and leaf water potential (R^2 -values of up to 0.98**), with the results from processed and unprocessed thermal images being slightly better. Overall, in this study the more simplistic technique based on IR thermometry performed in dense crop stands similarly well as the more sophisticated method provided by thermography.

Keywords: drought, phenotyping, salinity, thermistor, thermography, thermometry, wheat