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## Effect of Wind and Radiation on the Crop Water Stress Index Derived by Infrared Thermography

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### Abstract

For optimising irrigation scheduling, information about plant water status is required. Water stress detection with infrared thermography is a non-contact method and thus very fast and practical. It is capable to estimate large leave populations simultaneously and provides an overview on stomata conductance to water vapour variation and dynamics. However, the application has a drawback as the leaf temperature depends not only on stomata conductance to water vapour but also on other environmental factors like air temperature, radiation, humidity and wind speed, which may lead to inaccuracies in thermography-based water status detection.

A greenhouse experiment was conducted on potted maize plants, which were dried out by stopping irrigation and compared to the well watered plants. Drought stress reactions were monitored in terms of stomatal conductance to water vapour and soil water content. Infrared pictures were taken daily during the time interval 12:30–14:30 with an Infrared-camera (Infratec Vario CAM). Wet-bulb temperature (maximum adiabatic cooling of the leaves) was measured by spraying water on a reference leaf just before taking the picture. The maximum leaf heating was measured by inhibiting transpiration of a reference leaf by covering the surface with a petroleum jelly. The crop water stress index (CWSI) was calculated from the measured mean canopy temperature and wet and dry reference temperature. After the establishment of drought stress, wind was applied and later plants were illuminated with 400W sodium lamps and the changes in canopy temperature were measured in a 10min interval. Associated meteorological data (relative humidity, temperature) were measured at an interval of 5 minute. In addition to the infrared pictures, visible images were taken concurrently to identify the area of the leaves accurately.

The results showed that the CWSI of plants under water stress changed quickly under the influence of wind and radiation. CWSI underestimate the level of water stress. And after a certain time interval it was difficult to distinguish between plants under stress and non-stress conditions.

**Keywords:** Crop water stress index, leaf water potential, maize