

1. An IR-based coefficient to screen plant environmental stress – concept, test and applications

ABSTRACT: By introducing a reference dry leaf (a leaf without transpiration), a formerly proposed plant transpiration transfer coefficient (hat) was applied to detect environmental stress caused by water shortage and high temperature on melon, tomato, and lettuce plants under various conditions. Results showed that there were obvious differences between leaf temperature, dry reference leaf temperature, and air temperature. The proposed coefficient hat could integrate the three temperatures and quantitatively evaluate the environmental stress of plants. Experimental results showed that the water stress of melon plant under two irrigation treatments was clearly distinguished by using the coefficient. The water stress of melon plants under two irrigation treatments was clearly distinguished by using the coefficient. The water stress of a tomato plant as the soil dried under a controlled environmental condition was sensitively detected by using hat. A linear relationship between hat and conventional crop water stress index was revealed with a regression determination coefficient $R^2=0.97$. Finally, hat was used to detect the heat stress of lettuce plants under high air temperature conditions (28.7°C) with three root temperature treatments (21.5 , 25.9 , and 29.5°C). The canopy temperature under these treatments was respectively 26.44 , 27.15 , and 27.46°C and the corresponding hat value was -1.11 , -0.74 , and -0.59 . Heat stress was also sensitively detected using hat. The main advantage of hat is its simplicity for use in IR applications.