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Daytime and Nighttime Field Spectral Imagery of Ripening Paddy Rice for Determining Leaf Greenness and 1000-Grain Weight

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Abstract: A spectral-image observation technique to measure the reflectance information of rice plant organs (instead of the overall canopy) under either daylight or artificial light at night was developed, and examined for its usefulness as a method for the in-situ assessment of leaf greenness and grain quality during the ripening period. Generally, conditions are less significant for nighttime measurement since cloudiness does not affect the nighttime observations, and the evening calm helps extend the practical observation hours. A digital imaging system corresponding to the wavelength range of 450 nm to 720 nm, at intervals of 10 nm, collected spectral reflectance images of ripening rice-paddy plots on three clear days in daylight and during the night, respectively. The imaging system observed the rice canopies illuminated by the sun during the daytime and with two 100-W xenon lamps at night on each day. The reflectance values observed at several points on the illuminated leaves and panicles were normalized using the mean and the standard deviation for each spectrum. The normalized reflectance (NR) spectra obtained in the day and night agreed well with each other for the same target organs. Exemplary estimation trials for leaf greenness (SPAD value) using the NR spectra, and correlation analyses between 1000-grain weight of harvested rice grains and the NR spectra indicated that nighttime measurement could substitute for daytime measurement.

Keywords: Artificial light source, Digital image, Reflectance, Rice, SPAD, 1000-grain weight

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