

Sensor installation and data processing methods of light extinction rate for crop growth monitoring

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Continuous crop monitoring should be necessary under recent abnormal weather condition to take prompt agricultural action. Leaf area index (LAI) and normalized difference vegetation index (NDVI) are most widely used crop growth parameters developed for identifying the process of crop growth. LAI is often utilized as the input data for crop growth model, surface energy balance model, and hydrology model to determine amount of photosynthesis and transpiration. However, the value of LAI is hard to record continuously because the hand-held scanner for harvested all leaves or the portable optical instrument for crop canopy are used. NDVI is a remote-sensed vegetation index correlated with the amount of biomass of crop. However, the downward spectral sensor to measure NDVI at surface-level, not drone or satellite, requires to be higher than the maximum height of the crop using a sensor frame structure in the farmland. Employment of such structure might be an inconvenient task due to removing and reinstalling in every cropping season. In this study, the canopy light extinction ratio (CLER), the ratio of radiation below canopy to radiation above canopy, was tested in garlic field as crop growth parameter to monitor crop continuously without larger sensor frame structure than crop height. Quantum sensors with a 180-degree field of view (FOV) were used to measure the extinction of photosynthetic active radiation (PAR) by crop canopy absorption. One sensor was installed at outside of canopy, and five multi-sensor was installed at regular intervals of 30cm on the bottom surface of the canopy. The five sensors on the bottom were averaged in the case of a fully diffuse irradiation. The values of CLER were decreased as the crop growth. CLER has strong correlation with LAI and NDVI regardless of the variety and season of garlic. Therefore, for easy sensor installation and continuous crop growth monitoring, CLER will be useful in farmland.

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