

Continuous monitoring of the canopy gas exchange of rice and soybean based on the aerodynamic analysis of the plant canopy

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Abstract

It is important to measure the gas exchange activity of the crops in canopy scale to understand the process of biomass production and yield formation. Thermal imaging of the canopy surface temperature is a powerful tool to detect the gas exchange activity of the crop canopy. The simultaneous measurement of the canopy temperature and the meteorological data enables us to calculate the canopy diffusive conductance (g_c) based on the heat flux model (Monteith et al. 1973, Horie et al. 2006). It is, however, difficult to realize the long-term and continuous monitoring of g_c due to the occurrence of the calculation error caused by the fluctuation of the environmental condition. This is partly because the model assumption is too simple to describe the meteorological and aerodynamic conditions of the crop canopy in the field condition. Here we report the novel method of the direct measurement of the aerodynamic resistance (r_a) of the crop canopy, which enables us the stable and continuous measurement of the gas exchange capacity of the crop plants. The modified heat balance model shows the improved performance to quantify g_c under the fluctuating meteorological condition in the field. The relationship between g_c and biomass production of rice and soybean varieties is also discussed in the presentation.

Keywords: gas exchange, plant canopy, rice, soybean, aerodynamic analysis

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