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Comparison of Water Use Efficiency of Paddy Rice (Oryza sativa L.) among Locations and Interannual Variation in Humid Areas : 1. Reliability of estimated canopy transpiration rate from meteorological and physiological data of the crop

Fumihiko ADACHI, Tohru KOBATA, Masayuki ARIMOTO and Tadashi IMAKI
1) Faculty of Agriculture, Shimane University
2) Faculty of Agriculture, Shimane University
3) Faculty of Agriculture, Shimane University
4) Faculty of Agriculture, Shimane University

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Abstract:
The transpiration rate is affected not only by meteorological but also by physiological and structural factors of the crop. Our objectives were to develop a method of estimating the transpiration rate (T) of paddy rice (Oryza Sativa L.) using meteorological and physical data of the crop without continuous direct measurement of T in the field. We measured following parameters at the Experimantal Farm of Shimane University, Matsue : net radiation, relative humidity, air temperature and wind speed during the whole growing season, diurnal changes of stomatal conductance (gs) of fully expanded leaves near the canopy surface on several dominant growth stages, and plant height, leaf area index (LAI) of paddy field rice at 2-week intervals. Evapotranspiration (E_T) and the evaporation rate from soil surface (E) were measured with a microlysimeter during the rice planting season. When three methods to calculate estimated evapotranspiration rate (E_c)(the Penman, Van Bavel and Penman-Monteith methods) were applied, the fitness of regression between E_c from the Penman-Monteith method and E_T was highest. The fitness was improved further when canopy resistance was corrected by the ratio of irradiated to total leaf area calculated empirically from LAI. T was good assumed from the product of E_T and T/E_T which is calculated from the empirical equation[14] as a function of LAI. We concluded that the transpiration rate of paddy rice can be more strictly estimated from E_c by the Penman-Monteith method with minor modification that canopy resistance is corrected by illuminated leaf area and soil evaporation is assumed by LAI. This method is available for comparison of transpiration rate where continuous measurements of transpiration rate for long intervals is very difficult.

Keywords:
Canopy resistance, Evapotranspiration, Leaf area index, Penman-Monteith method, Rice, Stomatal conductance, Transpiration

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