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学　位　論　文　要　旨
SUMMARY OF DOCTORAL THESIS

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題目　Title:

Study on partitioning evapotranspiration into transpiration and soil evaporation
（蒸発散量の蒸散量と土壌面蒸発量への分離に関する研究）

It is important for more precise irrigation planning and management to evaluate transpiration and soil evaporation in evapotranspiration individually. Then, this study examined measuring techniques and simulation models for partitioning evapotranspiration into transpiration and soil evaporation.

Maize was planted in an unheated and naturally ventilated greenhouse at different plant densities. Evapotranspiration was measured by weighing lysimeters and soil evaporation was measured by micro-lysimeters. Transpiration was determined as a difference between evapotranspiration and soil evaporation. The fixed and Uchijima's variable light extinction coefficients were used to estimate transpiration and soil evaporation. The Uchijima's variable light extinction coefficient gave a better estimation of transpiration at all plant densities in this study than the fixed light extinction coefficient. A modified variable light extinction coefficient was proposed for a more precise estimation. Cumulative transpiration and soil evaporation were estimated better for 8 plants/m^2 than those for 4 plants/m^2. Daily crop coefficients were related to days after emergence and different crop coefficient curves were obtained for two plant densities. Then, daily crop coefficients of two plant densities were related to leaf area indexes and an exponential relationship was obtained.

Energy balance on a field is the main factor for evapotranspiration. Then, maize was planted at an open field. The Bowen ratio energy balance method (Method 1) was used to measure latent heat fluxes from maize field and soil. Then, latent heat flux from canopy was determined as a difference between those from maize field and soil. A weighing lysimeter and sap flow gauges (Method 2) were used to measured latent heat fluxes from maize field and canopy, respectively. Then, latent heat flux from soil was determined as a difference between those from maize field and canopy. The coefficients of determination in latent heat fluxes by Method 1 and Method 2 were 0.71 for maize field, 0.74 for canopy and 0.36 for soil. Method 1 underestimated latent heat flux from maize field and overestimated that from canopy. It resulted in an underestimation of latent heat flux from soil. Measurements of energy balances among maize field, soil and canopy by Method 1 indicated that soil had a major impact on the energy balance between canopy and maize field. During a dry period, sensible heat from the soil contributed about 31 % to latent heat flux from canopy.

It was clear by this study that the light extinction coefficient was important to estimate transpiration and soil evaporation. Then, the modified variable light extinction was proposed. It became clear that the Bowen ratio energy balance method was useful to validate evapotranspiration models.