Rice Panicle Temperature and Crop Microclimate in Stressful Thermal Environments: Towards a Model of Spikelet Sterility.

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Rice inflorescences are sensitive to chilling and heat, resulting in spikelet sterility. It is not the air temperature itself, however, that causes the stress but the temperature of the sensitive tissues during specific developmental stages. Chilling affects sterility mainly through (1) disruption of meiosis during microspore stage (tissues located at bottom of canopy exposed to floodwater temperature at the beginning of booting) and (2) failure of panicle exertion (temperature of elongating internodes at mid height of canopy). Heat affects mainly pollination and fertilization processes at anthesis at the top of the canopy. The organs concerned can have markedly different temperature from air by up to 6°, depending on microclimate generated by the architecture, roughness and transpiration rate of the canopy. Quantifying and predicting these complex thermal relationships is essential to evaluate the impact of climate change scenarios and the adaptation of cultivars to them. So far, no crop model is available to simulate crop microclimate dynamics and to link them to physiological processes.

This study, conducted in the context of the GTZ-funded RISOCAS project, aims as a first step to observe experimentally on 7 contrasting varieties of irrigated rice at climatically contrasting sites (Senegal, Philippines, Camargue in France) the thermal relationships and components of the crop heat balance. This includes diurnal soil, water, canopy, panicle and air temperature patterns and their relationship with canopy structure and weather. First results are presented from the 3 environments, notably vertical temperature gradients in the canopy and temperature distribution with the panicle, using infrared photography and thermocouples, as well as heat balance measurements and recordings of standard agrometeorology. As a 2nd step, these observations will be related to spikelet sterility and yield losses. Finally, the results will be used to develop a micrometeorological module for the cereal crop models SARRAH and EcoMeristem.

This paper presents first results, discusses methodological issues and provides an outlook on the planned modelling approaches.

Keywords: *oryza sativa*, thermal stress, panicle sterility, microclimate, panicle temperature, modelling, climate change

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