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## Effects of Temperature, Solar Radiation, and Vapor-Pressure Deficit on Flower Opening Time in Rice

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**Abstract:** Flower opening in the early morning helps to avoid sterility of rice (*Oryza sativa* L.) caused by heat stress at anthesis. Although flower opening time (FOT) is under genetic control, it is also affected by weather, particularly by air temperature ( $T_a$ ). However, the effects of  $T_a$ , solar radiation ( $R_s$ ), and vapor-pressure deficit (VPD) on rice FOT are unclear, making it difficult to predict FOT. Therefore, we investigated the correlation of FOT with  $T_a$ ,  $R_s$ , and VPD during various periods before anthesis under field conditions.

By photographing spikelets at 10-min intervals, we determined the FOT of five cultivars. To evaluate the individual effects of cultivar,  $T_a$ ,  $R_s$ , and VPD on FOT, we constructed general linear models (GLMs) and calculated mean  $T_a$ ,  $R_s$ , and VPD every 3 hr from 0000 to 1200. The GLMs revealed that the average  $T_a$ ,  $R_s$ , and VPD between 0600 and 0900 significantly affected FOT (adjusted  $R^2=0.399$ ;  $P<0.001$ ). The standardized partial regression coefficients of  $T_a$  and  $R_s$  were negative and those of VPD were positive, indicating that higher  $T_a$ , higher  $R_s$ , and lower VPD in the early morning result in earlier FOT. Moreover, multiple-regression analysis showed that the period affecting FOT the most, and the relative contributions of  $T_a$ ,  $R_s$ , and VPD to FOT differ with the cultivar.

**Keywords:** [Flower opening in the early morning](#), [Flower opening time](#), [Heat-induced sterility](#), [Oryza sativa](#), [Rice cultivars](#), [Solar radiation](#), [Temperature before anthesis](#), [Vapor-pressure deficit](#)

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