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Assessment of Critical Temperature for the Grain Filling of Late Transplanted Temperate Rice

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[Abstract]

Grain filling traits of rice were traced to determine the critical temperature that ceased grain filling process, from the late transplanted temperate rice varieties in the field conditions of 2020 and 2021. The tested three varieties were transplanted six times with four target heading dates of 20 Aug. (control), 10 Sep., 20 Sep. and 30 Sep. Nine times of sampling were made from a week after heading with three replicates for each treatment.

Development of grain filling percentage, grain dry weight and milled rice weight demonstrated sigmoid curves in the first and second transplants of 2020, and in the first to third transplants of 2021. The three grain filling traits in the 2020 third transplants and in the 2021 fourth transplants initially increased with the progress of grain development, and reached the peaks at certain time points, then decreased thereafter. Non-linear regression analyses, performed for the traits in the transplants that showed sigmoid curves except control, indicated that 95% of the final data (95% FD) was attained when the seven-day moving temperature (Sd-MovT) was 8.4-9.6°C, which excluded the cases when the temperature before the dates of 95% FD was lower than that on the dates of 95% FD. Sd-MovT on the date of peak data was 8.5-9.8°C in the 2020 third transplants and 6.9-8.3°C in the 2021 fourth transplants. Grain development was observed when seven-day mean temperature (Sd-MT) from 35 to 41 days after heading date was 9.4-10.8°C in the 2020 third transplants and 10.1-11.9°C in the 2021 fourth transplants. But Sd-MT of 8.7-9.1°C in 2020 and 6.9-7.6°C in 2021, at 42-48 days after heading, resulted in no progress of grain development. Overall, Sd-MovT at the point of stagnated grain development appeared in the range of 6.9-9.8°C. The lowest Sd-MT that showed the progress of grain development was 9.4-9.5°C and the highest Sd-MT that showed no grain development was 9.1°C, both of which appeared in Odae and Haiami of the 2020 third transplants. Therefore it is concluded that critical temperature for the grain development of temperate rice in natural conditions exists between 9.1°C and 9.5°C.

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