

Production of long-day specific early-flowering mutant by heavy-ion irradiation on indonesian rice cultivar: Gemdjah Beton

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Rice is among the most widely cultivated field crops in the world and almost half of the world's population depends on it.¹⁾ Rice is typically a short-day plant; however, it still possesses a complex genetic regulation for determining the heading date. *Rice Heading date 3a* (*Hd3a*) and *Rice FT-like 1* (*RFT1*) florigen genes mainly regulate its flowering trait.²⁾

Gemdjah Beton (GB) is an Indonesian rice cultivar under the ecotype Bulu that requires approximately 17 weeks to flower after being transplanted into the rice field. We developed early-heading mutant lines in GB background by heavy-ion induction.³⁾ This study aimed to understand the genetic regulation for heading induction in the mutants. The GB-10 line was created by the irradiation of dry seeds with C-ions accelerated to 135 MeV/nucleon at a dose of 125 Gy in April 2011. LET values of the C-ions corresponded to 22.5 keV/ μm . The early heading M₃ population was isolated in 2013.³⁾ Flowering time observation was conducted inside the growth chambers under Short-day (SD) (10 hours light/14 hours dark) and Long-day (LD) (14.5 hours light/and 9.5 hours dark) conditions. The date of the first panicle emerged was recorded as the flowering time. GB-10 exhibited an early flowering time under LD conditions. However, under SDs flowering time between GB-10 and Wild-type (GB Wt) plants did not exhibit a clear difference (Fig. 1). In addition, GB Wt plants resulted in extended days to heading under LDs, whereas GB-10 flowered approximately 17 days earlier. We performed Real-time quantitative RT-PCR to check the gene expression of two florigen genes, *Hd3a* and *RFT1*. Fully emerged leaves of seven-week-old seedlings grown under the same SD and LD conditions (2 hours after dawn) were used to extract total RNA. Each data point shows an average of three biological replicates and the rice ubiquitin gene was used for normalization.

Consistent with the heading date, the rice florigen expression was clearly induced under LDs. Both *Hd3a* and *RFT1* exhibited approximately 100-time relative expression quantity difference under LDs (Fig. 2). Under SDs, their relative expression difference was not significantly different. This florigen expression was consistent with the heading date phenotypes. Typically, the florigen expression is measured in three-week-old seedlings, when plants flower approximately

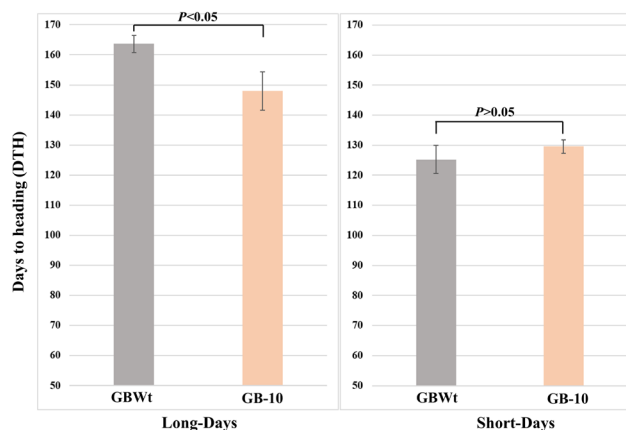


Fig. 1. Flowering time of Gemdjah Beton wild-type (GB Wt) and GB-10 plants under LD and SD conditions.

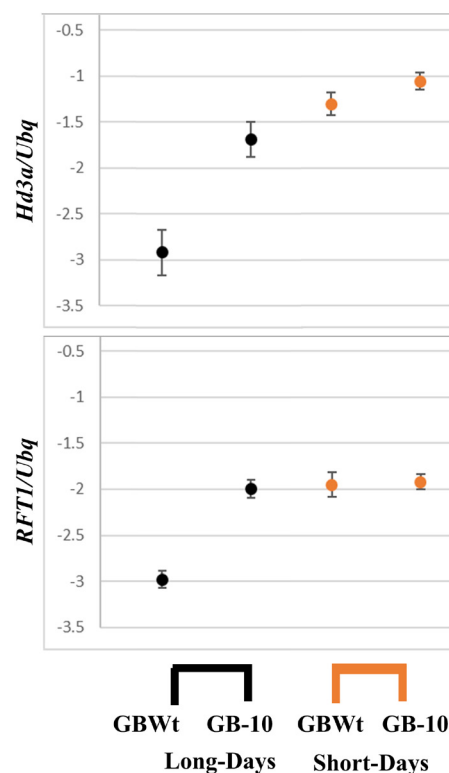


Fig. 2. Relative gene expression *Hd3a* and *RFT1* under LD and SD conditions. The relative expression of each target gene is shown on the logarithmic Y-axis.

around 100 days after germination (DAG). However, GB Wt flowered after approximately 160 DAG. There-

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fore, seven-week-old rice plant leaves would be a good material to check the florigen expression. Based on these flowering time data and gene expression data, we can confirm that GB-10 possesses promoted *Hd3a* and *RFT1* gene expression which stimulate early flowering under LDs.

References

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