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Updates of Golden Rice Research in Bangladesh

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Abstract

GR2-E BRRI dhan29 Golden Rice was developed and selected at IRRI from cross between GR2-E Kaybonnet Golden Rice and BRRI dhan29. The Kaybonnet was modified through agrobacterium-mediated transformation of beta carotene gene (ZmPSY1) from maize using plasmid pSYN12424. Event GR2E was uniquely identified using a multiplex PCR method employing three primers named ZD-E1-P1, ZD-E1-P2 and ZD-E1-P3. BC₅F₅ progenies of GR2E were imported from IRRI, Philippines. A contained trial was conducted in Aus 2015 comprising 170 lines. Totally 30 materials were selected and advanced to conduct confined field trial at CFT site, Gazipur during Boro 2015-16. Then 08 best materials were advanced for multi-locations CFT during Boro 2016-17. One material was selected and advanced for multi-locations CFT during Boro 2017-18 being very similar to BRRI dhan29 in grain type and plant height but 1-2 days late in maturity and amylose 24%. To confirm that BRRI dhan29 GR2E rice was substantially equivalent agronomically to the recurrent parental line, BRRI dhan29, grain yield and other phenotypic measurements were collected from confined field experiments at five locations during both the 2017 and 2018 boro rice growing seasons in Bangladesh. A total of 15 agronomic parameters were recorded and of these, three were significantly different between GR2E BRRI dhan29 and non-transgenic control BRRI dhan29. Across all locations and years, the GR2E entry was consistently about 1–2 days later to flowering and time to maturity compared to the BRRI dhan29 check. While grain yield of GR2E was 13.3 percent higher than BRRI dhan29 in 2017, and approximately 3.8 percent lower than control BRRI dhan29 in 2018, in the combined analysis over seasons and locations yield differences were not statistically significant. The combined analysis of the agronomic and phenotypic data generated over locations and growing seasons for GR2E rice and its non-transgenic control support the conclusion that the genetic modification resulting in event GR2E did not have an unintended effect on plant growth habit and general morphology, vegetative vigour, or grain yield. From the data and observations, there were no indications that GR2E rice exhibited any fitness advantage that would make it more invasive or persistent in the environment, or have altered susceptibility to pests or diseases, than conventional rice. GR2E introgression line IR112060 GR2E:2-7-63-2-96 can be used for the purposes of breeding advancement as well as variety release in future based on its consistent performance across locations and seasons. No sequence homology structural alerts for potential toxicity and allergenicity of the ZmPSY1 protein. Feeding trial to male and female mice at 100 mg/kg did not result in mortality or other evidence of acute oral toxicity. Nutritional composition of GR2E like fibre, polysaccharide, ash, crude fat, protein, minerals, carotenoids and straw composition were analyzed and it revealed that every is very similar to control except carotenoid. As the genes are endosperm specific so, it expresses only in grain, not in other parts of the plant. An application for the environmental and food safety assessment of GR2E golden rice is waiting for NCB approval.

The paper presented in the special seminar, held in BRRI auditorium on 01 October 2018