UDP–Glucose–4–epimerase 1 (BrUGE1) increases yield and enhances drought tolerance in rice

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UDP–glucose–4–epimerase (GALE), also known as UDP–galactose–4–epimerase (UGE), is an NAD dependent enzyme that is responsible for reversibly inverting the UDP–galactose to form UDP–glucose in a wide variety of species. UDP–galactose and UDP–glucose are precursors for many biosynthesis of numerous carbohydrates, glycolipids and glycosides. In this study, the full–length cDNA of UGE1 was cloned from Brassica rapa and overexpressed in rice. The gene named BrUGE1 had a total length of 1,328 bp that contains an open reading frame (ORF) of 1,056 bp. It has a highly conserved catalytic domain and is highly expressed in stem, young shoot and leaf in rice. Southern blot analysis showed the presence of single copy gene number. Overexpression analysis in rice showed enhanced tolerance to drought stress with increased mRNA transcript overtime using two–week old seedlings. The tolerance was partially explained by the activation and increased in osmolyte sugars. Further studies showed that BrUGE1 overexpressing lines produced significantly more yield than the wild type Gopumbyeo. This can be accounted to an increase in the number of spikelets per panicle and filled grains. Interestingly, these lines were less affected by sugar toxicity compared to Gopum and might act in the direction of UDP–Galactose to UDP–Glucose.

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