Higher expression of dehydroascorbate reductase confers enhanced tolerance to various abiotic stresses in rice (*Oryza sativa* L. ssp. *japonica*)

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Ascorbate (AsA) is a major antioxidant that is utilized to convert harmful H₂O₂ to H₂O. Dehydroascorbate reductase (DHAR) contributes to maintain reduced pools of ascorbate by recycling the oxidized AsA (dehydroascorbate, DHA) to the reduced AsA. Transgenic rice plants (*OsDHAR1–OX1,–OX2*) carrying a maize ubiquitin promoter::*OsDHAR1* exhibited higher tolerance to salt, H₂O₂, and PEG stresses compared to non-transgenic control WT rice plants, which was supported by a series of experiments such as phenotypic appearance, ion leakage, and PSII effective quantum yield (Fv/Fm). The transcriptional and translational expression of the gene construct enhanced in the *OsDHAR1–OX1* rice plants, where the activity of DHAR increased significantly, as well as those of MDHAR, GR, and APX related to AsA recycling. The *OsDHAR1–OX1* rice plants raised AsA level and especially very much AsA/DHA ratio under salt stress. After all, the *OsDHAR1–OX1* and –*OX2* rice plants grown in a paddy field during farming season showed that the overexpression of *OsDHAR* improved significantly crop yield such as total plant weight and total grain yield. All of our results demonstrate that the activity of DHAR is closely related with the recycling efficiency of AsA and plays an important role to grow healthy for rice plants against various environmental stresses.

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