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CRISPR/Cas9 Targeted Mutagenesis of *OsSAP*, a Senescence Associated Protein Domain Transcription Factor, Enhances Drought Tolerance in Rice

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[Introduction]
Senescence associated genes are up-regulated when stress is applied to plants. In particular, the climate is changing rapidly around the world, and drought in particular is a problem that we must solve. Senescence associated genes confer resistance to plants by up-regulating the expression of various transcription factors when plants are exposed to stress environments. CRISPR/Cas9 can completely delete the function of a gene. In this research, the function of *OsSAP*, a gene related to cellular aging, was completely removed through genome editing (GE).

[Materials and Methods]
For genome-editing of *OsSAP*, three guide RNAs were designed using a target gene. pRGEB32 vector was used to construct a CRISPR/Cas9 vector that can be expressed in rice. Regenerated *OsSAP*-GE lines were analyzed for genome-editing through sequencing, and ROS analysis and relative expression level analysis were performed in drought condition using GE-lines in which *OsSAP* editing occurred.

[Results and Discussion]
Among fifteen genome editing rice, three representative *OsSAP*-GE rices in which *OsSAP* functions were removed with CRISPR/Cas9 were used in this research. *OsSAP* was expressed during the entire period of rice growth, especially in leaf. *OsSAP*-OX resulted in drought resistance, and *OsSAP* genome editing was very susceptible under drought condition. It was also demonstrated that *OsSAP*-OX rice exhibited a higher survival rate than *OsSAP*-GE rice under drought stress conditions. 3,3-diaminobenzidine and nitro blue tetrazolium histochemical staining identified that *OsSAP* can withstand drought stress by inhibiting the production of reactive oxygen species (ROS) and peroxidases in cells. Collectively, these results indicate that *OsSAP* can improve resistance to drought by regulating the activity of antioxidant enzymes.

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