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Effect of Hydrogen Peroxide Treatment on Sorghum Seed Germination at Low Water Potential

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[Introduction]

Recently, the temperature of the Earth has been rising due to climate change and shortage of water during the growth of the crops causes significant damage. Sorghum is more tolerant to drought stress than maize and is cultivated as a typical summer crop in Korea. This study was carried out to investigate the effect of hydrogen peroxide treatment as a measure to improve the tolerance to the drought. For this purpose, antioxidant activity against ROS and proteomic analysis for germinating seeds were investigated.

[Materials and Methods]

The seeds of sorghum (CV Hwanggeumchal) used in this experiment were harvested at Gyeongsang National University Experimental Farm in 2016. The water potential of solution for imposing drought conditions were prepared as 0, -0.2 and -0.5 MPa using PEG 6000, and the seeds were treated with 0, 10, 20, 50 and 100 mM H_2O_2. The embryo was separated from the endosperm at day 1 after imbibition and finely ground in liquid nitrogen. Each sample was analyzed by ORAC for antioxidant activity and proteins were extracted with phenol buffer and subjected to two dimensional electrophoresis for proteome analysis.

[Results and Discussions]

The germination of seeds under well-watered and slight drought condition was commenced at 12 h after the imbibition and germination under strong drought (-0.5 MPa) was commenced at 24 h after imbibition. The germination rate of seeds treated with 10, 20, 50 and 100 mM H_2O_2 was higher than that of untreated (0 mM H_2O_2) germination under the severe drought (-0.5 MPa) condition. In particular, the germination rate in 100 mM H_2O_2 treatment was 72%, which was 20% higher than that of untreated control (0 mM H_2O_2). The plumule and radicle length of seedlings treated with 20 mM H_2O_2 were 4.2 cm, 2.7 cm greater than those of untreated (0 mM H_2O_2) seedlings, respectively, in the moderate drought condition (-0.2 MPa). In the severe drought condition (-0.5 MPa), plumule length of seedlings treated with 100 mM H_2O_2 were 1.6 cm longer than those with 0 mM H_2O_2 treatment, and the length of radicle was 0.9 cm longer than that of untreated (0 mM H_2O_2) seedlings. Based on the above results, ORAC of the embryo part from seeds incubated for 24 h under the conditions of 0, -0.5, and -0.5 MPa (+100 mM H_2O_2) were examined. As a result, the antioxidant capacity at -0.5 MPa was 1104.5 μ M Trolox/gFW at 0 and -0.5 MPa + 100mM H_2O_2, respectively, and the protein expression was also different in the secondary electrophoresis.

[Acknowledgements]

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science (No. 2017R1A2B40046720173)

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