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Effect of sulfur on the cadmium transfer and ROS-scavenging capacity of rice (*Oryza sativa* L.) seedlings

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Abstract

Cadmium (Cd) pollution is rapidly increasing in worldwide due to industrialization and urbanization. In addition to its negative effects on the environment, Cd pollution adversely affects human health. Rice (*Oryza sativa* L.) is an important agricultural crop worldwide, including South Korea, and studies have examined its ability to alleviate Cd uptake from the soil into plants. However, information about the relationship between sulfur (S) and antioxidants in rice seedlings is still limited with regard to Cd phytotoxicity. We therefore investigated the changes in reactive oxygen species (ROS) and antioxidants in rice (*Oryza sativa* L. 'Dongjin') seedlings exposed to toxic Cd, S treatment, or both. The exposure of rice seedlings to 30 μ M Cd inhibited plant growth; increased the contents of superoxide, hydrogen peroxide, and malondialdehyde (MDA); and induced Cd uptake by the roots, stems, and leaves. Application of S to Cd-stressed seedlings decreased Cd-induced oxidative stress by increasing the capacity of the glutathione (GSH)-ascorbate (AsA) cycle, promoted S assimilation by increasing cysteine, GSH, and AsA contents in treated plants, and decreased Cd transfer from the roots to the stems and leaves. In conclusion, S application of plants under Cd stress promoted Cys and GSH biosynthesis and GSH-AsA cycle activity, thereby lowering the rate of Cd transfer to plant shoots and promoting the scavenging of the ROS that resulted from Cd toxicity, thus alleviating the overall Cd toxicity. Therefore, these results provide insights into the role of S in regulating the tolerance, uptake, and translocation of Cd in rice seedlings. The results of this study indicate that S application should have potential as a tool for mitigating Cd-stress in cereal crops, especially rice.

Keywords: antioxidants, cadmium, reactive oxygen species (ROS), rice seedlings, sulfur

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