Natural Antioxidants Reduce the Toxic Effect of Heavy Metals on the Growth of Rice (Oryza sativa L.)

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Heavy metal pollution is one of the main environmental factors affecting rice yield and quality, therefore, development of strategies to reduce the toxicity of heavy metals on rice growth and to lower the heavy metals accumulation in rice have always been the concentrated interests of scientists. The objective of this study was to investigate the effects of the addition of three natural antioxidants (anthocyanin, tea polyphenols and vitamin C) and glutathione (GSH) on the amelioration of the growth of Cu2+ and Cd2+ in rice roots and stems. Both two heavy metal ions (Cu2+ and Cd2+) retarded rice seed germination and seedling growth, while the addition of GSH, anthocyanin and tea polyphenols effectively reduced the toxicity of heavy metals on rice, and partially restored the growth of rice. Scanning electron microscopy and 3D X-ray microscopy confirmed that the addition of natural antioxidants effectively improved the renewal and abscission of root epidermal cells and maintained the morphogenesis of root vascular bundles. Further reactive oxygen species (ROS) and QRT-PCR data suggested that the addition of natural antioxidants might activate the rice's own ROS signaling pathway to improve the autoimmune function, thus effectively reducing the toxicity of heavy metals. This study is a valuable preliminary study on the role of natural antioxidants in reducing the toxic effects of heavy metals on the growth and development of rice, which proved that natural antioxidants can effectively reduce the toxicity of heavy metals on the growth of rice.

Awards Won:

Third Award of $1,000