

Glutathione Application Affects Modulation of the ROS, Redox, and Hormone Balance in Cd-exposed Brassica napus

카드뮴에 노출된 유채에서 활성산소종, 산화·환원 및 호르몬균형의 조절에 미치는 글루타치온 처리효과 구명

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Glutathione Application Affects Modulation of the ROS, Redox, and Hormone Balance in Cd-exposed *Brassica napus*

카드뮴에 노출된 유채에서 활성산소종, 산화환원 및 호르몬균형의 조절에 미치는 글루타치온 처리효과 구명

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Glutathione (GSH) plays critical roles in the physiological processes, stress defense, growth, and development of plants. Our study investigated the effects of exogenous GSH on the biochemical responses of reactive oxygen species (ROS), redox, and hormone levels in oilseed rape (*Brassica napus* L. 'Tammi') seedlings under cadmium (Cd) stress. Cadmium (10 μ M) alone treatment inhibited the growth; increased the level of superoxide, hydrogen peroxide, and malondialdehyde; and enhanced the uptake of Cd by roots and shoots of the plants grown in Cd-treated hydroponics for 10 days. Furthermore, it reduced GSH content, and GSH-redox ratio, which have been correlated with the decrease in AsA- and NADPH-redox status. However, the exogenous application of GSH in Cd-treated plants reduced the Cd-induced oxidative stress, improved the redox homeostasis by increasing AsA, GSH, and NADPH contents, and increased Cd uptake and accumulation in the roots and shoots. The ratio of IAA/Zeatin, ABA/Zeatin, SA/Zeatin, and JA/Zeatin was significantly increased in the roots and leaves under Cd-stressed condition, respectively, compared with those of the untreated control. However, GSH applications in all organs remarkably decreased ratios of the IAA/Zeatin, ABA/Zeatin, SA/Zeatin, and JA/Zeatin compared to the Cd alone treatment. Therefore, the results suggest that exogenous GSH treatment is a practical approach to alleviate Cd-induced oxidative damages by sustaining sufficient levels of AsA, GSH, and NADPH and maintaining balance of the hormone status.

Keywords: *Brassica napus*, Cadmium, Glutathione, Hormone balance, Reactive oxygen species (ROS), Redox status

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