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Abstract

Potential of Different Sources of Sulfur in Mitigating Cadmium Induced Toxicity in Mustard †

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Abstract: The response of five mustard cultivars, Pusa Tarak, RH-0742, Pusa Agrini, Giriraj and RH-406, to 0, 100 and 200 mg Cd/kg soil was evaluated in terms of photosynthetic and growth characteristics, antioxidant metabolism, oxidative stress and S-assimilation. The 200 Cd/kg soil was found to show more detrimental effects on photosynthetic and growth characteristics than the 100 Cd/kg soil. Among these cultivars, cv. Giriraj showed the maximum resistance against Cd stress and showed the least reduction in photosynthetic and growth parameters with the maximum increase in antioxidant metabolism. Further the influence of optimum S (100 mg S kg^{-1} soil) and excess S (200 mg S kg^{-1} soil) in the form of different sources (gypsum, magnesium sulfate, elemental sulfur, and ammonium sulfate) was studied, and their involvement in countering Cd induced toxicity was evaluated. Both optimum S and excess S have a positive impact on the photosynthesis and growth of plants under controlled conditions, while excess S more conspicuously alleviated the detrimental effects of Cd. Among different S sources, elemental S proved to be more beneficial in alleviating Cd stress as compared to other sources by modulating the activities of antioxidant enzymes and a sustained lower level of lipid peroxidation by reducing the contents of H_2O_2, and TBARS. The sulfur-induced aforementioned results were due to the production of S-containing amino acids such as cysteine, which is a constituent of reduced glutathione, and Cys-rich heavy metal chelators such as metallothionines and phytochelatins. These results suggest that S application in the elemental form can more potently induce antioxidant potential, S-assimilation, and photosynthetic attributes and most efficiently help Cd sequestration, playing a crucial role in plant tolerance to Cd stress.

Keywords: antioxidant system; cadmium; mustard; photosynthetic potential; sulfur sources

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