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. 200 Cd soil was found to show more detrimental effects on photosynthetic and growth characteristics than 100 Cd. Among these cultivars, cv. Giriraj showed maximum resistant against 200 Cd stress and showed least reduction in photosynthetic and growth parameters with maximum increase in antioxidant metabolism. Further the influence of optimum-S (100 mg S kg^{-1} soil) and excess S (200mg 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 has positive impact on photosynthesis and growth of plants under control condition 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 activities of antioxidant enzymes and sustained lower level of lipid peroxidation by reducing contents of H_2O_2, and TBARS. Sulfur induced aforesaid results were due to production of S containing amino acids like cysteine which is a constituent of reduced glutathione and Cys rich heavy metal chelators like metallothionines and phytochelatins. These results suggest that S application in elemental form can more potentially induce antioxidant potential, S-assimilation, photosynthetic attributes and most efficiently help Cd sequestration playing crucial role in plant tolerance to Cd stress.

Keywords: Antioxidant system, cadmium, mustard, photosynthetic potential, sulfur sources.