

Role of silicon in alleviation of iron deficiency and toxicity in hydroponically-grown rice (*Oryza sativa* L.) plants

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(Received : Jan. 17-2012 ; Accepted : May 10-2012)

Abstract

Silicon (Si) nutrition may alleviate biotic and abiotic stresses including heavy metal deficiency and toxicity in plants. Iron deficiency and toxicity are important limiting factors in growth of rice. In the present study, role of Si nutrition on alleviation of iron deficiency and toxicity was investigated in rice plants. Plants were cultivated in greenhouse in hydroponics, using Yoshida solution, under different iron treatments (0, 2, 10, 20, 50, 100 and 250 mg/L as Fe- EDTA) and Si nutrition (0 and 1.5 mM as sodium silicate). Results revealed that both iron deficiency and toxicity imposed significant reduction in fresh and dry weight and length of plants. The activity of catalase was decreased in shoots due to iron deficiency. Activity of catalase in roots and cell wall peroxidase in shoots increased under iron toxicity compared with control plants. Si nutrition increased Si content in plants and improved plant growth in both iron deficiency (not in the absence of iron) and toxicity. Application of Si increased the activity of catalase in shoots and polyphenol oxidase in both roots and shoots under iron deficiency. Also, the activity of catalase in roots and polyphenol oxidase in shoots raised following iron toxicity. This in turn may reduce the oxidative stress in plants. In addition, increase of lignin in extreme iron toxicity due to Si nutrition may enhance sites of iron absorption in plant cell walls and decrease iron toxicity. The results indicated that Si nutrition could ameliorate harmful effects of iron deficiency and toxicity in rice plants possibly through improvement of antioxidant enzyme activity and reduction of oxidative stress.

Keywords: Iron deficiency, Iron toxicity, Oxidative stress, Catalase enzyme.

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