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PBE
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The beneficial effects of Si on iron deficiency stress alleviation in barley: modulation of Strategy II genes expression and metal redistribution

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The beneficial effects of silicon (Si) on various abiotic and biotic stresses in plants are well established; however, molecular mechanisms are not completely understood. An ameliorative effect of Si on iron (Fe) deficiency stress has only been shown on plants which use the reduction-based strategy (Strategy I) for Fe acquisition. The aim of our study was to investigate influence of Si on Fe deficiency stress alleviation in a cereal plant which uses the chelation-based strategy (Strategy II) for Fe acquisition, and barley was chosen as a representative.
Si successfully ameliorated Fe deficiency in barley, attenuating chlorosis and biomass loss of the youngest leaves, as well as ROS accumulation, accompanied with the recovered activities of antioxidative enzymes, ascorbate peroxidase and catalase. Si increased Fe content in the youngest leaves of Fe deprived plants, as well as Fe concentration in the water-soluble (w-s) fraction. On the other hand, w-s concentration and total content of optimally supplied microelements, Mn and Zn, were decreased in Si supplied plants. The expression of Strategy II genes was modulated under the influence of Si. An expeditious increase in the gene expression was detected in Fe deficient roots. Moreover, a dramatic Si-promoted upregulation of some of the investigated genes was detected in leaves.
Fe deficiency in plants due to low Fe availability in soils has a considerable impact on both yield and nutritional value of crops. New findings presented in our study may support development of strategies to overcome this substantial agricultural problem.