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Overexpression of Wheat *TaVIT2* in *Vit1-1* Mutant Background of Arabidopsis mediates Iron and Zinc Homeostasis in Iron Deficient Conditions

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ABSTRACT

Iron (Fe) deficiency is a serious nutritional issue in plants and severely affects crop yield and the quality of food products in terms of mineral bioavailability. In cereals, like wheat and rice dietary availability of Fe in seeds is a major concern. Vacuolar Iron Transporter (VIT) genes mediate Fe transport and its vacuolar sequestration in plants. Differential expression of wheat VIT2 was examined in aleurone, endosperm, leaf, stem, root, flag leaf and seeds. The expression analysis correlated with Fe accumulation in different tissues of wheat. Contrasting expression pattern of TaVIT2 was obtained in response to differential external Fe conditions. To improve Fe concentration in edible plant parts we examined wheat VIT2 gene by expressing the gene in vit-1-1 mutant background of Arabidopsis thaliana. In heterologous complementation studies, the phenotype of vit-1-1 mutants was reversed at low Fe conditions. Complementation lines expressing TaVIT2 exhibited enhanced chlorophyll content, improved vegetative and reproductive growth under Fe-deficient conditions. Fe and zinc (Zn) concentration increased in roots, leaves and seeds of complementation lines. Genes related to metal uptake and intercellular transports were induced in complementation lines.

The results suggested that TaVIT2 gene increases Fe uptake strategy, facilitating metal homeostasis in complementation lines. This interaction between vacuolar Fe sequestration and long-distance metal transport may be an important approach to increase micronutrient levels in crops and genetically engineered plants can be grown in Fe deficient soil.