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Silicon Mediated Tolerance to Stress in Plants

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ABSTRACT

Silicon (Si) is not an essential nutrient, but has been found to play an important role in plants. Silicon is categorized as a beneficial nutrient and is commonly available in earth crust. Si absorption at the lateral roots is categorized into three types, namely, active, passive and rejective uptake. In the active uptake process Si-uptake is faster as compared to water uptake, whereas, in passive uptake Si is taken up at a rate equal rate to water. The role of silicon in improving biotic and abiotic stress is well established. The article focuses on uptake of Si and its role in alleviation of biotic and abiotic stress in plants.

Keywords: Silicon, abiotic stress, nutrient, Plants

Silicon, a nutrient thought not considered as an essential nutrient, has been found to play an important role in plants. Silicon is categorized as a beneficial nutrient and is commonly available in earth crust. According to Sahebi *et al.* (2015), Silicon is the second most abundant element after oxygen in the earth crust. Silicon plays many significant roles in plant metabolism, those include; plant growth, photosynthetic activity, chlorophyll content, activity of different enzymes and performance of crops under different biotic and abiotic stresses (Tripathi *et al.* 2014). Silicon dioxide (SiO_2) is the common form of Si in soil. Plant absorbs silicon in the form of Monosilicic acid or orthosilicic acid (H_4SiO_4) by the active process of root system (Mitani *et al.* 2005). Generally, silicon is accumulated in the epidermal tissues. The layer of cellulose membrane-Si formed in the presence of calcium and pectin ions helps in protecting the plant from different stresses (Rodrigues *et al.* 2003) Though its concentration in the root and shoot shows significant difference due to alteration in Si uptake and transportation mechanism (Hodson *et al.* 2005).

Uptake, transportation and accumulation of Si in plants

According to Liang *et al.* (2006) In the uptake and transport of silicon and Si-accumulator active and passive mechanism plays vital role. Significant variation exists in the concentration of Si within and among plant species, though intra species variation of Si concentration is lower than inter-species variation (Broadley *et al.* 2011). Ma and Yamaji (2006) reported that, followed by root uptake, silicic acid is transported to stele from cortical region, and is further translocated into shoots via transpiration stream through xylem. The transpiration process results in the accumulation of silica in shoot region and the accumulated silica is further converted into amorphous silica through the process of Si polymerization. Si absorption at the lateral roots is categorized into three types i.e. active, passive

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