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Enhanced tolerance of horticultural plants to abiotic and biotic stresses by Silicon

Silicon (Si) has been reported to alleviate abiotic stresses caused by salt, drought, low and high temperatures and metal toxicity, and to improve nutrient imbalance. It also has been found to be beneficial for improving the resistance to insects and pathogens, and therefore for crop quality and yield. It is known that Si gives the resistance to plants by both physically and metabolically. The extent of stress tolerance varies by plant species and even cultivars. Its beneficial effects have been reported to be particularly distinct in monocots such as rice. Yet there have been only limited number of reports on its effect in horticultural plants. Various horticultural plants fed with silicate have been examined in our recent studies for their growth and development, and responses to abiotic and biotic stresses including salt, drought, low and high temperatures, and some pathogens and insects. The species used include *Ajuga multiflora, Allium tuberosum, Capsicum annuum, Cotoneaster wilsonii, Dendranthema grandiflorum, Dianthus caryophyllus, Euphorbia pulcherrima, Kalanchoe blossfeldiana, Lycopersicon esculentum, Nephrolepsis exaltata, Rosa hybrida, and Salvia splendens.* Silicate-fed *Dendranthema grandiflorum and Euphorbia pulcherrima* tolerated both high temperature and drought stresses, while the control plants were severely affected. Silicate fertilization significantly affected growth of *Nephrolepsis exaltata* and silicate-treated plants had increased tolerance to temperature stress. Number of Bemisia tabaci naturally infesting *Euphorbia pulcherrima* in a glasshouse decreased by 91% in the treatment of 50 mg•L^{-1} K_2SiO_3 applied as foliar sprays as compared to that in the control. Florets affected by aphids in the control of *Salvia splendens* 'Vista Red' and 'Sizzler Red' was 67 and 45% as compared to 0 and 20% in the 100 mg•L^{-1} K_2SiO_3 treatment, respectively. Incidence of powdery mildew in Rosa hybrida 'Remata' by infection of Sphaerotheca fuliginea significantly decreased by 50 mg• L^{-1} K_2SiO_3 applied as foliar sprays as compared to that in the control. Antioxidant enzyme activity and chlorophyll fluorescence (Fv/Fm) was increased by silicate treatment. High salt represents a water deficit due to decreased osmotic potential in the soil solution. Shoot growth of *Salvia splendens* was strongly retarded by 50 mM NaCl treatment, while it was sustained when the plants were supplied with either 50 or 100 mg•L^{-1} Si at the same time. Some plug or micropropagated transplants and potted plants also showed their responses in terms of growth, tolerance to temperature or salt stress, ion leakage, and antioxidant enzyme activity as affected by silicate treatment. Incidence of hyperhydric shoots in micropropagated *Cotoneaster wilsonii* caused by high doses of TDZ and repeated subcultures was significantly reduced by supplementation of the culture medium with silicate. The results suggest strong possibility of enhanced tolerance of horticultural plants to abiotic and biotic stresses mediated by Si.

Biography

Byoung Ryong Jeong has completed his PhD from Colorado State University, USA, and Post-doctoral studies from University of Missouri-Columbia, USA, and Chiba University, Japan. He is a Professor in Department of Horticulture and the Dean of College of Agriculture and Life Sciences, Gyeongsang National University, Republic of Korea. He has published more than 250 papers in reputed journals and has been serving as an Editor-in-Chief of Horticulture, Environment and Biotechnology, and President of the Korean Society for Floricultural Science.

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