

INORGANIC PLANT BIOSTIMULANT

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Abstract

We propose a new class of plant biostimulants, the inorganic one, which include silicon (Si), titanium (Ti) and selenium (Se) compounds. These elements: Si, Ti or Se, are not considered essential because plant can complete their life cycle without them. None of these elements is known to be involved into functional plant biochemical structures. However, treatment with soluble silicon (H_4SiO_4), chelated titanium ions or selenium oxoacids salts (selenate or selenite) determine on plant physiological effects like the plant biostimulants: improved nutrient uptake and nutrient use efficiency, increased plant tolerance to abiotic stress, enhanced crop yield quality. We discuss several mechanisms of actions: interaction with related essential elements (as Ti-Fe or Se-S), modulation of the redox regulatory network (reactive oxygen or nitrogen species, gaso-transmitters as NO or H_2S), influence on the cellular receptor structure and function, including their cascading signalling. These different mechanisms of action are discussed also in relationship with the effects of Ti, Si or Se nanoparticles on plants. In case of Si and Se oxoacids / oxoanions are key molecular species involved into physiological effects, thus zero-valent / elemental nanoparticles, which could generate oxide / oxoanions, are proven to have plant biostimulants effects. In the case of titanium, the effects on plants are both beneficial and negatives, depending on the level of generated reactive oxygen species.