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Essential Minerals in Plant-Soil Systems

Coordination, Signaling, and Interaction Under Adverse Situations

A volume in Plant Biology, Sustainability and Climate Change

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Edited by:

Azamal Husen



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About the book

Description

Essential Minerals in Plant-Soil Systems: Coordination, Signaling, and Interaction under Adverse Situations is the first book to encompass these key aspects of plant science, biochemistry, soil science and fertilizer development in a single volume. Describing the micro- and macronutrients in the plant-soil system with the help of suitable illustrations, the book connects all the pieces enabling comprehensive and

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Key Features

- Provides a comprehensive overview of micro- and macronutrients and their interaction with phytohormones under stress conditions
- Explores proteomic and genomic research into deficiencies and toxicities in plant systems
- Highlights the use of nanobiotechnology for controlled release of micro- and macronutrients in the plant-soil systems

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Essential Minerals in Plant-Soil Systems

Coordination, Signaling, and Interaction Under Adverse Situations

Plant Biology, Sustainability and Climate Change

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Chapter 14 - Role of beneficial elements signaling and metabolic performance in plants under heavy metal stress

[Farhan Ahmad](#)¹, [Nida Sultan](#)², [Shazia Siddiqui](#)², [Aisha Kamal](#)³

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Abstract

A significant increase in bioaccumulation and biomagnification of heavy metals (HMs) in the environment has become a predicament for all living organisms including plants. At toxic concentrations, HMs can interact with a variety of essential cellular molecules that cause an excessive increase in reactive oxygen species. As a result, plants would suffer from severe morphological, cytological, metabolic, and physiological abnormalities. To combat the HM toxicity, plants are provided with a variety of defense mechanisms and they are in command of preserving the homeostasis of the vital metals. Ionome includes the role of beneficial elements such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), sulfur (S), and magnesium (Mg) also trace elements such as iron (Fe), copper (Cu), cobalt (Co), molybdenum (Mo), manganese (Mn), and zinc (Zn) in reducing the HM toxicity. Initially, only 19 elements were chosen for basic metabolism including macronutrients, such as C, O, H, Mg, S, N, Ca, P, and K, and micronutrients, such as Cu, Zn, Mn, Fe, Mo, B, Ni, Co, Cl, and B. Additionally, Si is also regarded as a helpful element which is used to maintain the structural integrity of the cells. Both macro- and micronutrients are crucial for the physiological and biochemical functions of plants, including the synthesis of chlorophyll, DNA and protein, photosynthesis, DNA and protein modifications, redox reactions in chloroplasts and mitochondria, sugar metabolism, and nitrogen fixation. Apart from these, they also play an important role in mitigating HM toxicity. This chapter is intending to summarize role of beneficial elements signaling and metabolic performance in plants under HM toxicity.

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