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DEVELOPMENT OF CYTOKININS OVEREXPRESSING PLANTS OFFER A GENERIC TECHNOLOGY FOR GETTING MORE CROP PER A DROP

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In nature, annual plants respond to abiotic stresses by activating a specific "avoidance" genetic program leading to an early flowering and accelerated senescence. This process leads to serious losses of crop yields and short shelf life of vegetables and fruits. We have shown that overcoming this genetic programing by cytokinins (CK) overproduction not only increase the life span of plants but unexpectedly enhanced also plant productivity under drought stress conditions. CK overproducing tobacco transgenic plants could grow on as little as 40% of the optimal water supply with no yield losses. To decipher the regulatory mechanism underlying the phenomenon of cytokinins-induced stress tolerance, the following analytical approaches and tools were employed: functional genomics of candidate stress-related genes such as antioxidants and kinases known to be involved in stress tolerance, analysis of short-term kinase activity in tobacco cell suspension under salinity stress, comparative phosphoproteomics and bioinformatics analysis. The results indicated that components of stress signalling and of tolerance pathways that are normally activated under abiotic stress surprisingly did not occur if exogenous cytokinins are added or CK levels are upregulated. Additionally, when cytokinins (BAP) were added to tobacco cell suspension under salt stress conditions, the expected enhancement of known kinase activity did not take place. Comparative phosphoproteomics analysis of tobacco cell suspension treated with BAP (as compared to control) indicated that more than 50% of the identified phosphoproteins were downregulated under drought stress conditions. We hypothesize that enhanced levels of cytokinins under abiotic stress conditions cause de-sensitization of environmental cues and consequently eliminate the activation of signalling pathways that are normally being activated under stress and inhibit growth. The suggested desensitization mechanism prevents growth arrest and allows normal metabolic activities such as photosynthesis under stress conditions. The unexpected phenomena of CK-induced stress tolerance is translated into a generic technology which is being successfully applied to various crops and offer a novel tool for coping with future food and water crises.

Biography

Shimon Gepstein has completed his PhD from Tel-Aviv University and Postdoctoral studies from University of California, Santa Cruz. He is the President of Kinneret College on the Sea of Galilee and Prof Emeritus of the Technion, Former Dean of Biology at The Technion. His research interests include hormonal regulations associated with plant senescence and plant adaptations to abiotic stress conditions. His major recent scientific achievements are the development drought resistant crops that can grow on as little as 50% of water without any yield losses. This technology may offer possible approach future severe predicted crises of the global food, water and energy shortages. He has published more than 65 papers in reputed journals and has been serving as a Chair of the National Committee of Agro biotech of the Ministry of Agriculture.

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