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Role of Nanoparticles in Agriculture

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SUMMARY

A decade back these nanoparticles were subject of study because of their unique physical and chemical properties but now they entered into period of commercial exploration. Nano Particles are the particles of smaller size between 1 to 100 nm. Nanoparticles are of interest due to the new properties (such as chemical reactivity and optical behavior) that they exhibit compared with larger particles of the equalant materials. Nanotechnology deals with the creation of useful materials, devices and systems using the particles of nanometer length scale and exploitation of novel properties (physical, chemical, biological) at that length scale.

INTRODUCTION

Nanoparticles- Methodology of action:

Nanoparticles function like "magic bullets", containing herbicides, nano-pesticide fertilizers, or genes, which target specific cellular organelles in plant to release their content. There are reports that embedded single walled carbon nanotubes (SWCNTs) in the isolated chloroplast augmented three times higher photosynthetic activity than that of controls, and enhanced maximum electron transport rates, and SWCNTs helps the plants to sense nitric oxide, a signaling molecule.

Silicon Dioxide Nanoparticles

Plant growth and development begins with the germination of seeds followed by root elongation and shoot emergence as the earliest signs of growth and development in plants. It is found that lower concentrations of nano-SiO2 improved seed germination of tomato. Nano-SiO2 increased seed germination by providing better nutrients availability to maize seeds, and pH and conductivity to the growing medium.

Practical applications of Nanotechnology

Here I summed up some of the practical applications of nanotechnology in various significant fields.

- The nanoparticles has potential practical application in fields of fluorescent biological labels, pathogen detection, drug and gene delivery, probing DNA and tissue engineering *etc.*
- Exogenous application of nano-SiO2 on *Larix olgensis* seedlings in research showed that nano-SiO2 improved seedling growth and quality.
- Mean height, root collar diameter, main root length, and therefore the number of lateral roots of seedlings and also induced the synthesis of chlorophyll.
- Exogenous application of nano-SiO2 and nano-titanium dioxide (nano-TiO2) improves seed germination of soybean by increasing nitrate reductase
- These Enhance the seeds ability to absorb and utilize water and nutrients.
- Under salinity stress, nano-SiO2 improves leaf fresh and dry weight, chlorophyll content and proline accumulation.
- An increase in the accumulation of proline, free amino acids, content of nutrients, antioxidant enzymes activity due to the nano-SiO2, helps in improving the tolerance of plants to abiotic stress.
- Nano-anatase TiO2 enhances the photosynthetic carbon assimilation by activating Rubisco (complex of Rubisco and Rubisco activase) that could promote Rubisco carboxylation, thereby increasing growth of plants.

CONCLUSION

The nanotechnology has potential application in field of pharmacology, medicine and agriculture as well. In the coming five to ten years this going to have significant role in certain sectors of sustainable agriculture

Effect of nSiO2 on seedlings growth of tomato shown in the Fig.

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