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Review of Nano Technology in Crop Improvement

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In memory of the father of Nano Technology Physicist Dr. Richard Feynman. Nanotechnology is engineering of Nano scale objects at molecular level, it is study and application of extremely small things that of about 100 nano meters or less than 100 nano meters. Nano means 1 Billionth, Nanometer = 1/80,000 diameter of human hair.

India ranks 3rd number for Research in Nano Technology only after China and USA. Indian agriculture practice is associated with traditional system, green revolution, alternative farming like "Conservation Agriculture" and "Organic farming" for obtaining smart and sustainable crop production. However, these practices could neither retain carbon for longer period nor check pollution N_2, Hence the soil media throughout the world, especially those brought under green revolution or contaminated with harmful trace metals and pesticides residues, Since it is not possible practically to eradicate entire soil mass through bioremediation. Hence, at this juncture applying of reengineering to plants for which nano technology could be a promising one.

Core values

Nano biosensors : These are compact analytical device incorporating biologically devised sensing elements, Nano Biosensors widely used as Herbicides, Insecticides, Pathogen detectors and pH maintenance of the soil environment.

Nano array based technology : For "gene" expressions in plants to overcome stress and sensors developed for its application in precision farming i.e. early detection of pathogens.

Nano particles : Nano fabricated materials containing plant nutrients could be used in aqueous suspension and hydrogel forms so as enables hazard free, convenient delivery system. Zero valant Nano Particles will be employed for remediation of contaminated soil. Iron and $CaCO_3$ which helps in formation of micro aggregates and macro aggregates. Important properties of Nano Particles are binding sites with receptors, dispersion and aggregation.

Bioremediation/Phytoremediation : It is a process wherein living organisms were employed for effectively decontaminate particular environment pollution like soil or water. Geneticaluse in Phytoremediation has modified plants for uptake of metals. Eg. Metal Chelator (MC) Metal Transporter (MT) Phytochelatin (PC) genes have been transferred to plants for uptake of metals.

Microcapsules and nano formulations : Few important Nano Formulations are being designed by Agro business and food corporation i.e. slow release, quick release, specific release, moisture release, heat release, pH release and ultra sound and magnetic release.

CEA (Controlled Environment Agriculture) : Smart bio sensors and smart delivery systems both comprises CEA. In future nano structured catalyst will be available for increasing efficiency bio-pesticides and herbicides.

Transgenics : Direct gene(DNA) transfer from plant to plant gene transfer by agrobacterium mediated transfer will enhance quality agriculture production.

Gene Transfer : DNA coated gold nano particles are employed as bullets in "Gene-gun" systems for bombardment of plants cells and tissues to achieve gene transfer.

Nano Herbicides : These are being developed to address the perennial weed management. Hence it is smart delivery of herbicides.

Nano Fertilizers : Application of micro-nutrients shows increase in fertility of the soil and reduces soil toxicity, minimizes negative effect against over dose application.

Results

Lipofection : Small lipid bags (Liposomes) containing plasmids which are used to transfer DNA in plant cells carrot and tobacco plants.

Micro injections : DNA solution directly injected into the plants cells by micro injections tobacco and maize crop 14% to 66% Micro Injection technology failed.

Nano chips : Nano chips are attached to seed surface either with help of polymer matrix or as pouring solutions maiz corn seeds of strain B73 were used in Agriculture University Tiran (Israel) which yield high output of foodgrain.

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UHV (Ultra High Vaccum) : Technology fits only research and agriculture industry in Israel. DNA nanocapsules of specific proteins used for DNA vaccines.

Conclusion

Nano technology has a potential to revolutionize agriculture system. It has potential role in monitoring crop growth, protecting crops, detection of crop pathogens, increases global production and enhances food security and reduces waste for sustainable intensifications and production of bio-fuels. As per toxicology studies nano technology do not have much more negative impact on Agro environments. Hence nano technology is eco-friendly and challenging to accept for the improved crop production. Nano technology in agriculture solves the purpose of doubling the farmers income by 2022. “My village My Proudh” “Mera Gaon Mera Gaurav”. Hence implementation of nano technology is proudh for all innovative farmers and progressive farmers.