ADVANTAGES OF NANOTECHNOLOGY IN AGRICULTURE

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INTRODUCTION

Nanotechnology is one of rapidly active technology having potential for sustainable growth in agriculture. Nano materials possess effective properties which makes it suitable in agriculture field. Nanotechnology is the study and understanding of atom or structure at 1-100nm of scale. At this scale every atom differs in their properties. Control of atom or matter at this nanoscale can give better understanding of physical, chemical, biological processes .And formation of better material or structure definitely gives a positive impact. Smaller size of nano material possesses large surface area and becomes more active. It can also alter atoms which makes it more reactive in various sectors. It exhibits multiple applications and gives various knowledge on sustainable agriculture, food security and environmental impact.

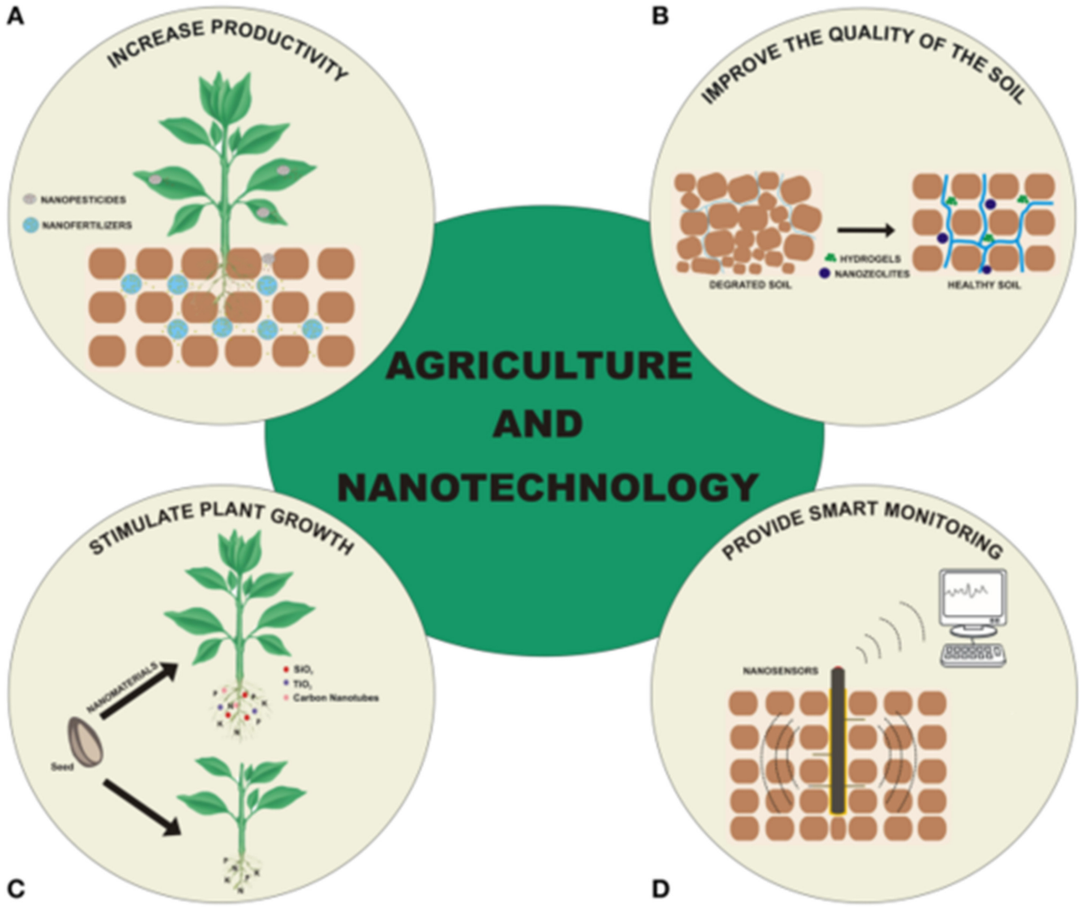
Over dependency on chemically based fertilizers, pesticides have generated serious problems in sustainability, health issues and environmental impact. After this agro-chemical came in existence, which is environment friendly, but it has also generated some issues like poor shelf-life, effective under changing environmental conditions. As a result, nanoparticle came to face these issues in existence and helps in enhancing crop, production, food security and sustainability. It likely affects the all spheres of agriculture field preparation, crop production to post cooking and food serving.

NANOTECHNOLOGY IN AGRICULTURE

Nanotechnology could be described as the application which involves ability to see and to control every single atom or matter of any structure and manipulate any structure at the atomic level. Because of this unique property nanotechnology will be able to solve many inherent problems in agriculture.

- Capable of improving the soil quality having efficient nutrients which enhance greater productivity.
- Facilitate the process to ensure availability of nutrients to plant in manner that plants demand.
- Influence the improvement of genetic traits of plants, delivery of genes, DNA molecule and drug molecule at a particular site in plants for the development of insect pest repellent properties.
- Tools like quantum dots based on nanotechnology are also used properly for monitoring of pathogens on daily basis.
- Nano encapsulation reduces leaching and evaporation of harmful substance which plays important role in protection of environment.

APPLICATIONS OF NANOTECHNOLOGY



A. INCREASE PRODUCTIVITY

Sustainable agriculture aims at increasing the yield without adverse environmental impact while cultivating the same agriculture area. Nanomaterials based on the use of inorganic, polymeric and lipid nanoparticles, synthesized by exploiting different techniques (E.g., emulsification, ionic gelation, polymerization, oxyreduction, etc.) have been developed to increase productivity. They have numerous applications, as an example, Nano systems have been developed for immobilization of nutrients and their release in soil. They have minimized leaching, while improving the uptake of nutrients and their release in soil.

B. IMPROVE THE QUALITY OF THE SOIL

Hydrogels, Nano-clays, and Nano-zeolites have been reported to enhance the water-holding capacity of soil, hence acting as a slow release source of water, reducing the hydric shortage periods during crop season. Applications of such systems are favorable for both agricultural purposes and reforestation of degraded areas. Organic e.g., such as polymer and carbon nanotubes and inorganic e.g., such as Nano metal sand metal oxides Nano-materials have also been used to absorb environmental contaminants, increasing soil remediation capacity and reducing times and costs of Treatments.

C. STIMULATE PLANT GROWTH

The real impact of nanomaterials on plants depends on their composition, concentration, size, surface charge, and physical chemical properties, besides the susceptibility of the plant species. Carbon nanotubes and nanoparticles of Au, SiO2, ZnO, and TiO2 have to ameliorate development of plants by enhancing elemental uptake and use of nutrients.

D. PROVIDE SMART MONITORING

Nano biosensors play a significant role in smart monitoring or we can say in detecting plant diseases. Apart from helping in precision farming to enhance productivity, Wide range of Nano biosensors help in sensing agriculture like in herbicides, pesticides, soil PH. Smart delivery system induced in this technology helps in efficient use of resources like nutrients, water as plant required. Rapid detection of viruses, bacteria with correct quantification can takes place by the help of Nano biosensors. Nano biosensors represent improved features as compared to other existing analytical sensors. Biological information converted into signal by transducer this gives accurate control of need of water nutrients and early symptoms of disease. Finally, the use of Nano biosensors at a broad spectrum for crop monitoring is very useful and leads to accurate and within time decisions, decreased costs and waste, improved crop quality and production and give deeper understanding of plant biosynthesis pathways. Quantum Dots also help in detecting pathogens responsible for distinct plant diseases. Due to its Unique spectral properties (Efficient luminescence, small emission spectrum, better photo stability, as compared to other organic dyes), it is used for bio imaging and bio sensing. The most devasting disease Rhizomania in sugar beet caused by beet nectrotic yellow vein virus.

The only vector for the transmission of this virus ispolymyxabetae (keskin) was successfully detected by quantum dots FRET based sensor. Optical transducer of semiconductor cadmium telluride QDS with enzyme acetyl cholineste is integrated layer by layer congregation to determine organophosphorus pesticides present in fruits and vegetables. Detection of low concentration of QDs indicates no cytoxicity for seed germination and seedling growth. In plants Qds can also be used for live imaging in plant roots to know about physiological processes.

CONCLUSION

In conclusion, considering the great challenges we will be facing, in particular due to a growing global population and climate change, the application of nanotechnologies as well as the introduction of nanomaterials in agriculture, have greatly contributed to address the issue of sustainability. In fact, the efficient use of fertilizers and pesticides can be enhanced by the use of Nanoscale carriers and compounds, reducing the amount to be applied without impairing productivity.