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Nanotechnology in Sustainable Agriculture

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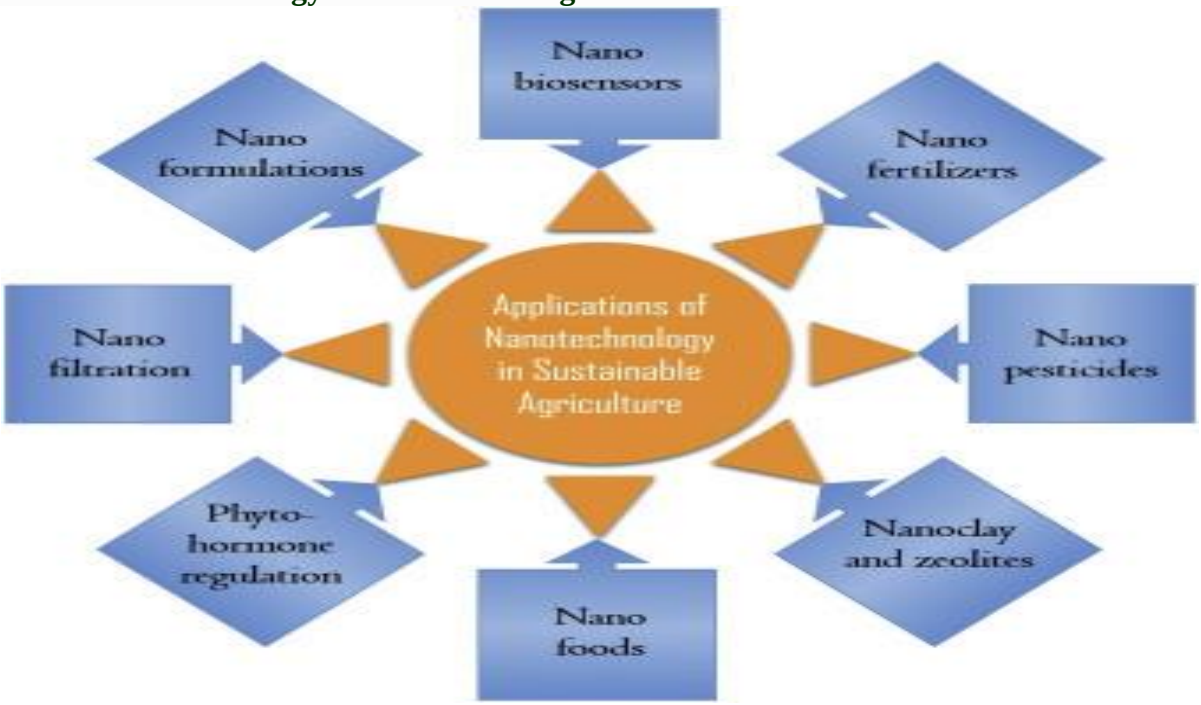
SUMMARY

Nanotechnology has the potential to positively impact the agrifood sector, minimizing adverse problems of agricultural practices on environment and human health, improving food security and productivity. Development of systemic fungicides which have significant advantages in disease management in modern agriculture but these chemicals have become lethal to beneficial microbes and insects of the rhizospheres and entering into the food chains as undesirable chemical residues. Nano-formulations are safer than synthetic fungicides against the plant diseases.

INTRODUCTION

Nanotechnology is playing an important role in the global food security (Gajjar *et al.* 2009). The products of nanotechnology in agriculture include fertilizers to increase plant growth, pesticides for pest and disease management, and sensors for monitoring soil quality and plant health. Nanotechnology helped in the development of novel antimicrobials against pathogenic microbes. Significant development in the synthesis of nanomaterials such as polymeric, carbon-based and metallic has attracted researchers' attention towards its applications in managing plant diseases. Toxicological considerations including negative environmental effects, further lend redesigning of nanomaterials by tuning its size, shape, surface etc to increase antimicrobial activity and decrease ecological toxicity.

Applications of Nanotechnology in Sustainable Agriculture



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A wide variety of agrochemicals are being developed against potato foliar diseases. Development of systemic fungicides lent significant advantages in disease management in modern agriculture. The uptake and translocation of systemic fungicides in the plant protect new growth of the plant for a certain period. The performance of such fungicides is further less influential by application method which makes its use more practical. Further translocation of fungicides has the potential to affect the parasites which already established in the plant. Fungicides which used for curative treatments reduce the spore production (anti-sporulant activity), thus reduce disease inoculums.

In this way, curative treatment impedes the epidemic phase of the disease and reduces sizeable quantity of yield loss. Systemic fungicides often exterminate the seed-borne microbes, or pathogens exist in tubers, stolons, bulbs, or other planting materials. The eradicative outcome of fungicides helps in the production and use of high quality seed/planting materials (Mancini and Romanazzi, 2013). Thus it is beyond doubt that fungicides has certainly reduced the outbreak of the diseases but at the same time it contributed in the development of resistant genes among the microbes (Lamsal *et al*. 2011); some of these chemicals have became lethal to beneficial microbes and insects of the rhizospheres and entering into the food chains as undesirable chemical residues.

In the recent years, nanotechnology is playing an important role in the global food security (Gajjar *et al.* 2009). Nanotechnology has the potential to positively impact the agrifood sector, minimizing adverse problems of agricultural practices on environment and human health, improving food security and productivity (as required by the predicted rise in global population), while promoting social and economic equity. The products of nanotechnology in agriculture include fertilizers to increase plant growth, pesticides for pest and disease management, and sensors for monitoring soil quality and plant health.

Nanotechnology helped in the development of novel antimicrobials against pathogenic microbes. Significant development in the synthesis of nanomaterials such as polymeric, carbon-based and metallic has attracted researchers' attention towards its applications in managing plant diseases. Toxicological considerations including negative environmental effects, further lend redesigning of nanomaterials by tuning its size, shape, surface etc to increase antimicrobial activity and decrease ecological toxicity.

CONCLUSION

Nano-formulations are safer than synthetic fungicides against the plant diseases. In view of the detrimental effect of synthetic-chemicals on the life-supporting systems, there is a pressing need to develop alternative strategies against the pathogenic microbes. And also, there is a need for the reduction/elimination of synthetic pesticide use in agriculture. In this direction, use of novel tools based on nano-formulations deserves considerable attention and regard.

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