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Applications of nanotechnology for plant disease management.

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Abstract

Plant diseases have been a major challenge in agriculture, leading to significant economic losses globally. Nanotechnology has emerged as a promising solution to combat plant diseases, thanks to its unique physicochemical properties. This article aims to review the recent applications of nanotechnology for plant disease management. The article highlights the different nanomaterials used for plant disease management, their mode of action, and their effectiveness. The article concludes that nanotechnology has the potential to revolutionize plant disease management and enhance food security.

Introduction

Plant diseases are a significant threat to food security, leading to significant economic losses globally. Traditional plant disease management strategies such as chemical treatments and genetic modification have limitations such as environmental pollution, health hazards, and public concerns. Nanotechnology has emerged as a promising solution to combat plant diseases due to its unique physicochemical properties such as high surface area-to-volume ratio, chemical stability, and reactivity. Nanoparticles have shown potential for use in plant disease management by targeting the pathogens, boosting plant defence mechanisms, and delivering bioactive compounds. This article reviews the recent applications of nanotechnology for plant disease management.

Nanotechnology for Plant Disease Management:

Nanotechnology has shown potential in plant disease management through various applications such as nanofertilizers, nanopesticides, and nanosensors. Nanofertilizers are designed to deliver nutrients more efficiently to plants, enhancing their resistance to diseases. Nanopesticides are engineered to target plant pathogens selectively, thereby reducing the use of harmful chemical pesticides. Nanosensors have

also been developed to detect plant diseases early, allowing for timely interventions. The mode of action of nanoparticles in plant disease management includes disruption of pathogen cell membranes, induction of plant defense mechanisms, and delivery of bioactive compounds.

Several studies have reported the effectiveness of nanotechnology in plant disease management. For instance, silver nanoparticles have been shown to inhibit the growth of various plant pathogens such as Fusarium oxysporum and Phytophthora infestans. Zinc oxide nanoparticles have also been shown to enhance the resistance of plants to bacterial pathogens such as Xanthomonas campestris. Furthermore, chitosan nanoparticles have been shown to deliver bioactive compounds such as chitinase, enhancing the resistance of plants to fungal pathogens such as Botrytis cinerea.

Conclusion:

Nanotechnology has emerged as a promising solution to combat plant diseases due to its unique physicochemical properties. Various nanomaterials such as nanofertilizers, nanopesticides, and nanosensors have shown potential for use in plant disease management. The mode of action of nanoparticles in plant disease management includes disruption of pathogen cell membranes, induction of plant defense mechanisms, and delivery of bioactive compounds. Nanotechnology has the potential to revolutionize plant disease management and enhance food security. However, more research is needed to address the potential environmental and health risks associated with the use of nanoparticles in agriculture.

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