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Probiotics as Biostimulants and Biofortifiers in Seed Germination: An Investigatory Study

Carolina Nery*

Department of Horticulture, Universidad Autónoma Agraria Antonio Narro, Saltillo 25315, Mexico

Introduction

The global agricultural industry faces a myriad of challenges, from fluctuating climate conditions to the growing demand for food production and the depletion of soil nutrients. In response to these challenges, agricultural researchers are increasingly turning to alternative methods to enhance crop yield, improve seedling health, and increase the nutritional value of crops. One promising area of research is the use of probiotics as biostimulants and biofortifiers in seed germination. Probiotics, typically associated with promoting gut health in humans and animals, have been found to have several beneficial effects on plant growth and development. When applied to seeds, these beneficial microorganisms can enhance germination rates, stimulate root development, improve resistance to stress, and even increase the nutritional content of crops. This article explores the role of probiotics as biostimulants and biofortifiers in seed germination, discussing their mechanisms of action, benefits, and potential applications in sustainable agriculture [1-3].

Description

In the context of agriculture, probiotics refer to beneficial microorganisms, including bacteria, fungi, and yeasts, that are used to promote plant growth and improve soil health. The most commonly used probiotics in agriculture are plant growth-promoting rhizobacteria, mycorrhizal fungi, and lactic acid bacteria (LAB). These microbes can be applied to seeds, soil, or plant surfaces and interact with plants in several ways to enhance their growth and resilience. When probiotics are applied to seeds, they colonize the seed coat and form a beneficial relationship with the plant during the early stages of germination. This relationship can lead to several positive outcomes, including improved seed vigor, enhanced stress tolerance, and increased nutrient availability. Additionally, some probiotics may help to biofortify crops, which involves increasing the nutritional content of the plant, particularly with regard to essential micronutrients like iron, zinc, and vitamins. Biostimulants are natural or synthetic substances that, when applied to plants or seeds, stimulate natural growth processes without being a direct source of nutrients. Probiotics serve as biostimulants by improving seed germination, enhancing root growth, and promoting overall plant health. Their effectiveness in these areas is attributed to a variety of mechanisms. Moreover, the regulatory approval for probiotic-based products can be complex, as agricultural probiotics are still a relatively new area of research. Further studies are needed to confirm the long-term benefits and safety of using probiotics in large-scale agriculture [4,5].

Conclusion

The use of probiotics as biostimulants and biofortifiers in seed germination represents a promising frontier in sustainable agriculture. These beneficial microorganisms can enhance seedling health, increase germination rates, improve nutrient uptake, and even biofortify crops with essential micronutrients. As research continues to uncover the mechanisms by which probiotics influence plant growth and development, their application in agricultural practices could help improve food security, reduce reliance on chemical fertilizers, and promote environmentally friendly farming practices. The future of agriculture may very well depend on harnessing the power of probiotics to create healthier, more resilient crops that are not only more productive but also more nutritious. While the potential benefits of probiotics in agriculture are vast, there are challenges to their widespread adoption. For one, the efficacy of probiotics can vary depending on the environmental conditions, the specific crop, and the strain of probiotic used. The stability of probiotics in different formulations also needs to be optimized to ensure their effectiveness in field conditions.

Acknowledgement

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Conflict of Interest

None.

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***Address for Correspondence:** Carolina Nery, Department of Horticulture, Universidad Autónoma Agraria Antonio Narro, Saltillo 25315, Mexico; E-mail: neryc@gmail.com*

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