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REVIEW ARTICLE **OPEN ACCESS**

A Review on Endophytes as a Biofertilizer

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ABSTRACT
The microbial population lives on the outside of plants as well as inside the plant tissues as endophytes. Endophytes are an endosymbiotic group of microbes that can be easily isolated from any microbial or plant growth medium and colonised in plants. Agricultural fields can use this special biofertilizer to promote plant development. These microbial communities increase plant development and agricultural production because they are linked to a number of characteristics that promote plant growth. These microbial communities increase plant growth and agricultural yields because they are linked to a number of characteristics that promote plant growth. Plant tissues are isolated from various plant sections during the isolation processes in order to isolate the endophytic bacterial and fungus communities. The recovery and isolation of endophytic bacteria requires the removal of stem tissues, leaf tissues, and mostly roots. The functionality and quantity of endophytic bacteria are Endophytes are typically found in plant tissues and include methylotrophic bacterial and fungal communities, low GC-containing bacteria, high GC-containing bacterial communities. The current compilation will place special emphasis on the richness of the aforementioned microbial communities and their function as biofertilizers in agricultural fields. The history of various microbial endophytes will give us a better understanding of how they affect agriculture and how to promote and sustain it.
Keywords: -*Endophytes, Chemical fertilizers, Bio fertilizer, agricultural field, plant growth promoting traits*

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INTRODUCTION

Agricultural sector is increasing in sustainable development for the protection of natural resources as greater productivity increases efficacy and competitiveness for management technology. Much agricultural advancement regarding the green revolution applied in forced the potentialthe use of chemically derived pesticides and herbicides for increasing yield in high throughput [1]. Endophytic bacteria are helpful microorganisms for plants that live inside plants and can enhance plant growth in both easy and difficult situations. They can directly benefit host plants by enhancing nutrient intake, controlling growth, and phytohormones associated with stress Endophytic microorganisms indirectly enhance plant health by using antibiotics, hydrolytic enzymes, and nutritional treatments to target pests and pathogens as well as through preparing plant defenses [2]. Heinrich Friedrich Link (1809) was the German botanist who described Endophytes for the first time. He coined the term "Endophyte" at the time to describe a distinct group of parasitic fungi that live in plants. The word "endophyte" was originally used by De Bary in 1866, and Vogl was the first to discover that the grass seed Lolium temulentum contains mycelium. Freeman discovered an endophytic fungus in Persian darnel in Germany in 1904. (annual grass). Although endophytic bacteria and rhizospheric bacteria are different in that they live inside plant tissues, both types of bacteria use similar strategies to encourage plant growth. Both no leguminous and leguminous plants have produced endophytic bacteria that have been isolated. Phytorem ediation, biofertilization, and biocontrol are three connected strategies used by plant growth promoting bacterial endophytes. Phyto stabilization includes the production of indole acetic acid as well as the consumption of 1-aminocyclopropane-1-carboxylate. In addition to nitrogen fixation, phosphate and potassium solubilization, and siderophore production, biofertilization included in biocontrol [3]. extremely powerful. It degrades soil, pollutes ground water, and causes salt burns. The best way to avoid using chemical fertilizers is to switch to biofertilizers [7]. Microbes indirectly improve plant health by building plant defenses and by utilising antibiotics, hydrolytic enzymes, and nutritional therapies to target diseases and pests [1].

DISCUSSION

The biological preparation of efficient organisms known as "biofertilizers" is used to encourage plant growth and development. By stabilizing atmospheric nitrogen and releasing soil phosphorous, this biofertilizer increases soil fertility [4]. There are various problems with chemical fertilizers. Similar to how it will affect Flora both immediately and long-term. The soil's composition, pH, salinity, and organic carbon content are all impacted by the usage of chemical fertilizers[5]. This endophytic bacterium is very helpful for plant growth. On soil and human-made creatures, chemical fertilizers have an extremely negative impact. The alternative to chemical fertilizers is hence these biofertilizers.India has achieved full independence, but it still faces significant obstacles in terms of agricultural growth. Since India is largely an agricultural nation, it is imperative to fully utilize alternative farming techniques in order to provide improvements and nutritional advantages. is significant as a nutrition. An improvement that is significant for both sustainable agriculture and human health.

Endophytic bacteria are extremely advantageous for the growth of crops. The roots of plants are home to this creature. By utilizing three pathways—indole pyruvate, acetaldehyde, tryptamine, and auxin indole acetic acid (IAA)—this endophytic bacterium may also generate plant growth hormones like IAA from tryptophan.together with indole-3 acetamide and indole-3 acetonital. An essential role for this indole acetic acid is in the induction of 1-aminocyclopropane 1-carboxylate (ACC). According to the research, the endophytic microbe *pseudomonas putida* possesses all three of the aforementioned pathways [6].Nitrogen has a crucial role. which is often absorbed by plants as alto no nitrates and ammonium ions in the growth of coops [3].Plant roots include endophytic bacteria, which are linked through symbiotic relationships. They may rehabilitate the soil and fix atmospheric nitrogen, which encourages plant development. Endophytic bacteria can produce folium Phosphorus should be dissolved so that the plant can grow its height and roots. Seriously, one of the most important nutrients is potassium. Bacteria are thus made soluble in potassium. promote crop output and lessen the environmental pollution. It is evident from the aforementioned observations that biofertilizers are significantly more effective than chemical fertilizers and have highly promising long-term prospects.

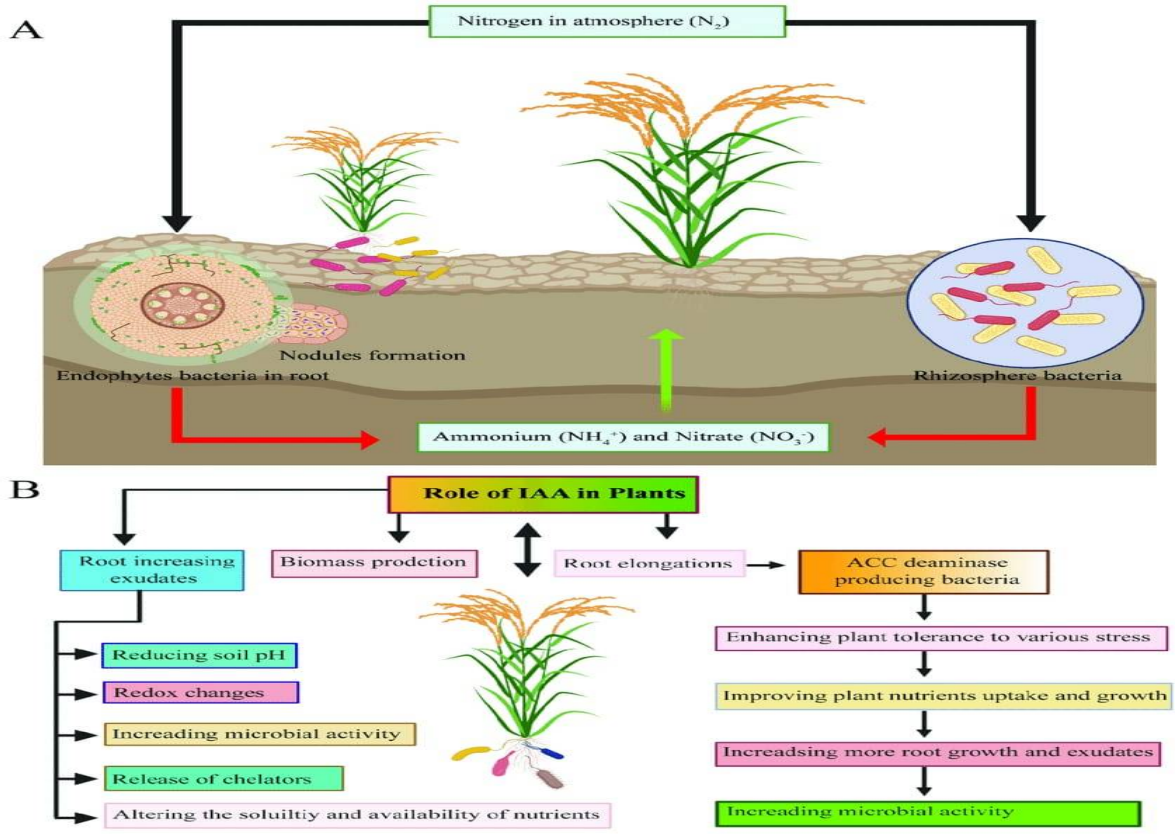

Fig 1:- How endophytic bacteria works?[8]

APPLICATIONS OF ENDOPHYTES: -

- It is capable of increasing agricultural productivity.

- These endophytic bacteria can be utilized as a powerful substitute for chemical fertilizers known as "biofertilizers."
- These endophytic microorganisms are commonas biofertilizers, these are inexpensive.
- It boosts agricultural output.
- It is a viable and sustainable biotechnological option for increasing crop yield.

CONCLUSION

This endophyte can be used in food yielding crops as well as other cash crops. The following biofertilizers are available in liquid form, and the shelf life of the solid to liquid and another alternative form by indicating in the consortium products and are not hazardous and eco-friendly. It can be used in a variety of ways. It has a scientific sustainable approach to the environment, which results in consequences that prevent soil deterioration. This review aims to highlight the efforts of the to instill endophyte beneficial augmentation that represents and evolves to achieve sustainable dues to nature and environment and For mankind.

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