Harnessing Beneficial Microbes for Suppression of Harmful Soil Microbes in Agricultural Systems

Introduction

A key component of sustainable agriculture, soil health affects disease resistance, nutrient cycling, and crop output. Increased dependency for chemical inputs and soil degradation might result from an imbalance between beneficial and detrimental bacteria. Suppressing harmful soil bacteria with good microbes presents a viable, environmentally responsible way to improve soil health and agricultural sustainability.

Background

A complex community of microorganisms, including nematodes, fungus, and bacteria, live in soil and interact in a variety of ways. *Pseudomonas putida* and *Bacillus popilliae* species are examples of beneficial bacteria that can outcompete or oppose dangerous diseases through a variety of ways, such as: Antibiotics, siderophores, and hydrolytic enzymes that stop the growth of pathogens are examples of antagonistic activity.The activation of plant defense pathways that increases resistance to a wide range of diseases is known as Induced Systemic Resistance (ISR).Restricting the growth of pathogens by sequestering vital resources such as iron.

Impact of the Project in Agriculture

- Lower the incidence of disease and the pathogen load.
- Increase the availability and absorption of nutrients.
- Encourage stable plant development and yield.
- Reduce reliance on chemical inputs in accordance with environmentally friendly agricultural methods.

Objectives

- To separate and describe naturally occurring beneficial microorganisms from the soil.
- To assess how well they work against prevalent soilborne diseases.
- To evaluate how they affect soil health metrics, plant development, and yield.
- In order to create microbial inoculants that can be used in agricultural systems.

Methodology

Isolation and Screening- To isolate bacteria and identify the antagonistic activity of the isolated bacteria.

Characterization- Perform sequencing and identify the production of siderophores, antibiotics and hydrolytic enzymes.

In Vitro Evaluation-Assess the ability of selected microbes to suppress pathogens under controlled conditions.

Field Trials-Use treated and control plots in randomized block design experiments.

Anticipated Result

- Identification of beneficial microorganisms that are effective and have the potential to be biocontrolled.
- Creating microbial inoculants that are suited to the agricultural environment in the area.
- Demonstration of improved crop performance and a lower pathogen load.
- Reduction of chemical use in support of sustainable agricultural methods.