ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25dec969

# Plant Growth-Promoting Bacteria from Limed Soils Enhance Seed Germination and Seedling Development

Yuvasree S.[1]

Publication Date: 2025/12/24

**Abstract: Soil acidification is a critical constraint to sustainable crop production, particularly in regions with intensive cultivation practices. Liming is a widely adopted strategy to ameliorate soil acidity, improve nutrient availability, and enhance microbial diversity. The present study aimed to isolate and characterize bacterial strains from cultivated soils collected before and after liming, and to evaluate their effects on seed germination and seedling growth of selected crop plants. Several bacterial isolates were obtained and screened for their plant growth-promoting traits, including phosphate solubilization, indole-3-acetic acid (IAA) production, and antagonistic activity against soil-borne pathogens. Seeds treated with these isolates demonstrated significantly higher germination rates, enhanced root and shoot elongation, and improved vigor index compared to untreated controls. The findings suggest that liming not only alters the physicochemical properties of soil but also fosters beneficial microbial communities that can act as bioinoculants to support sustainable agriculture. This study highlights the potential of lime-influenced soil bacteria as eco-friendly alternatives to chemical inputs for promoting crop establishment and productivity.**

***Keywords:*** *Soil Microorganisms, Characterization, Germination, Seedling Growth, Crop Plants, Liming, PGPR.*

**How to Cite:** Yuvasree S. (2025) Plant Growth-Promoting Bacteria from Limed Soils Enhance Seed Germination and Seedling Development. *International Journal of Innovative Science and Research Technology*, 10(12), 1472-1473. https://doi.org/10.38124/ijisrt/25dec969

## I. INTRODUCTION

Soil quality plays a pivotal role in sustaining agricultural productivity, yet soil acidification remains one of the major challenges in many cultivated regions of the world, including the Barind tract of Bangladesh. Acidic soils negatively affect nutrient availability, microbial activity, and overall crop growth, leading to reduced yields. Liming is a widely practiced soil management technique that neutralizes soil acidity, enhances nutrient uptake, and modifies the soil microbial community structure.

Microorganisms are known to play an essential role in seed germination and seedling establishment through multiple mechanisms, such as the production of phytohormones, solubilization of phosphate, nitrogen fixation, and suppression of soil-borne pathogens.

## II. METHODOLOGY

Soil samples were collected from cultivated fields in the Barind region. Two sets of samples were taken from the same plots: (a) before liming and (b) 30 days after liming. At each timepoint, five random sub-samples (0–15 cm depth) were collected per plot using a sterilized soil auger and pooled to form one composite sample per plot. Bacterial isolates were cultured, characterized for PGPR traits, and tested on crop seeds for germination and seedling growth assays.

## III. RESULTS

Bacteria isolated from limed cultivated soil were successfully cultured and characterized. Germination assays revealed that seeds treated with bacterial inoculants showed significantly higher germination percentages compared to untreated controls. Early seedling growth parameters, including shoot length, root length, and fresh biomass, were also enhanced. Among the isolates, Bacillus sp. and Pseudomonas sp. demonstrated the most pronounced effects.

Table 1 Germination Rate Comparison

| Treatment | Germination % | Root Length (cm) | Shoot Length (cm) |
|---|---|---|---|
| Control | 72 | 4.2 | 6.1 |
| Bacillus sp. | 90 | 5.5 | 7.8 |
| Pseudomonas sp. | 92 | 5.7 | 8.0 |

[Placeholder: Germination Rate Comparison Chart]

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## IV. DISCUSSION

The results demonstrate that liming not only improves soil pH but also promotes the proliferation of beneficial bacteria capable of supporting crop growth. These bacterial isolates likely contribute to improved germination and seedling vigor through mechanisms such as phytohormone production, phosphate solubilization, nitrogen fixation, and suppression of soil-borne pathogens. Bacillus and Pseudomonas species are well-documented PGPR, and their dominance after liming suggests that soil pH management plays a critical role in shaping microbial communities favorable for crop productivity.

## V. CONCLUSION

Bacteria isolated from cultivated soil after liming significantly enhanced seed germination and early seedling growth of crop plants. The positive effects can be attributed to their plant growth-promoting traits including nutrient solubilization and phytohormone production. Integrating liming practices with bioinoculant applications could provide a sustainable strategy to improve crop establishment, soil fertility, and overall agricultural productivity.

## REFERENCES

[1]. Adams, F. (1981). Nutritional imbalances and constraints to plant growth on acid soils. J. Plant Nutr., 4(2), 81-87.
[2]. Ali, M.Y. (2000). Influence of phosphorus fertilizer and soil moisture regimes on root system development, growth dynamics, and yield of chickpea. Ph.D. Thesis, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur, Bangladesh.
[3]. Arshad, M., & Frankenberger, W.T. Jr. (1991). Effects of soil properties and trace elements on ethylene production in soils. Soil Sci., 151(5), 377-386.
[4]. Nahar, M.K., Shirmin, S., Saleh, M.A., Uddin, M.S., & Zaman, S. (2022). Bacteria isolated from cultivated soil after liming promote seed germination and seedling growth of crop plants. Rhizosphere, 22, 100531.