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Pink Pigmented Facultative Methylotrophs for Better Crop Growth

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SUMMARY

Pink Pigmented Facultative Methylotrophs (PPFMs) are beneficial epiphytic microorganisms. PPFMs improve plant growth and development by producing plant growth hormones, providing tolerance to biotic and abiotic tolerances, improve seed germination and participate in carbon nutrient cycling.

INTRODUCTION

By looking at any leaf, one may not see anything unusual. But, hidden on every plant, there lives a tiny world filled with microbes. Among them is a special group of bacteria known as Pink Pigmented Facultative Methylotrophs, commonly called PPFMs. These tiny microorganisms are gaining attention in Indian agriculture for their remarkable benefits to crops and natural environments.

PPFMs

PPFMs belong to the bacterial genus *Methylobacterium*. They appear rose-pink in colour when grown on laboratory medium because of natural pigments they produce. But what truly makes them unique is their diet, they can use methanol, a simple single-carbon compound that plants release naturally from their leaves during growth. Besides they can also utilize other organic compounds making them facultative methylotrophs.

Because they feed on methanol and live on plant surfaces, PPFMs form a natural relationship with plants. They are found on almost all crops, grasses, trees, weeds, and even household plants.

Bacteria with Big Benefits

Even though they are microscopic, PPFMs play several big roles that support plant health and farm productivity.

1. Natural Growth Promoters

PPFMs produce plant growth hormones such as:

- Auxins
- Cytokinins
- Gibberellins

These hormones help seeds germinate faster, strengthen roots, and improve overall plant growth and development. Many scientific studies have shown that crops treated with PPFMs perform better than untreated plants.

2. Helping Plants to Tolerate Stress

Whether the plant faces drought, high temperature, or salty soils, PPFMs help it survive by activating natural defense mechanisms. This makes them especially useful in areas affected by climate change.

3. Supporting Seed Germination

Seed treatment with PPFMs has been found to improve germination rates, seedling strength, and early growth. This is particularly important for vegetable nurseries and horticultural crops.

4. Eco-Friendly and Safe

PPFMs do not cause disease. Instead, they help plants grow naturally. Because they use methanol and other carbon compounds, they support environmental carbon cycling, making them a green and sustainable option for agriculture.

PPFMs Habitat

The wonderful thing about these bacteria is that they are everywhere:

- On the surface of leaves
- In soil
- In water
- On seeds

- Even inside certain plant tissues

Healthy, growing plants release more methanol, so they attract more PPFMs naturally.

Use of PPFMs in Agriculture

In recent years, scientists and universities have begun exploring PPFMs as **biofertilizers**, **foliar sprays**, and **seed treatment agents**. Some agricultural universities in India, have developed PPFM-based formulations for farmers. These formulations help increase yield in crops like rice, sugarcane, cotton, vegetables, and fruits.
Because they are easy to culture and highly compatible with plants, PPFMs show great promise for:

- Improving crop yield
- Reducing chemical fertilizer use
- Enhancing stress tolerance
- Promoting sustainable farming

Case study: In a field experiment on green gram *Vigna radiata* during the 2023-24 season, seed treatment plus a foliar spray of 2% PPFM at flowering and pod-formation produced a grain yield of **1,358 kg/ha** and haulm yield of **2,420 kg/ha**, along with highest net returns compared to control (Parameshwari *et al.*, 2025).

In a different trial with irrigated black gram (*Vigna mungo),* foliar spray of PPFM (2%) plus recommended NPK dose significantly improved plant height, number of branches, leaf area index, pods per plant, 100-seed weight and overall grain and straw yield compared to control (Ajay *et al.*, 2022).

Future Prospects

As Indian agriculture moves toward eco-friendly and climate-smart practices, beneficial microbes like PPFMs will play a larger role. Research is ongoing to develop reliable, farmer-friendly formulations and to combine PPFMs with other helpful microbes into multi-strain biofertilizers may be to develop synthetic microbial communities.

With more awareness and field trials, PPFMs may soon become as widely used as *Rhizobium*, *Azotobacter*, or Phosphate Solubilizing Bacteria.

CONCLUSION

Pink Pigmented Facultative Methylotrophs may be tiny, but their contribution to plants is irreplaceable. By helping crops grow better, resist stress, and use nutrients more efficiently, these pink bacteria represent a promising tool for sustainable agriculture. As farmers and scientists continue to explore their potential, PPFMs are paving the way for a greener future one leaf at a time.

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