SUNSHINE AGRICULTURE
e-Newsletter

ISSN (E): 2583 – 0821

Sun. Agri.:e- Newsletter, (2025) 5(3), 38-39

Article ID: 402

Boosting Sustainable Horticulture: The Role of Biofertilizers in Fruit and Vegetable Production

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Available online at
http://sunshineagriculture.vitalbiotech.org/

Article History
Received: 16.03.2025
Revised: 21.03.2025
Accepted: 25.03.2025

INTRODUCTION

In the wake of climate change, soil degradation and increasing pressure on farmers to produce more with fewer resources, sustainable agricultural practices have become the need of the hour. Horticulture, especially the cultivation of fruits and vegetables, is no exception. Among the various eco-friendly strategies being promoted to improve productivity and maintain soil health, biofertilizers have emerged as a promising tool. These microbial-based products not only enhance nutrient availability in soil but also support plant growth, disease resistance and long-term soil fertility (Gupta & Sain, 2016).

This article explores the role of biofertilizers in horticulture, their types, benefits, applications and their contribution to sustainable farming.

What are Biofertilizers?

Biofertilizers are natural inputs containing living microorganisms, which colonize the rhizosphere or the interior of the plant and promote growth by increasing the availability or uptake of primary nutrients (Bhattacharyya & Jha, 2012). Unlike chemical fertilizers that provide direct nutrients, biofertilizers facilitate biological processes like nitrogen fixation, phosphorus solubilization and the production of growth-promoting substances. Biofertilizers are cost-effective, especially for small-scale cultivators, owing to reduced production and application expenses (Kumar et al., 2018). They are suitable for sustainable production since they decrease the need for chemical-based fertilizers (Sharma et al., 2015)

Importance of Biofertilizers in Horticulture

Fruits and vegetables are high-value crops that require optimum nutrition for healthy growth, flowering, fruiting and quality yield. Excessive reliance on chemical fertilizers often leads to soil exhaustion, pollution and health hazards. Biofertilizers offer a safer and more sustainable alternative.

Here's how biofertilizers are crucial in horticulture:

1. Improved Nutrient Availability
2. Enhanced Plant Growth
3. Better Soil Health
4. Disease Suppression
5. Environmental and Economic Benefits

Types of Biofertilizers Used in Horticulture

Different crops and conditions require different types of biofertilizers. Some of the commonly used ones include:
- Nitrogen Fixers (Rhizobium, Azotobacter, Azospirillum)
- Phosphate Solubilizers (Bacillus, Pseudomonas, Aspergillus)
- Potassium Solubilizers (Bacillus mucilaginosus, Pseudomonas spp)
- Mycorrhizae (AM Fungi)
- PGPR (Plant Growth-Promoting Rhizobacteria)

Applications in Fruit and Vegetable Crops

Fruit Crops:
- Banana: Use of Azospirillum and PSB enhances bunch weight and finger size.
- Citrus: Mycorrhizal application improves nutrient uptake and tree vigor.
- Pomegranate and Guava: Azotobacter and PSB increase fruit size and yield.
Vegetable Crops:
- Tomato and Brinjal: Azotobacter and PSB enhance plant growth and early flowering.
- Chilli: PGPR and PSB improve fruit set and reduce fruit rot.
- Pea and Beans: Rhizobium inoculation increases nodulation and yield.

Methods of Application

Biofertilizers can be applied in various ways, depending on the crop and stage of growth:
1. Seed Treatment
Seeds are coated with a slurry of biofertilizer and a sticking agent like jaggery solution. After drying in shade for 20–30 minutes, seeds are sown directly. This method ensures early root colonization and is cost-effective.
2. Seedling Dip
Seedlings are dipped in a biofertilizer solution before transplanting. This promotes quick root establishment and protects young plants from soil-borne diseases. Commonly used in vegetables like tomato and cabbage.
3. Soil Application
Biofertilizers are mixed with compost or FYM and applied near the root zone. This enriches the soil microflora and enhances nutrient availability, especially in fruit orchards and field crops.
4. Foliar Spray
Liquid biofertilizers are diluted and sprayed on plant leaves. It helps in fast absorption of growth-promoting substances and supports better flowering and fruiting in vegetable crops.

Challenges in Adoption

Despite the benefits, the widespread adoption of biofertilizers faces several challenges:
- Lack of awareness among farmers about the benefits and correct usage.
- Limited shelf life and storage issues due to microbial nature.
- Variable performance due to soil conditions, climate and microbial competition.
- Inadequate quality control in the production of biofertilizer products.

CONCLUSION

Biofertilizers are not just alternatives but essential components of a sustainable horticultural system. They offer an eco-friendly, cost-effective and long-term solution to enhance the productivity and quality of fruit and vegetable crops while maintaining soil and environmental health. As the demand for safe and chemical-free produce increases, the role of biofertilizers will become even more significant in the future of Indian horticulture.
A combined effort from researchers, extension workers, policymakers and farmers is required to integrate biofertilizers into mainstream horticultural practices. By doing so, we can ensure a greener, healthier and more resilient food system for the generations to come.

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