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Effect of Biofertilizers on Fruit Quality and Shelf Life in Mango, Banana, and Citrus

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Biofertilizers — living microbial inoculants that enhance nutrient availability and promote plant growth — are increasingly used in horticultural crops to improve yield, fruit quality, and postharvest shelf life, while reducing dependency on chemical fertilizers. This article reviews the effects of biofertilizers such as *Azotobacter*, *Azospirillum*, *phosphate-solubilizing bacteria (PSB)*, *arbuscular mycorrhizal fungi (AMF/VAM)*, *Trichoderma spp.*, and *plant growth promoting rhizobacteria (PGPR)* on the physicochemical and nutritional properties of fruits in mango (*Mangifera indica*), banana (*Musa spp.*), and citrus (*Citrus spp.*). It also summarizes mechanisms, research findings, practical applications, and recommendations for farmers to enhance organic production and postharvest handling.

Keywords: Biofertilizers, PGPR, Mango, Banana, Citrus, Fruit Quality, Shelf Life, Postharvest, Trichoderma, AMF, PSB

Introduction

Fruit quality and shelf life are key determinants of profitability and consumer acceptance in horticulture. Excessive use of chemical fertilizers negatively impacts soil and environment. Biofertilizers provide a sustainable alternative that improves nutrient uptake, hormonal regulation, stress tolerance, and microbial balance in the rhizosphere. Their role is crucial in mango, banana, and citrus — high-value fruit crops with significant domestic and export demand.

Common Biofertilizers and Their Modes of Action

Type of Biofertilizer	Examples	Mode of Action / Benefit
Nitrogen-fixers	<i>Azotobacter</i> , <i>Azospirillum</i>	Fix atmospheric nitrogen for plant use
Phosphate Solubilizers (PSB)	<i>Bacillus</i> , <i>Pseudomonas</i> , PSF	Convert insoluble phosphates into soluble forms
AMF / VAM	<i>Glomus</i> , <i>Gigaspora</i> spp.	Increase root surface area, water & nutrient uptake
Trichoderma spp.	<i>T. harzianum</i> , <i>T. viride</i>	Biocontrol + plant growth stimulation
PGPR	Multiple rhizobacterial strains	Produce IAA, siderophores, ACC deaminase, resist pathogens

These microorganisms enhance nutrient acquisition, strengthen antioxidant systems, modulate phytohormones, and improve fruit development and postharvest performance.

Effect on Physico-Chemical Fruit Quality

Mango

- Increased fruit weight and size

- Higher TSS (°Brix), total sugars, and ascorbic acid
- Better peel colour and aroma development
- Combination of Azotobacter + PSB + AMF showed highest improvement
- Improved leaf NPK status leading to better biochemical composition

Banana

- Enhanced bunch weight and pulp:peel ratio
- Uniform ripening and reduced disorders
- Increased sugar content and vitamin level
- AMF and PGPR promote root proliferation and nutrient uptake

Citrus

- Improved fruit size, juice % and sugar-acid ratio
- Higher micronutrient uptake (Ca, Mg) leads to better firmness
- Reduced pre-harvest physiological disorders

Influence on Shelf Life & Postharvest Behavior

Biofertilizers improve shelf life through:

- Better cell-wall stability (via enhanced Ca assimilation)
- Higher antioxidant activity → slows senescence
- Reduced weight loss during storage
- Lower incidence of postharvest rots and delayed decay
- Induction of **Systemic Acquired Resistance (SAR)**
- Strengthening of fruit tissues & delayed ripening

Example Findings:

- VAM + PSB in mango reduced physiological weight loss by 20–30%
- Trichoderma application reduced postharvest disease incidence in banana
- PSB + Azotobacter improved firmness and storage life in citrus

Practical Application Methods

Method	Recommended Dosage	Remarks
Seed/Seedling Treatment	20–25 g/kg of seed	Enhances early root colonization
Root Dip	1–2% solution	For nursery or field planting
Soil Application	5–10 kg/acre + FYM	Enhances survivability
Drip/Fertigation	Liquid biofertilizer	Suitable for orchards
Consortia	Multiple strains	Gives better results than single strain

Key Crops: Mango, Banana, Citrus, Papaya, Pomegranate, Grapes, Strawberry, Tomato, Brinjal, Onion

Limitations & Research Gaps

- Strain-specific responses depending on environment
- Short shelf life of some formulations
- Lack of farmer awareness & trained application
- Need for large-scale orchard trials
- Compatibility issues with agrochemicals

Recommendations for Growers

- Use locally tested consortia rather than single strains
- Combine biofertilizers with organic manure for high effectiveness
- Maintain orchard hygiene and proper postharvest handling
- Apply during root flush or active growth period
- Maintain input documentation for organic certification

Conclusion

Biofertilizers significantly improve fruit quality, nutritional value, and postharvest shelf life in mango, banana, and citrus. Their integration with organic manures and consortia-based

application results in enhanced TSS, antioxidant levels, sweetness, colour development, firmness, and storage behavior. Therefore, biofertilizers are highly recommended as a sustainable and economical alternative for achieving better fruit quality and extended shelf life under both conventional and organic horticulture.

References

1. Vejan, P., et al. (2016). Emerging role of PGPR in agrobiology.
2. Rathod, K. D., et al. (2022). Effect of Biofertilizers on Mango cv. Mallika. *Biological Forum*.
3. Dutta, P. (2012). Effect of biofertilizers on nutrient status and fruit quality of mango.
4. Sau, S., et al. (2017). Influence of biofertilizer on Himsagar mango. *Journal of Crop and Weed*.
5. Harish, S., et al. (2008). PGPR-based biohardening in banana. *Scientia Horticulturae*.
6. Abobatta, W.F. (2022). Biofertilizers in fruit orchards. *Journal of Agricultural Research*.
7. Fatima, F. (2022). Role of biofertilizers in postharvest life.