ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug577

Comparative Effects of Fungal and Bacterial Biofertilizers on Growth, Yield, and Nutritional Quality of Two Cucumber Varieties in Southwest Nigeria

Mustapha Abdulganiy Oluwasegun
Federal University of Technology Akure
Akure, Ondo State, Nigeria

Publication Date: 2025/08/30

Abstract: This study investigates the effects of selected fungal and bacterial biofertilizers on two cucumber varieties Greengo F1 and Lily F1 under field conditions in Southwest Nigeria. A randomized complete block design was used to apply five treatments, namely Trichoderma harzianum, Penicillium menonorum, Bacillus subtilis, Rhizobacteria, and a control. Growth parameters, yield, soil physicochemical properties, microbial diversity, and fruit nutritional composition were measured.

The results showed that biofertilizer application significantly enhanced growth characteristics, particularly plant height and stem girth. Rhizobium and Bacillus subtilis treatments were most effective, especially on the Lily F1 variety. Yield and fruit quality were also improved with biofertilizer use. Soil nutrient content, pH, organic matter, and microbial abundance increased, indicating enhanced soil fertility. The study concludes that microbial inoculants, particularly bacterial strains, can significantly contribute to sustainable cucumber production in nutrient-depleted soils.

Keywords: *Cucumber, Biofertilizer, Trichoderma, Bacillus Subtilis, Rhizobacteria, Sustainable Agriculture, Soil Health.*

How to Cite: Mustapha Abdulganiy Oluwasegun (2025) Comparative Effects of Fungal and Bacterial Biofertilizers on Growth, Yield, and Nutritional Quality of Two Cucumber Varieties in Southwest Nigeria. *International Journal of Innovative Science and Research Technology*, 10(8), 1636-1638. https://doi.org/10.38124/ijisrt/25aug577

I. INTRODUCTION

Agriculture is a critical sector for food security and economic development in many developing countries, including Nigeria. However, over-reliance on chemical fertilizers and poor land management practices have led to soil degradation, low fertility, and environmental pollution. Biofertilizers have emerged as promising sustainable alternatives. These natural inoculants contain beneficial microorganisms that enhance soil fertility and promote plant growth through mechanisms such as nitrogen fixation, phosphate solubilization, and hormone production.

Cucumber (Cucumis sativus L.) is an economically important vegetable crop with increasing cultivation in sub-Saharan Africa. Its short growth cycle and high market value make it an attractive crop for farmers. However, cucumber cultivation faces challenges such as poor soil fertility, pest and disease pressure, and limited research on sustainable practices. Biofertilizers have the potential to mitigate these challenges by improving soil health, reducing dependency on synthetic inputs, and enhancing crop quality.

This study aims to evaluate the effects of fungal (Trichoderma harzianum, Penicillium menonorum) and bacterial (Bacillus subtilis, Rhizobacteria) biofertilizers on the growth, yield, and nutritional content of two cucumber varieties: Greengo F1 and Lily F1. The findings are intended to inform sustainable agricultural practices for smallholder farmers in Nigeria and beyond.

II. MATERIALS AND METHODS

The research was conducted at two locations: Federal University of Technology Akure (FUTA) Research Farm and Odudu Community, Akure North, Nigeria. A randomized complete block design (RCBD) with five treatments and three replications was employed. The treatments included

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug577

Trichoderma harzianum, Penicillium menonorum, Bacillus subtilis, Rhizobacteria, and a control.

Cucumber varieties Greengo F1 and Lily F1 were inoculated with respective biofertilizers for 24 hours before planting. Data were collected weekly on growth parameters such as plant height, stem girth, and number of fruits. Soil samples were taken before and after treatment for analysis of pH, organic matter, nitrogen, phosphorus, and microbial population.

Nutritional composition of the harvested cucumber fruits was determined using standard procedures outlined by the Association of Official Analytical Chemists (AOAC). Parameters included moisture, protein, fat, ash, crude fiber, and carbohydrate contents. Data were analyzed using analysis of variance (ANOVA), and treatment means were compared using Tukey's test at a 5% significance level.

III. RESULTS AND DISCUSSION

The effects of biofertilizers on cucumber growth, yield, and soil quality were significant across both experimental locations. Plant height, stem girth, fruit count, and nutritional content showed marked improvements in plots treated with microbial inoculants compared to the control.

➢ *Tables: Biofertilizer Effects on Cucumber*

Table 1: Effect of Biofertilizers on Plant Height (cm) at Week 6

Treatment	Greengo F1	Lily F1
Control	72.30	78.60
Trichoderma harzianum	88.40	97.90
Penicillium menonorum	85.60	93.20
Bacillus subtilis	98.90	110.33
Rhizobacteria	96.40	107.70

Table 2: Effect of Biofertilizers on Number of Fruits per Plant

Treatment	**Greengo F1**	**Lily F1**
Control	3.4	4.0
Trichoderma harzianum	5.2	6.0
Penicillium menonorum	4.8	5.5
Bacillus subtilis	7.3	8.1
Rhizobacteria	6.9	7.8

Table 3: Nutritional Quality of Cucumber Fruits (%)

Treatment	**Protein**	**Moisture**	**Fat**	**Fiber**	**Carbohydrate**
Control	0.9	94.1	0.3	0.6	4.1
Trichoderma	1.2	94.9	0.2	0.8	2.9
Penicillium	1.1	94.5	0.2	0.7	3.3
Bacillus	1.4	95.3	0.1	1.0	2.2
Rhizobacteria	1.3	95.1	0.2	0.9	2.5

Table 4: Effect of Biofertilizers on Soil pH and Organic Carbon

Treatment	**Soil pH**	**Organic Carbon (%)**
Control	5.4	0.89
Trichoderma harzianum	5.9	1.21
Penicillium menonorum	6.0	1.18
Bacillus subtilis	6.5	1.38
Rhizobacteria	6.3	1.34

Table 5: Total Microbial Count in Soil (cfu/g)

Treatment	**Bacteria Count**	**Fungi Count**
Control	3.2×10^5	1.1×10^4
Trichoderma harzianum	4.6×10^5	2.3×10^4
Penicillium menonorum	4.4×10^5	2.1×10^4
Bacillus subtilis	5.7×10^5	2.5×10^4
Rhizobacteria	5.4×10^5	2.4×10^4

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25aug577

➢ *Plant Height and Stem Girth*

The Lily F1 variety consistently showed superior plant height and stem girth compared to Greengo F1. Rhizobium and Bacillus subtilis treatments produced the highest plant height (110.33 cm) and stem girth (4.8 cm), particularly at the sixth week. This can be attributed to enhanced nutrient uptake facilitated by microbial activity in the rhizosphere.

➢ *Fruit Yield*

Bacillus and Rhizobium treatments significantly increased the number of fruits per plant. Trichoderma-treated plots also showed notable yield improvements, although slightly lower than bacterial treatments. This aligns with previous findings suggesting that PGPR and fungi enhance flowering and fruit setting in cucumbers.

➢ *Soil Properties*

Biofertilizers positively altered the soil's physicochemical characteristics. Treated soils showed increased pH, organic carbon, total nitrogen, and available phosphorus. Trichoderma and Penicillium treatments improved soil structure by reducing bulk density and increasing porosity, thus enhancing root proliferation.

➢ *Microbial Activity*

The microbial population of treated soils was significantly higher than that of untreated controls. This included beneficial species such as Bacillus, Rhizobium, Trichoderma, and Pseudomonas. Their presence likely contributed to improved nutrient solubilization and disease suppression.

➢ *Nutritional Quality*

Cucumber fruits harvested from treated plots had higher protein, crude fiber, and moisture content. Bacillus-treated fruits showed increased protein (1.4%), while Trichoderma-enhanced samples had better crude fiber content. These enhancements suggest that biofertilizers not only improve quantity but also the quality of produce.

Overall, bacterial treatments outperformed fungal treatments, and Lily F1 proved more responsive to biofertilizers. The results reinforce the role of biofertilizers in sustainable agriculture, improving plant performance while promoting healthier soils.

IV. CONCLUSION

The study confirms that biofertilizers significantly enhance cucumber growth, yield, and nutritional quality while improving soil fertility. Among the tested treatments, Bacillus subtilis and Rhizobacteria showed the most positive effects, especially when applied to Lily F1 variety. Fungal treatments also improved crop performance, but to a lesser extent.

This research supports the integration of microbial biofertilizers into cucumber cultivation practices in Nigeria and similar agro-ecological zones. The use of these biological agents reduces dependency on chemical fertilizers, promotes environmental sustainability, and contributes to food security. Future studies could explore long-term field trials, economic cost-benefit analyses, and combinations of microbial consortia for enhanced efficacy.

REFERENCES

[1]. Akinmoladun, F. O., et al. (2015). Effect of organic fertilizer on cucumber nutrient content. Nigerian Journal of Horticultural Science, 20(1), 88-95.
[2]. Ali, S., et al. (2019). Comparative efficacy of fungal biofertilizers on soil nutrient status. African Journal of Microbiology Research, 13(14), 271-278.
[3]. Bashan, Y., et al. (2014). Advances in plant growth-promoting bacterial inoculant technology. Critical Reviews in Plant Sciences, 33(6), 451-499.
[4]. Bhattacharyya, P. N., & Jha, D. K. (2012). Plant growth-promoting rhizobacteria (PGPR): emergence in agriculture. World Journal of Microbiology and Biotechnology, 28(4), 1327-1350.
[5]. Harman, G. E., et al. (2004). Trichoderma species—opportunistic, avirulent plant symbionts. Nature Reviews Microbiology, 2(1), 43-56.
[6]. Kumar, A., et al. (2017). Biofertilizers: Sustainable tool for agriculture. International Journal of Current Microbiology and Applied Sciences, 6(5), 311-317.
[7]. Liao, M., et al. (2015). Rhizosphere bacteria enhance cucumber resistance to Fusarium. Journal of Plant Protection Research, 55(4), 384-392.
[8]. Mishra, J., & Kaur, G. (2015). Bacillus subtilis: A potential PGPR. Journal of Environmental Biology, 36(3), 483-496.
[9]. Pawar, S. S., et al. (2020). Biotic stress management in cucurbits. Journal of Plant Pathology, 102(1), 1-8.
[10]. Schreiter, S., et al. (2014). Effect of biofertilizers on microbial community structure. Applied and Environmental Microbiology, 80(18), 5632-5640.
[11]. Sharma, R., et al. (2019). Integrated nutrient management in cucumber. Agricultural Research Journal, 56(3), 447-452.
[12]. Singh, A., et al. (2013). Phosphate-solubilizing fungi: Trichoderma and Penicillium. Soil Biology and Biochemistry, 57, 114-124.
[13]. Verma, J. P., et al. (2001). Impact of biofertilizers on crop yield. Agronomy Journal, 93(2), 235-243.
[14]. Wang, Q., et al. (2020). Bacillus subtilis inoculation improves cucumber productivity. Applied Soil Ecology, 145, 103349.