

Assessment of Biofertilizer (Azotobacter, Azospirillum, and PSB) Integration with Chemical Fertilizers on Chemical Composition of Okra [*Abelmoschus esculentus* (L.) Moench] cv. Parbhani Kranti

Jitendra Kumar, Vinay Joseph Silas, Syed Mohd Quatadah, Aneeta yadav

Rama University, Faculty of Agricultural Sciences and allied Industries ,U.P, (INDIA)

Address for Correspondence: - Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur- 209 217 (U.P), India

Corresponding E-mail: jitendrakumar.fas@ramauniversity.ac.in

Abstract

The present investigation entitled “*Effect of Azotobacter, Azospirillum, and PSB in combination with chemical fertilizers on chemical parameters of okra [Abelmoschus esculentus (L.) Moench] cv. Parbhani Kranti*” was conducted during the Kharif season of 2025-2026 at the Agricultural Research Farm, Rama University, Mandhana, Kanpur (U.P.), India. The study aimed to evaluate the influence of biofertilizers and their integration with recommended doses of chemical fertilizers on quality attributes of okra.

The experimental results revealed significant improvement in chemical parameters such as ascorbic acid content, titratable acidity, and moisture percentage under integrated nutrient management practices. The optimal results were obtained with the application of 40% recommended dose of fertilizers (RDF) in combination with 75% PSB, 55% *Azotobacter*, and 60% *Azospirillum*, indicating the effectiveness of partial substitution of chemical fertilizers with biofertilizers.

Keywords: *Azotobacter*, *Azospirillum*, PSB, NPK, okra, integrated nutrient management

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench), commonly known as lady's finger, belongs to the family Malvaceae. It is widely cultivated in tropical and subtropical regions and is an important vegetable crop of global significance (Ahmed et al., 2006). Cytogenetically, okra is considered an amphidiploid species with a somatic chromosome number of $2n = 130$, derived from hybridization between *A.*

tuberculatus ($2n = 58$) and an unknown species ($2n = 72$). The genus *Abelmoschus* comprises approximately 38 species.

Okra is a warm-season crop and is among the oldest cultivated vegetables in the world. It plays a vital role in improving nutritional security, particularly in developing countries, due to its rich nutrient profile. The seeds contain approximately 20% protein and 20% oil,

comparable to soybean protein and cottonseed oil, respectively (Siemonsma and Hamon, 2002).

The immature fruits and leaves of okra are widely used as a thickening agent in soups due to their mucilaginous nature and high vitamin and mineral content (Awodoyin and Olubode, 2009). It is a rich source of carbohydrates, proteins, minerals, and vitamins such as vitamin A, vitamin C, thiamine, and riboflavin. Due to its nutritional and medicinal value, okra has been recognized as a health-promoting vegetable by the World Health Organization.

Biofertilizers are living microorganisms that enhance nutrient availability by fixing atmospheric nitrogen and solubilizing essential nutrients in the soil (Subba Rao, 1993). Microorganisms such as *Azotobacter*, *Azospirillum*, and phosphate-solubilizing bacteria (PSB) play a crucial role in sustainable agriculture by improving soil fertility and plant growth. These beneficial microbes not only enhance nutrient uptake but also produce plant growth-promoting substances, thereby improving crop productivity.

Materials and Methods

The experiment was conducted using the okra cultivar 'Parbhani Kranti', with seeds procured from the Indian Agricultural Research Institute (IARI), New Delhi. The study was carried out during the Kharif season of 2025-2026 using a Randomized Block Design (RBD) with three replications.

The treatments consisted of different combinations of biofertilizers (*Azotobacter*, *Azospirillum*, and PSB) along with varying levels of recommended doses of fertilizers (RDF) for NPK. The treatments included: T₁ (*Azotobacter* + 60%), T₂ (PSB + 75%), T₃ (*Azospirillum* + 65%), T₄ (PSB + *Azotobacter* + 40% NPK), T₅ (PSB + *Azospirillum* + 75%), T₆ (PSB + *Azospirillum* + *Azotobacter* + 40%), T₇ (*Azotobacter* + *Azospirillum* + 60%), and T₈ (PSB + *Azospirillum* + 75%), along with control (RDF).

Observations were recorded on key chemical parameters, including moisture content (%), titratable acidity (%), and ascorbic acid content (mg/100 g). The collected data were subjected to appropriate statistical analysis.

Results and Discussion

The results indicated that integrated application of biofertilizers and chemical fertilizers significantly influenced the chemical composition of okra fruits.

A marked reduction in acidity was observed with the application of biofertilizers. The lowest acidity (0.135%) was recorded under treatment T₅, followed by T₁ (0.325%) and T₈ (0.326%), whereas the highest acidity (0.700%) was observed in the control (RDF).

Ascorbic acid content was significantly enhanced under integrated nutrient management. The maximum vitamin C content (26.53 mg/100

g) was recorded in T₄ (PSB + *Azotobacter* + 40% NPK), while the minimum (11.34 mg/100 g) was observed under control conditions. These findings are in agreement with the results reported by Upadhyay et al. (2007).

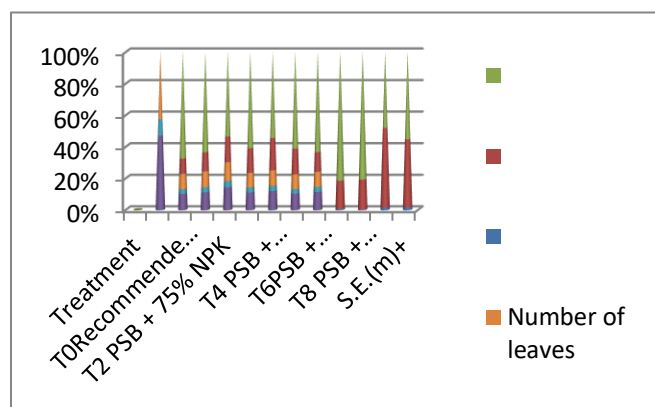
Moisture content was also significantly affected by the treatments, with the highest value (92.43%) recorded in T₆ (PSB + *Azospirillum* + *Azotobacter* + 40%), whereas the lowest moisture content (80.01%) was observed in the control. Similar findings have been reported by Premsekhar and Rajashree (2009).

Overall, the study demonstrates that integrated use of biofertilizers along with reduced levels of chemical fertilizers significantly improves the quality attributes of okra, thereby contributing to sustainable agricultural practices.

Treatment	Acidity (%)	Vitamin-c (mg/100)	Moisture (%)
T ₀ Recommended dose of fertilizers(RDF)	0.602	11.35	83.36
T ₁ <i>Azotobacter</i> + 60% NPK	0.225	14.250	76.463
T ₂ PSB + 75% NPK	0.112	16.540	55.343
T ₃ <i>Azospirillum</i> + 65% NPK	0.225	20.432	81.105
T ₄ PSB + <i>Azotobacter</i> + 55% NPK	0.176	26.532	71.381
T ₅ PSB + <i>Azospirillum</i> + 75% NPK	0.135	21.340	80.495
T ₆ PSB + <i>Azospirillum</i> + <i>Azotobacter</i> 55%	0.221	15.853	82.433
T ₇ <i>Azotobacter</i> +	0.650	14.563	66.483

<i>Azospirillum</i> 60 %			
T ₈ PSB + <i>Azospirillum</i> 75%	0.326	17.852	76.353
C.D. at 5%	0.115	3.354	3.220
S.E.(m)±	0.043	1.014	1.311

Fig. 1 Effect of *Azotobacter*, *Azospirillum*, PSB on Chemical Parameters and its Combinations with Chemical Fertilizers of Okra [*Abelmoschus esculentus* (L.) Moench] cv. Parbhani Kranti



Conclusion:

The present study indicates that the application of inoculants (PSB + *Azotobacter* + 75% NPK) improved the growth yield and nutritional quality of okra. In order to boost okra production and quality, growers are advised to apply inoculants (PSB + *Azotobacter* + 75% NPK) in accordance with Rama University's Kanpur conditions.

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