

Original Research Article

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Effect of Bio-Fertilizers on Growth, Yield and Yield Attributing Characters of Brinjal

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ABSTRACT

A field study was conducted during the *Kharif* season of 2017-18 at Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur to study about the effect of bio-fertilizers on growth, yield and yield attributing characters of Brinjal (*Solanum melongena* L.) cv. Azad B-3. The experiment was laid out in a randomized block design with 10 treatments replicated thrice. Four different bio-fertilizers viz., *Azospirillum*, *Azotobacter*, PSB (Phosphorous solubilizing bacteria) and VAM (Vesicular Arbuscular Mycorrhiza) were used alone and in different combinations with chemical fertilizers. All the bio-fertilizers are applied as seedling root dip method in which 200g of each bio-fertilizers are dissolved in 3 liters of water in different containers. The roots of brinjal seedlings are dipped in it for 10 minutes immediately after transplanting and then transplanted into main field after keeping in shade for 5-10 minutes. Among all the treatments, it is noticed that the growth, yield and yield attributing parameters like plant height, number of primary branches, number of secondary branches, fruit length, fruit width, total number of fruits/ plot and fruit yield were found maximum with the application of *Azospirillum* + PSB + 75% N + Full P & K and the minimum being recorded in control T₁ in which no bio-fertilizers and chemical fertilizers were used. So based on the results it could be concluded that the application of *Azospirillum* and PSB in combination with 75% N and full N & K favourably influenced the growth, yield and yield attributing characters in brinjal cv. Azad B-3

Keywords

Brinjal, Bio-fertilizer, *Azotobacter*, *Azospirillum*, PSB, VAM

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Introduction

Brinjal or eggplant (*Solanum melongena* L.) is a popular vegetable of solanaceous family widely grown in India and it is economically important due to its high nutritional and medicinal values. Bio-fertilizers are the

preparations containing micro-organisms with capability of mobilizing nutritive elements from non-usable form to usable form through biological process. Bio-fertilizers improve the quantitative and qualitative features of many plants (Yosefi *et al.*, 2011). Bio-fertilizers used in conjunction with chemical fertilizers

improve crop productivity and nutrient use efficiency. In brinjal, generally *Azotobacter*, *Azospirillum*, Phosphate Solubilizing Bacteria (PSB) and VAM (Vesicular Arbuscular Mycorrhiza) are used.

Azotobacter are a group of aerobic, free-living soil microbes which play an important role in the nitrogen cycle in nature binding atmospheric nitrogen which is inaccessible to plants and releasing it in the form of ammonium ions into the soil (Nitrogen fixation). They can fix nitrogen equivalent to 30-40kg N/ha. It also produces hormones like Indole Acetic Acid (IAA) and GA₃, Vitamins like biotin and folic acid and supported by judicious use of organic matter, ensure good seed germination and increasing productivity.

Azospirillum is an eco-friendly liquid biological fertilizer formulation containing bacteria *Azospirillum* which contain large amount of lipid granules which enters the cortical cells of the root and fix up atmospheric nitrogen and also produces biologically active substances like vitamins, nicotinic acid, Indole Acetic Acid (IAA), Gibberellins, etc and better helps in retention of flowers and enhances plant growth. It fixes nitrogen equivalent to 40-50 kg/ha. It increases root biomass in the inoculated plant thereby helps in greater absorption of native nutrients in soil resulting in higher yield.

The phosphate solubilizing bacteria (PSB) may convert insoluble form of phosphate to soluble form by producing organic acids. About 15-25% of insoluble phosphate can be solubilized saving chemical fertilizers significantly.

The endomycorrhizae otherwise known as Vesicular Arbuscular Mycorrhizae (VAM) is formed by the symbiotic association between certain phycomycetous fungi and angiosperm roots. It is found associating symbiotically

with root of the plants and helps in greater absorption of phosphorous, water and other important macro and essential micro elements and making them available to the plants in an easily usable organic form. Besides they are also reported to impart resistance to plants against drought and soil borne fungal pathogens and nematodes.

Bio-fertilizers being cheap input, provide highly economic assurance, eco-friendly environment, sustain soil health and plant growth by adding organic contents as well as supplementing 25-40% of chemical fertilizers N and P requirement in terms of urea and DAP. It is becoming difficult to meet the nutrient need of farming through chemical fertilizers alone and due to its higher costs the concept of Integrated Plant Nutrient Supply System (IPNS) is gaining ground. Therefore, this present investigation was carried out to study about the effect of different bio-fertilizers on growth, yield and yield attributing characters of brinjal cv. Azad B-3.

Materials and Methods

The experiment was carried out in a Randomized Block Design (RBD) during kharif season of 2017-18 at Vegetable Research Farm, Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The variety taken was Azad B-3 which is long fruited and shining purple in colour. Prior to the experiment, the mechanical and chemical analysis of the soil of the experimental field was done. 10 treatments were taken which were replicated thrice. The treatments were T₁(Control), T₂(PSB + *Azotobacter* + 75 % P + Full N & K), T₃(*Azotobacter* + *Azospirillum* + 75 % N + Full P & K), T₄(PSB + VAM + 75% P + Full N & K), T₅ (*Azospirillum* + PSB + 75% N + Full P & K), T₆ (*Azospirillum* + RDF NPK), T₇ (*Azotobacter* + RDF NPK), T₈(PSB

+ RDF NPK), T₉(VAM + RDF NPK), T₁₀(RDF NPK). Bio-fertilizers were applied as seedling root dip method. 200g each of biofertilizers dissolved in 3 liters of water in different containers. Immediately after uprooting, the roots of disease free healthy brinjal seedlings of 45 days old were dipped in this solution separately for 10 minutes and kept in shade for drying for 5-10 minutes and then transplanted to main field. Five plants from each treatment were selected at random and tagged for recording the observations. The analysis of variance and interpretation of data were done as per procedures given by Chandel(1999).

Results and Discussion

Effect of bio-fertilizers on plant height

Statistical analysis revealed that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K) recorded maximum plant height (96.23 cm) which is significantly higher over the rest of treatments. The treatment T₅ has maximum height followed by T₄ and T₂ over control T₁ which showed the minimum plant height (79.15 cm).

Effect of bio-fertilizers on number of primary branches

Statistical analysis showed that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K) recorded more number of primary branches (6.32) which is significantly higher over the rest of treatments and it is followed by T₄ and T₉ over control T₁ which showed the lowest number of primary branches (3.95).

Effect of bio-fertilizers on number of secondary branches

Statistical analysis indicated that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K)

recorded maximum number of secondary branches (11.27) which is followed by T₄ and T₉ and the minimum number being recorded in T₁ (Control) which is 7.15.

Effect of bio-fertilizers on fruit length(cm)

Statistical analysis revealed that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K) recorded maximum fruit length (13.89 cm) which is higher over rest of the treatments and is followed by T₄ and T₂ and the lowest fruit length found in control (T₁) i.e, 7.25 cm.

Effect of bio-fertilizers on fruit width(cm)

Statistical analysis showed that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K) has increased fruit width (8.42 cm) which is significantly higher over rest of the treatments. T₅ has maximum fruit width followed by T₄ and T₉ over the control T₁ which showed lowest fruit width (6.65 cm).

Effect of bio-fertilizers on number of fruits per plot

Statistical analysis revealed that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K) has increased total number of fruits per plot (724.66) which is significantly higher over rest of the treatments. T₅ has maximum number of fruits per plot followed by T₄ and T₂ over the control T₁ which showed minimum number of fruits per plot (580.00).

Effect of bio-fertilizers fruit yield (q/ha)

Statistical analysis revealed that treatment T₅ (*Azospirillum* + PSB + 75% N + Full P & K) possessed the highest fruit yield (448.65 q/ha) which is significantly higher over the rest of the treatments. It is followed by T₄ and T₂ over the control. The lowest yield recorded in the treatment T₁ (237.44 q/ha).

Table.1 Effect of bio-fertilizers on growth, yield and yield attributing characters of brinjal

Treatment	Plant height(cm)	No. of primary branches	No. of secondary branches	Fruit length(cm)	Fruit width(cm)	Total no. of fruits per plot	Yield (q/ha)
T ₁	79.15	3.95	7.15	7.25	6.65	580.00	237.44
T ₂	92.30	5.48	9.42	12.24	8.08	698.00	404.35
T ₃	86.66	4.50	9.21	9.42	7.50	682.33	332.48
T ₄	93.41	5.88	11.21	12.87	8.41	705.33	413.26
T ₅	96.23	6.32	11.27	13.89	8.42	724.66	448.65
T ₆	86.30	4.56	10.43	10.91	8.02	676.00	378.10
T ₇	90.11	5.07	10.12	10.82	7.94	695.33	336.81
T ₈	90.52	4.35	9.90	10.47	7.75	672.33	360.20
T ₉	92.19	5.63	10.93	11.94	8.27	636.66	393.00
T ₁₀	83.25	4.24	8.25	9.04	8.00	625.66	291.12
C.D.	5.16	1.21	1.82	1.45	0.60	43.20	50.77

Effect of bio-fertilizers on plant growth and its characteristics

The various bio-fertilizers affected plant height, number of primary branches and number of secondary branches significantly. Maximum plant height, number of primary branches and secondary branches were recorded in T₅ (*Azospirillum* + PSB + 75% N + Full P &K) and the minimum being recorded in T₁ (control).

Significant increase in plant height, number of primary branches and number of secondary branches are due to increased uptake of nutrients in the plant leading to enhanced chlorophyll content and carbohydrate synthesis and increased activity of hormones produced by *Azospirillum* and phosphate solubilizing bacteria (PSB). The PSB seedling root treatment increased phosphate availability in soil which in turn helped better proliferation of root growth and uptake of other nutrients to the greater extent so that there is enlargement in cell size and cell division which might have helped in increasing plant height, number of primary and secondary branches.

Effect of bio-fertilizers on yield and yield attributing characters

Application of different bio-fertilizers influenced significantly fruit yield and its components. Significant increase in the fruit length, fruit width, number of fruits and fruit yield per plot are found maximum in T₅ (*Azospirillum* + PSB + 75% N + Full P &K) and the minimum found in T₁ (control).

Increase in fruit yield and its parameters may be due to increase in number of branches which produced more leaves and this worked as an efficient photosynthesis structure and produced high amount of carbohydrate in the plant. More number of branches produced more number of flowers which resulted higher fruits per plant and increased fruit yield and their attributes.

From the result of present investigation, it is concluded that in order to obtain higher yield in brinjal, it is better to go for application of *Azospirillum* + PSB + 75% N + Full P &K (in which both the bio-fertilizers are applied as root dipping @ 200 g dissolved in 3 liters of water) under the agro-climatic conditions of Central Uttar Pradesh.

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