RESEARCH ARTICLE

Influence of Biofertilizers on the Growth, Yield and Quality of Brinjal Crop

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ABSTRACT

The influence of biofertilizer inoculation, viz. *Azotobacter* and Phosphate Solubilising Bacteria (*PSB*) alone and in different combinations with recommended dose of chemical fertilizer (NPK) on Brinjal (*Solanum melongena* L.) crop was tested during the Kharif season of the year 2008 at agricultural field (21^{0}35'72.51 N; 78^{0}98'21.32E) to explore the possibility of reducing doses of chemical fertilizers and for better soil health. The results revealed significant improvement in growth characters such as height of plant (11.03% to 37.54%), stem diameter (6.38% to 23.79%), length of root (5.56% to 36.93%), number of functional leaves (5.67% to 51.51%), weight of fresh shoot (7.90% to 35.91%) and weight of dry shoot (7.14% to 46.94%) over the control. Similarly, number of fruits picked per plant (11.30% to 52.81%) and yield of fruits (11.89% to 54.61%) was more in inoculated crop. The attack of shoot-root borer, fruit borer and little leaf infestation was less (26.71% to 50.14%) as compare to un-inoculated condition.

Key words: Brinjal, Biofertilizers, NPK, Growth and Yield.

INTRODUCTION

The brinjal, also known as 'eggplant' or 'Guinea squash,' It is one of the most popular and commercial crop grown in India and other parts of the world and rightly called as vegetable of masses. The common large-fruited forms are believed to have originated in Indo-Burma region. Fruits are moderate sources of vitamins and medicinal properties including de-cholestrolizing action. China is the largest producer of Brinjal and contributes about 68.7% of the world's Brinjal production while India occupies second position in production with a share of 23.3%. However, the productivity of Brinjal is quite low (16-17 MT) in India. In India, Brinjal occupies fourth position in area and sixth in production among the vegetable crops. Brinjal cultivation is about 600 hectares with very fragmented attempts of biofertilizer applications in Saoner Tahsil of the Nagpur district (M.S.). Shoot-root borer, bacterial wilt, fusarian wilt, little leaf are the major threats to the brinjal.

The use of N-fertilizer not only spoils the ground water, soil but also have deleterious effects by the emission of harmful gases. The chemical fertilizers should be replaced with the natural and organic fertilizers which can play a key role of the conservation of the environment, (Jangral and Lakra, 2014).

Forum for Nuclear Co-operation in Asia Bio-fertilizer Project, National Project on Organic Farming and All India Network Project on Bio-fertilizers aims to encourage use of bio fertilizers. Bio fertilizers improve the quantitative and qualitative features of many plants (Yosefi *et al*., 2011). Biofertilizers used in conjunction with chemical fertilizers improve crop productivity and nutrient use efficiency. Positive effect of azotobacterization on growth and yield of Brinjal also been reported by many workers. There is a positive influence of PSB on the growth and yield attributes of Brinjal-cv.Krishna (Gaikwad and Wani, 2001).

It is becoming difficult to meet the nutrient need of farming through chemical fertilizer alone and due to its higher costs, the concept of integrated plant nutrient supply system (IPNS) is gaining ground. Therefore, the investigation was planned and conducted to study the influence of liquid biofertilizers alone, dual and in different combinations with chemical fertilizers on the vegetative and reproductive growth, yield and quality attributes of *Solanum melongena* L.

MATERIALS AND METHODS

The experiments were laid down during Kharif season of 2008. The Randomized Block Design with four replications was adopted in field experiments. The sowing of experimental materials was done on 17th June and transplanting on 22nd July 2008 at agricultural field (21^{0}35'72.51 N; 78^{0}98'21.32 E) in Saoner Tahsil of Nagpur district (M.S.). The brinjal variety Syngenta Green-Crown was given a spacing of 80-85 cm between two plants and 90-100 cm between two lines.

Overall the soils of experimental plots was medium, black, alkaline, with available N (158 kg/ha), P (7.38 kg/ha), K (443 kg/ha), organic C (0.42%), electrical conductivity (0.181 dSm^{-1}) and with 60.87% water holding capacity. This data was utilized to calculate the recommended dose of chemical fertilizer (RDF) in the form of granular urea, single super phosphate and muriate of potash. The RDF for present experiment was 75 N: 75 P_2O_5: 00 K_2O. The other agronomic practices were followed uniformly during cropping season and need based protection measures were taken. NPK fertilizers given in split doses by top dressing in ring placement as per the treatments. First application (07th Aug. 2008) constitute half dose of N and complete dose of P and K. Second application (05th Sept. 2008) constitutes remaining half dose of N.

The bioinoculant cultures (*Azotobacter chrochoccum* as AZT and *Bacillus polymyxa* as PSB) were confirmed from the RCOF, Nagpur, Ministry of Agriculture, Govt. of India. The seedlings were treated with liquid bioinoculant of viable cell count at transplanting time. Second inoculation of biofertilizers was made by broadcasting near the root zone of plants (19th Aug. 2008). The treatments were T-1: 100% RDF of NPK; T-2: 50% RDF of NPK + AZT + PSB; T-3: 50% RDF of NPK + AZT; T-4: AZT + PSB; T-5: AZT and T-6: Control (No treatment). Irrigation was provided as per the need and climate. The total rainfall of 869.4 mm was received during the season with 52 rainy days.

Observations were recorded on height of plant, stem diameter, length of root, number of functional leaves, weight of fresh plant, weight of dry plant, number of fruits picked per plant, yield of fruit and the gravity of pest infestations. Observations were recorded by selecting randomly two plants from each treatment for length of root, weight of fresh plant and weight of dry plant, all plants for pest infestation and five plants for rest of the parameters. The mean data for the yield was subjected to statistical analysis.

RESULTS AND DISCUSSION

Height of the plant studied from 15 to 150 Days After Planting (DAP). The max. plant height at 150 DAP (98.64 cm) was found in AZT + PSB + 50% RDF of NPK and 100% RDF of NPK (98.18 cm), whereas the min. was in control (71.44 cm). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 37.43%, 37.54%, 28.96%, 17.67% and 11.03% increased height per plant respectively over the control. Half dose of the chemical fertilizer is appeared to be compensated by the combined treatment of *Azotobacter* and PSB. The findings are in agreement with Dhumal (1992), Wange and Kale (2004). Mean stem diameter was under investigation from 15 to 150 DAP. The max. stem diameter at 150 DAP (3.33 cm) was found in 100% RDF of NPK and AZT + PSB + 50% RDF of NPK (3.08 cm), where as the min. was in control (2.69 cm). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 23.79%, 15.69%, 16.04%, 11.89% and 6.38% increased mean stem diameter per plant over the control. A secretion of growth hormones and availability of nutrients and moisture influenced positively the stem diameter. Findings are closely supported by Manjusha (1996).

Average length of root per plant was studied from 30 to 165 DAP. The max. length of root at 165 DAP (57.14 cm) was found in 100% RDF of NPK and AZT + PSB + 50% RDF of NPK (52.60 cm), where as the min. was in control (41.73 cm). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 36.93%, 26.05%, 13.04%, 10.38% and 5.56% increased length of root per plant respectively over the control. It is in conformity with Dhumal (1992) and Jakhar and Chauhan, (1997). Mean number of functional leaves per plant was observed from 30 to 150 DAP. The max. number of leaves at 120 DAP (552.38) was found in 100% RDF of NPK and AZT + PSB (463.25), where as the min. was found in control (364.58). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 51.51%, 27.06%, 19.55%, 13.10% and 05.67% more mean number of leaves respectively per plant over the control. The findings are in close agreement with Manjusha (1996) and Wange and Kale, (2004).

Average weight of a fresh shoot was observed from 30 to 150 DAP. The max. weight of a fresh shoot at 150 DAP (791 g) was found in 100% RDF of NPK and AZT + PSB + 50% RDF of NPK (787 g), whereas, the min. was recorded in the control (582 g). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 35.91%, 35.22%, 16.32%, 12.89% and 7.90% increase of average weight of a fresh shoot over the control. The chemical fertilizers and combined biofertilizer treatments recorded significantly more weight due to the proper nutritional supply. The max. weight of a dry shoot at 150 DAP (144 g) was found in 100% RDF of NPK and AZT + PSB + 50% RDF of NPK (139 g), whereas, the min. was obtained in the control (98 g). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 46.94%, 41.84%, 21.43%, 16.33% and 7.14% increase of average weight of a dry shoot respectively over the control, (Table 1). These finding are in close agreement with Singh and Bhargava (1994) and Gaikwad and Wani (2001).

The max. number of fruits picked per plant during the crop time was recorded in AZT + PSB + 50% RDF of NPK (40.31) and 100% RDF of NPK (38.23), where as the min. fruits picked per plant was in control (26.38). The treatments T-1, T-2, T-3, T-4 and T-5 have shown 44.92%, 52.81%, 33.09%, 24.64% and 11.30% more fruits picked per plant respectively over the control. The max. yield of brinjal fruit per plant during the crop time was recorded in 100% RDF of NPK (2554.7 g) and AZT + PSB + 50% RDF of NPK (2516.46 g), where as the min. yield per plant was in control (1651.96 g). All the treatments were significantly superior in fruit yield over the control. The treatments T-1, T-2, T-3, T-4 and T-5 have shown 54.61%, 52.33%, 36.09%, 23.48% and 11.89% more fruit yield per plant respectively over the control, (Table 2). The max. yield of brinjal fruit (marketable and infested) per hectare during the crop time was recorded in 100% RDF of NPK (306.56 qh^{-1}) and AZT + PSB + 50% RDF of NPK (301.97 qh^{-1}). It is followed by 50% RDF of NPK + AZT (269.77 qh^{-1}), AZT + PSB (244.79 qh^{-1}), AZT alone (221.81 qh^{-1}) and control (198.21 qh^{-1}). Pal (1996), reported 48.25 to 65.38% more brinjal fruit yield in treatment of *Azotobacter* alone and in combination with other biofertilizer and reduced N doses over the uninoculated. Gaikwad and Wani, (2001), Wange and Kale, (2004) also support the results.

Table 1: Brinjal growth parameters as influenced by different treatments

Parameter	Observation	T-1	T-2	T-3	T-4	T-5	T-6
Height, cm	90 DAT	86.26	86.12	80.45	73.88	69.24	59.23
	150 DAT	98.18	98.26	92.13	84.06	79.32	71.44
Stem diameter, cm	90 DAT	2.72	2.12	2.24	2.07	1.98	1.86
	150 DAT	3.33	3.08	3.06	2.98	2.78	2.69
Root length, cm	90 DAT	30.33	28.37	27.11	26.57	26.11	24.54
	165 DAT	57.14	52.60	47.17	46.06	44.05	41.73
Number of leaves	90 DAT	502.48	412.36	388.67	371.24	344.25	327.85
	120 DAT	552.38	463.25	435.86	412.35	385.24	364.58
Weight of fresh plant, g	90 DAT	639	598	548	521	493	441
	150 DAT	791	787	677	657	628	582
Weight of dry plant, g	90 DAT	114	112	97	91	86	73
	150 DAT	144	139	119	114	105	98

Table 2: Brinjal fruit yield as influenced by different treatments

Parameter	T-1	T-2	T-3	T-4	T-5	T-6
No. of fruits pick^{-1} plant^{-1}	4.25±0.07	4.47±0.03	3.90±0.01	3.65±0.02	3.26±0.01	2.93±0.03
No. of fruits plant^{-1}	38.23±0.66	40.31±0.28	35.11±0.12	32.88±0.26	29.36±0.12	26.38±0.29
Fruits yield pick^{-1} plant^{-1}, g	283.85±0.05	279.60±0.11	249.79±0.36	226.65±0.17	205.38±0.20	183.55±0.20
Fruit yield plant^{-1}, g	2554.7±0.49	2516.46±1.03	2248.12±3.32	2039.91±1.57	1848.44±1.83	1651.96±1.80

Table 3: Brinjal disease or pest infestation (%)

Infestation	T1	T2	T3	T4	T5	T6
Shoot/root b	16.67	8.33	16.67	16.67	13.33	25.00
Fruit borer	21.30	22.64	19.40	20.44	20.25	24.81
Little leaf	20.25	8.33	25.00	16.67	25.00	33.33
Average over control	-28.90	-50.14	-26.71	-33.64	-30.62	--

All the treatments appeared to be the significantly superior over the control as the average infestation was less by 26.71 to 50.14% as compared to the control population, (Table 3). It suggests that the biofertilizers secretes some antibiotic substances or growth hormones. Similarly the treatments of chemical fertilizers are more susceptible to infestation but due to availability of nutrients make them more resistant as compared to the control population. The treatments AZT + PSB + 50% RDF of NPK, AZT alone has shown 66.68% and 46.68% less shoot-root borer infestation respectively over the control. The treatments 50% RDF of NPK + AZT, and AZT alone has shown 21.81% and 18.38% less of fruit borer infestation respectively over the control. The treatments AZT + PSB + 50% RDF of NPK and AZT + PSB alone has shown 75.0%, and 49.98% less of little leaf infestation respectively over the control. These findings are supported by Verma and Shende (1993). So, the proper application of biorfertilizers can reduce RDF dose of NPK, the cost of production and minimize soil pollution but cannot replace the yield benefits due to chemical fertilizers. Integrated and judicious use of inorganic and organic sources of fertilizers is essential.

REFERENCES

Dhumal KN (1992) Effect of *Azotobacter* on germination, growth and yield of some vegetables. *J. Maharashtra Agric.* Univ. 17 (3): 500.

Gaikwad RM and Wani PV (2001) Response of Brinjal (cv.Krishna) to Phosphate Solubilizing Biofertilizers. *J. Maharashtra Agric. Univ.*, 26 (1): 029-032.

Jaakhar SS and Chauhan MS (1997) Role of seed treatment with *Azotobacter* in root rot of cotton caused by Rhizoctenia species under green house condition. *J. of cotton Res & dev.* 11 (2): 278-281.

Jangral J and Lakra H (2014) Impact of Fertilizers on the Environment Sustainability Development and Agriculture. *GE-Int. J. of Management Research* (ISSN: 2321-1709). Vol.2 (2): 160-166.

Manjusha S (1996) Response of culture with graded doses of nitrogen on growth, yield and quality of Brinjal and Tomato, *M.Sc. (Agri.) Thesis* (Unpub), Dr. P.D.K.V. Akola, (India).

Pal ML (1996) Efffect of *Azotobacter, Azospirillum* alone and in combination with reduced doses of N on growth and yield of Brinjal. *Thesis* submitted to Dr. Panjabrao Deshmukh Agriculture University, Akola (India).

Singh P and Bhargava SC (1994) Changes in growth and yield component of *Brassica napus* in response to *Azotobacter* inoculation at different rates of nitrogen application. *J. Agric. Sci.* 122 : 241-247.

Verma OP and Shende ST (1993) *Azotobacter* a biofertilizer for vegetable crops: *Biofert. Newsletter*. 1(2):6-10.

Wange SS and Kale RH (2004) Effect of biofertilizers under graded nitrogen levels on Brinjal crop; *J. Soils and Crops*. 14 (1): 9-11.

Yosefi K, Galavi M, Ramrodi M, and Mousavi SR (2011) Effect of bio-phosphate and chemical phosphorus fertilizer accompanied with micronutrient foliar application on growth, yield and yield components of maize (Single Cross 704.) *Australian Journal of Crop Science,* 5: 175 – 180.