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Research Article

Effect of Microbial Innoculants on Growth and Yield Parameters in Brinjal under Temperate Conditions

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ABSTRACT

Use of Microbial inoculants in association with inorganic fertilizers has been proving beneficial in different crops by augmenting the production and reducing the use of chemical fertilizers. The Current research was aimed to study the use of microbial inoculants (Azospirillum, Azotobacter, PSB and KSB) in Brinjal crop at the Vegetable Farm of Division of Horticulture, Faculty of Agriculture, Wadura, SKUAST (K), during Kharif 2016. The results of the experiment showed that the application of microbial inoculants viz., Azospirillum + PSB+KSB alongwith 100 % RFD (T_8) produced highest fruit yield with maximum growth parameters. Comparatively higher effect of Azospirilum than the azotobacter was observed on the yield and growth parameters of the Brinjal crop.

Keywords: *Brinjal, Microbial Inoculants, Azospirilum, Azotobacter, PSB, KSB.*

INTRODUCTION

Brinjal or eggplant (*Solanum melongena* L.) is an important solanaceous crop of sub-tropics and tropics. The name brinjal is popular in Indian subcontinents and is derived from Arabic and Sanskrit whereas the name eggplant has been derived from the shape of the fruit of some varieties, which are white and resemble in shape to chicken eggs. It is a versatile crop adapted to different agro-climatic regions and can be grown throughout the year. It is a perennial but grown commercially as an annual crop. A number of cultivars are grown in India, consumer preference being dependent upon fruit color, size and shape.

Among the various inputs for the successful Brinjal crop production, there is an important role of soil nutrients applied either through chemical, biological or organic sources. Although chemical fertilizers can't be fully replaced by other sources yet there has been a quite good response of application of microbial inoculants in association with chemical fertilizers. Microbial inoculants refer to formulations composed of active strains of microorganisms that play an important role in soil ecosystems for sustainable agriculture being environment friendly and are potential alternative to chemical fertilizers.

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They could be phyto-stimulants, bio-fertilizers or microbial bio-control agents The application of inoculants is seen as being very attractive since it would substantially reduce the use of chemical fertilizers and there are now an increasing number of inoculants being commercialized for various crops (Berg, 2009). Microorganisms play an important role in agricultural systems, particularly plant growth-promoting microorganisms (PGPMs). Plant growth benefits may be attributed mainly to three mechanisms as follow. (i) PGPMs acting as biofertilizers (such as nitrogen-fixing bacteria and phosphate-solubilizing bacteria) assist plant nutrient uptake by providing fixed nitrogen or other nutrients (Kennedy & Islam, 2001) (ii) Phytostimulators (microbes expressing phytohormones such as *Azospirillum*) can directly promote the growth of plants, usually by producing plant hormones (Spaepen, et al., 2007 & Glick, 2007). (iii) Biological control agents (such as *Trichoderma*, *Pseudomonas,* and *Bacillus*) protect plants against phytopathogenic organisms (Mohiddin et al., 2010; Ashnaei et al., 2010; & Dawar, et al., 2009). Several reviews have discussed various aspects of growth promotion by PGPMs (Antoun Prevost, 2005; Zhuang et al., 2007; & Saharan & Nehra, 2011) The chemical fertilizers should be replaced with the natural and organic fertilizers which can play a key role in the conservation of the environment (11). The ability of *Azotobacter* to enter into dormancy as cysts might help in exploring some of the great variability of plant response to inoculation and also for ace-ecological studies for biological nitrogen fixation "Nitrogenase" enzyme is very important which is sensitive to oxygen. *Azotobacter* protects this enzyme by forming slime around cell. It converts atmospheric nitrogen in cellular proteins. Then cell proteins get mineralized in soil after death of *Azotobacter* cell contributing towards the nitrogen availability to the crop plants. The present investigation is an attempt to explore the use of different bio fertilizers in brinjal crop and to assess the best choice of different bio fertilizers with different doses of inorganic fertilizers recommended for the brinjal crop. Although it is not possible to wholly replace the inorganic fertilizers yet the present work will identify the feasibility of decreasing the dose of application of inorganic fertilizers in the brinjal crop.

MATERIALS AND METHODS

The experiment was conducted on the Vegetable Farm of Division of Horticulture Faculty of Agriculture, Wadura, SKUAST (K) Shalimar, during Kharif season of 2016. The seeds of Brinjal cv. *PPL* @ 500 gm/ha were used for preparation of nursery. The experiment was carried out in Randomized Block Design with Twelve treatments replicated thrice. The treatment details are: **T1**=No inorganic fertilizer or biofertilzer (control), **T2**=50% RFD (@ 100: 50: 50 kg NPK/ha) only, **T3**=75% RFD, **T4**=100% RFD, **T5**=*Azospirillum* + PSB + KSB +, **T6**=50% RFD + *Azospirillum* + PSB + KSB. **T7**=75% RFD + *Azospirillum* + PSB + KSB, **T8**=*Azospirillum* + PSB + KS + 100% RFD, **T9**=*Azotobacte*r + PSB + KSB, **T10**=50% RFD + *Azotobacter* + PSB + KSB, **T11**=75% RFD + *Azotobacte*r + PSB + KSB + **T12**=100% RFD + *Azotobacter* + PSB + KSB, On the raised beds, seeds of Brinjal were sown and then covered with soil. The seedlings were ready for transplanting after 45 days of sowing. The field was prepared with raised seed beds as individual plots in accordance with the treatment combinations. FYM was applied uniformly to all plots. The seedlings were transplanted at a spacing of 60 x 75cm and followed by uniform recommended cultural practices for all experimental plots. All observations regarding growth, and yield of Brinjal were taken by standard procedures and the data was subjected to statistical analysis.

RESULTS AND DISCUSSION

Growth parameters

Plant height and the no. of branches per brinjal plant as presented in the table 1 was significantly affected by application of different doses of inorganic fertilizers applied alone or in conjunction with microbial inoculants. Substituting the inorganic fertilizers with microbial inoculants at different doses of inorganic fertilizers showed more plant height and no of branches than applying the inorganic fertilizers alone at 50%, 75% or 100% RFD. The effect of azospirilum was significantly more than azotobacter in promoting the growth parameters of the brinjal plant. Evidently maximum plant height (104.0cm**)** and no. of branches per plant (5.8) was observed by treatment T8 (100%RFD +Azospirillum+PSB+KSB) The better growth of brinjal maybe attributed to the fact that *Azotobacter* is free living bacteria and have specific role in fixing atmospheric N in soil which enhance soil fertility (Subbarao, 1982; & Vyas et al., 1998). Likewise, *Azospirillum* produces phytohormone which stimulate root growth and changes in root morphology which in turn affects the assimilation of nutrients (Sumner, 1990). Phosphobacteria would help in the conversion of unavailable phosphorus form to available form especially in early crop growth phase and augment the plant growth is due to the biosynthesis of growth promoting substance (Anburani & Manivannan, 2002). Bio-fertilizers also produce the growth promoting substances *viz.*, auxin, gibberellins and cytokinin which contributes towards vigorous growth of the plant (Azcon & Bassera, 1975). These results are in conformity with Nathakumar and Veeragavathatham (2000) and Wange and Kale (2004) in brinjal.

Yield parameters:

All the yield parameters of the Brinjal in present study like number of fruit per plant, fruit yield per plant and per hectare has been significantly affected by application of inorganic fertilizers either alone or in combination with microbial inoculants. Increasing the doses of inorganic fertilizers from 50% of recommended dose to 100% recommended dose significantly showed increase in all the yield parameters. There was a significant effect of microbial inoculants on the yield parameters as evident from the results of treatments where doses of inorganic fertilizers where substituted with microbial inoculants. Consequently the higsest number of fruits per plant, fruit yield per plant and per hectare where observed with the treatment T8 (100% RDF+ *Azospirillum* + PSB+KSB) + The number of fruits per plant is an important determination of yield in brinjal due to apportioning efficiency part and hormonal balance in the plant system (Anburani & Manivannan, 2002). The increase in fruit yield might have been due to the better performance of the yield attributes. It may be due to better assimilation of plant nutrients through bio-fertilizers (Nanthakumar & Veeragavathatham, 2000). The possible reason for increased fruit yield might be associated to better inorganic nitrogen utilization in the presence of bio-fertilizers, which enhanced biological nitrogen fixation, better development of root system and possible higher synthesis of plant growth hormones (Gajbhiye et al., 2003). Similar trend of work has been noted by Anburani and Manivannan (2002), Devi et al. (2002a), Devi et al. (2002b) and Wange and Kale (2004).

Table1. Growth and yield attributes of Brinjal as effected by microbial inoculation

Treatments	Plant ht (cm)	No.of Branches/plant	No. of Fruits/plant	Fruit wt(g)	Fruit yield per plant(g)	Fruit yield per plot(kg)	Fruit yield per ha (q)
T_1	80.15	3.4	5.8	33.3	170.6	2.37	70.32
T_2	89.15	4.1	7.4	37.7	259.5	3.33	98.8
T_3	93.35	4.8	10.1	44.3	438.0	5.34	159.83
T_4	97.25	5.5	11.6	49.6	577.5	7.04	210.3
T_5	85.25	3.7	7.8	36.6	256.3	3.54	98.6
T_6	95.5	4.8	9.4	41.5	379.8	4.59	141.1
T_7	103.0	5.7	11.1	51.3	579.0	7.29	211.0
T_8	104.0	5.8	11.9	53.8	649.15	8.12	236.8
T_9	85.75	3.7	7.4	35.0	224.8	3.44	100.0
T_{10}	93.6	4.3	8.9	40.0	351.8	4.53	126.3
T_{11}	98.6	5.4	10.6	50.6	539.9	6.51	202.1
T_{12}	99.1	5.6	11.3	51.2	595.6	7.56	219.0
SEm	1.72	0.28	0.59	0.89	32.92	0.30	10.5
CD *(P=0.05)*	3.5	0.59	1.22	1.83	68.25	0.635	21.9

CONCLUSION

The present study as evidenced by the results of application of inorganic fertilizers alone or in combination with different microbial inoculants in Brinjal plant indicates that both growth and yield of Brinjal crop was can be successfully augmented by either substituting a part of inorganic fertilizers with microbial inoculants or the inorganic fertilizers can be supplemented with microbial inoculants (Azospirilum, Azotobacter, PSB and KSB). Although highest yield of the Brinjal crop was observed with the application of 100% RFD with supplemental inoculation by Azotobacter, PSB and KSB, yet the economics can be maximized by decreasing the dose of inorganic fertilizers and substituting that reduced dose with the microbial inoculants used in the present study.

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