Comparative Studies on the Growth and Yield of Brinjal (*Solanum melongena* L.) var PLR 2 based on Bioinoculants and Inorganic Fertilizers

D.Ananda Kumar *, K.Sivakumar and E.Mariyappan

Department of Agricultural Microbiology, Faculty of Agriculture, Annamalai University, Annamalai Nagar – 608 002, Tamilnadu, India

Abstract:-**To study Comparative studies on the growth and yield of Brinjal (*Solanum melongena* L.) var PLR 2 based on Bioinoculants and inorganic fertilizers. Bioinoculants and inorganic fertilizers to boost the productivity potential of yield of Brinjal. Significant difference in all parameter like plant height, number of leaves, leaf area and number of branches due to combined application of Bioinoculants and inorganic fertilizers. Maximum plant height 96.45 cm were observed in treatment 8 containing urea, super phosphate, Muriate of potash, AM Fungi, Phosphobacteria (*Bacillus megaterium)* (each 5g/pot). The maximum number of flowers 37 per plant was produced in T8 treatment and the maximum number of fruits 29/plant. The highest fruit weight was 90 g observed in T8 and leaf area fairly gives a good idea of photosynthetic capacity of plant. Significant difference s were noticed with regards to leaf area index among the treatments at all growth stages**

Keyword: **AM Fungi, Phosphobacteria and chemical fertilizers.**

I. INTRODUCTION

Eggplant (*Solanum melongena*) or aubergine, is a species of nightshade, grown for its edible fruit. Eggplant is the common name in North America, Australia and New Zealand, but British English uses the French word aubergine. It is known in South Asia and South Africa as brinjal. Brinjal has an important nutritional value due to its composition, which includes minerals like potassium, calcium, sodium and iron (Mohamed *et al*.,2003; Raigon *et al*., 2008) as well as dietary fibre (Sanchez-Castillo *et al*.,1999).

It contains 92.7 per cent water, 4 per cent carbohydrates, 1.4 per cent protein, 1.3 per cent fiber, 0.3 per cent fats, 0.3 per cent minerals and vitamin A in a negligible quantity (Tindall,1978). The varities of *Solanum melongena* L.show a wide range of fruit shapes and colours, ranging from oval or egg –shaped to long club shaped and form white , yellow, green through degrees of purples pigmentation to almost black .

India is the second largest producer of brinjal in the world next to China and produces 14MT from an area of 711.3ha (NHB, 2016). In India, the farmers use huge more amount of chemical fertilizers for crop production especially for vegetables, thus the soil which leads to soil pollution and ground water contamination, ultimately causing health hazards (Giannakoula *et al.*, 2010). In order to avoid the environmental pollution especially soil pollution, most of the scientists are recommending the use of biofertilizers along with inorganic fertilizers in a sustainable manner to maintain the soil health and also the productivity. diseases and increasing the yield (Lekberg and Koids, 2005).

Dwivedi, 2015 explained that the AM fungi varies with host ranges. Though they are ubiquitous, they showed that the every taxonomic group of plants and the list of species not infected is probably far of microorganisms like bacteria, fungi and actinomycetes which may help in increasing crop productivity by way of helping in solubilization of insoluble phosphorus, stimulating plant growth by providing hormones, vitamins and other growth promoting substances. Phosphate Solubilizing Bacteria (PSB) are capable of hydrolyzing organic and inorganic phosphorus from insoluble compounds and PSB produce phosphatase like phytase that hydrolyse organic forms of phosphate compounds efficiently (Zehra,2010)

II. MATERIALS AND METHODS

Present works was carried out in a Randomized complete block design (RCBD)at department of microbiology ,faculty of Agriculture, Annamalai university Chidambaram. The physical and chemical properties of experimental soil, which was used for pot culture study. The soil physical and chemical properties such p^H, Nitrogen (Jackson,1958), Phosphorus (Jackson,1958), Potassium (Peach and tracey,1956) content were analyzed. Micronutrient such as Zn,Fe,Cu and Mn were analyzed. Seed material of brinjal variety –PLR 2 were obtained from Vegetable Research station ,Palur panruti. The raised seed bed of 2x2m size was prepared and brinjal seeds were soaked in one cm depth in the rows spaced at 5 to 6 cm and covered with thin layer of soil . 30 days seedlings were transplanted to the trial pot.

The AM Fungi *Glomus fasciculatum* and PSB *Bacillus megaterium* were obtained from Department of Microbiology , Faculty of Agriculture, Annamalai university. The treatments were T-1 urea (5g/pot),T-2 super phosphate (5g/pot), T-3 Muriate of potash (5g/pot),AM Fungi (5g/pot), T-5 Phosphobacteria (*Bacillus megaterium*) (5g/pot),T-6

urea, super phosphate, Muriate of potash (each 5g/pot), T-7 AM Fungi, Phosphobacteria (*Bacillus megaterium*) (each 5g/pot), T-8 urea, super phosphate, Muriate of potash, AM Fungi, Phosphobacteria (*Bacillus megaterium*)(each 5g/pot) and T-9 control.The N,P and K Contents of the manures were tested in the laboratory and according to the results, the doses of manures were set in such in way that all the treatments contain same amount of N,P and K .Five plants plants were selected randomly from each unit pot to record yield contributing characters. All the practical management included mulching, weeding, and other agronomic treatments were done by manually. Irrigation was were done based on plant requirement.

In maturity time ,fruit yield, number of fruits per plant, total plant height ,shoot length, root length, number of branches per plant, number of leaves, fruit length and fruit width were measured .The collected data were analyzed statistically by F-test to examine the treatment effects and the mean differences were adjusted by Duncan's Multiple Range test (DMRT) (Gomez and Gomez.1984).

III. RESULTS AND DISCUSSION

The present study was observed that the application of Bioinoculants and inorganic fertilizers solely or combined application had a great influence at all the stages of the crop. Significant differences in all parameters like plant height, number of fruit, plant height, number of leaves ,leaf area and number of branches due to the combined application of bioinoculant and inorganic fertilizers. Maximum plant height (96.45cm)were observed in T8 (Table 1). The data on shoot length (72.45cm), and the root length (22.00 cm) as influenced by the combination of bioinoculant and inorganic fertilizers showed significant differences among the treatment at the all the stages. The highest number of branches per plant (13.00nos) was recorded in treatment T8.Highest fruit weight in T8 was (90.00g). Total number of leaf observed 34.00 per plant was observed in T8 and leaf area fairly gives a good idea of photosynthetic capacity of the plant . Significant differences were noticed with regard to leaf area index among the treatments at all growth stages. The treatments 8 showed significantly higher leaf area index (65**.**00cm). The increase in leaf area index could be attributed to increased cell division and elongation resulting in increased leaf expansion, more numbers of leaves due to beneficial influence of bioinoculants which release growth promoting substances and enchances the availability of phosphorus . From the data it appeared that flowering and fruiting of brinjal were positively influenced by sources of nutrients applied. The maximum numbers of flowers (37.00/plant) per plant was produced T8 treatment and the maximum number of fruits (29.00/plants).

Table 1: **Comparative studies on the growth and yield of Brinjal (Solanum melongena L.) var PLR 2 based on Bioinoculants and inorganic fertilizers**

treatment	No of fruit^{-1}	Weight of fruit (g)	No of flower^{-1}	Root length (cm)	Shoot length (cm)	Total plant height (cm)	Leaf area^{-1} (cm)	No of leaves^{-1}	No of branches^{-1}
T1	23.00	79.50	34.00	20.00	52.34	72.34	56.00	25.00	11.00
T2	22.00	77.40	29.00	19.00	49.20	68.20	52.00	18.00	10.00
T3	20.00	80.20	28.00	20.00	49.10	69.10	46.00	21.00	9.00
T4	15.00	81.25	21.00	21.00	55.00	76.00	48.00	23.00	10.00
T5	16.00	82.22	21.00	19.00	56.00	75.00	59.00	26.00	10.00
T6	26.00	85.60	36.00	23.00	69.00	92.00	60.00	31.00	12.00
T7	23.00	83.10	31.00	21.00	63.89	84.89	60.00	29.00	11.00
T8	**29.00**	**90.00**	**37.00**	**22.00**	**72.45**	**96.45**	**65.00**	**34.00**	**13.00**
T9	11.00	50.00	17.00	15.00	40.20	55.20	37.20	18.00	8.00

Similar results were reported by Naidu *et al*.,(1999) revealed that the morphological parameters were affected significantly due to the application of different combination of organics,chemicals,biofertilizers. Satya Vani (2014) described that mycorrhizal spore population in rhizosphere soil as well as the percentage of mycorrhizal infection in plant roots fluctuated with the changes in physico-chemical factors of the soils of brinjal.

The phosphobacteria increased phosphate availability in soils in turned helped better proliferation of root growth and uptake of other nutrients to the greater extent. so that the enlargement in cell size and cell division which might have helped in plant height, number of leaves,branches and fruits per plant. These results are in aggrement with those reports of Nanthakumar and Veeraraghavathatham (2009), Anburani and Manivannan (2002), and in brinjal.

Aminifard *et al.*,(2010) with study responses of eggplant to different rates of nitrogen under field conditions were reported that fertilization with 100 Kg/ha nitrogen resulted in the highest average fruit weight and fruit yield. Pal

et al., (2002) were reported that eggplant fruit yield increased with increase in nitrogen up to 187.5 kg/ha. Only microbial treated plants could not increase the vegetative growth of plants and the reason may be that they released nutrients at a slower rate. On the other hand, the only application of inorganic fertilizer was also less effective than the combined application. These results were in conformity with the findings of Rahman *et al.*,(1998) found that the vegetative growth and yield of berry was the highest with the combined application of manures and fertilizers. For eggplant, the integrated use of urea and poultry manure also resulted in a higher nutrient uptake Jose *et al.,* (1998).

The use of inorganic fertilizers causes a great impact on the environment and the cost of these fertilizers is increasing over the years. The farmers need to raise the crops by organic farming that will reduce the costs and will decrease the impact on the environment. In addition, organic farming will reduce the additional burden of environmental pollution that is caused while manufacturing these synthetic fertilizers at the source (Rathier and Frink, 1989).now it is a well established fact that organic fertilizers provide enough requirements for proper growth of the crop plant plant and may enhance the uptake of nutrients, increase the assimilation capacity as well (Tomati *et al.,* 1990). The use of bio inoculants useful as it increases soil porosity, aeration and water holding capacity, therefore a practically paying proposal.

Phosphate solubilizing Bacteria (PSB) are groups of beneficial bacteria capable of hydrolyzing organic and inorganic phosphorous from insoluble compounds. Chen *et al*.,(2006) P-solubilization ability of the microorganisms is considered to be one of the important traits associated with the plants phosphate nutrition. The cost of inorganic fertilizers has been enormously increasing to an extent that they are out of reach of the poor ,small and marginal farmers. It has become impractical to apply such costly inputs for a crops of marginal returns. The use of bioinoculants in such situation is therefore a practically paying proposal. Based the results it was concluded that the application of bioinoculants and inorganic fertilizers was found more beneficial and significantly improved growth parameters and yield components in brinjal. The benefits cost ratio was found lesser in using both bioinoculants and inorganic fertilizers compared to using chemical fertilizers alone in brinjal crop cultivation.

REFERENCES

[1]. Aminifard,M.H.,Aroiee,H.,Fatemi,H.,Ameri A.,Karimpour,S., 2010:Responses of eggplant (Solanum melongena L.) to different rates of nitrogen under field conditions.JCEA,11(4):453-458.

[2]. Anburani A,Manivannan K 2002.Effect of integrated nutrient management on growth in brinjal (Solanum melongena L.) CV.Annamalai.South Indian Horticulture,50(4-6):377-386.

[3]. Dwivedi, O.P. 2015. Distribution and Association of Arbuscular Mycorrhizal Fungi in Different Cultivars of Wheat from Lalganj Pratapgarh District of Utter Pradesh. India Advances in Bio Sci. and Bio Tech., 353-357

[4]. Chen,G.C.,He,Z.L, Stoffella ,P.J,Yang.X.E.,Yu,S.,2006.Calvert D use of dolomite phosphate rock (DPR) fertilizers to reduce phosphorous leaching from sandy soil. Environmental pollution,139:176-182.

[5]. Giannakoula, A., M. Moustakas, T. Syros and T. Yupsanis. 2010. Aluminum stress induces up-regulation of an efficient antioxidant system in the Al-tolerant maize line but not in the Al- sensitive line. Environ. Exp. Bot. 67: 487-494.

[6]. Gomez,K.A.,Gomez A.K.1958.Statistical procedures for agricultural research.2nd edn.John Wiley and Sons.New York.207-215.

[7]. Jackson, M.L. 1973. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi.

[8]. Jose D.,Shanmugavelu,Thamburaj 1988.Studies on the efficiency of organic and inorganic form of nitrogen in brinjal.Indian journal of Horticulture 45:100-103.

[9]. Lekberg, Y. and R.T. Koids. 2005. Arbuscular mycorrhizal fungi, rhizobia available P and nodulation of groundnut (Archis hypogea L.) in zimbawe. Agric. Ecosys. Environ., 110: 143-148.

[10]. Mohamed AE, Rashed MN, Mofty A (2003). Assessment of essential and toxic elements in some kinds of vegetables. Ecotox Environ Safe 55(3):251-60

[11]. Naidu AK,Kushwah SS,Diwivedi YC 1999.Performance of organic manures, bio and chemical fertilizers and their combination on microbial population of soil and growth of okra. Jawaharlal Nehru Krishi Vishwa Vidhyalaya Research Journal ,33 (1-2):34-38.

[12]. Nanthakumar S and Veeraraghavathatham D 2000. Effect of integrated nutrient management on growth parameters and yield of brinjal (Solanum melongena L.) cv PLR 1.South Indian Horticulture,48(1-6):31-35.

[13]. Pal S, Saimbhi MS, Bal SS 2002.Effect of nitrogen and phosphorus level on growth and yield of brinjal hybrid (Solanum melongena L.). J.veg.sci.29,90-91.

[14]. Rahman M.H, Hosain M.A, Kawai K 1998. Potentially of swamp for fish culture in Bangaladesh.Japan Aquaculturte society,svisanzoshku.46(4):481-486.

[15]. Raigón MD, Prohens J, Muñoz-Falcón JE, Nuez F (2008). Comparison of eggplant landraces and commercial varieties for fruit content of phenolics, minerals, dry matter and protein. J Food Compos Anal 21(5):370-376.

[16]. Rathier T.M .,Frink C.R 1989.Nitrate in runoff water from container grown juniper and Alberta spurce under different irrigation and N fertilization regimes.J Environ Horticul (7) (1):32-35.

[17]. Satya Vani, Motha, Hindumathi Amballa and Narsimha Reddy Bhumi. 2014. Arbuscular my corrhizalfungi associatedwithrhizospheresoils of brinjal cultivated in Andhra Pra desh, India. Int. J. Curr. Microbiol. App. Sci., 3(5): 519-529.

[18]. Sanchez Castillo CP, Englyst HN, Hudson GJ, Lara JJ, Solano ML, Munguía JL, James WP (1999). The nonstarch polysaccharide content of Mexican foods. J Food Compos Anal 12(4):293-314.

[19]. Tindall,D.,1978. Commercial vegetables growing. ELBS & Oxford University Press, London.pp. 711

[20]. Tomati U, Galli E.,Grappelli A, Dilena G 1990. Effect of earthworm casts on protein synthesis in radish (Raphanus sativum) and lettuce (Lactuca sativa) seedlings. Biology and fertility of soils,9: 288-289.

[21]. Zehra Ekin 2010. Performance of phosphate solubilizing bacteria for improving growth and yield of sunflower (Helianthus annuus L.) in the presence of phosphorus fertilizer. Af. J. Biotech. 9: 3794-00.