Comparative Study of Bio and Chemical Fertilizers on Plant Vigour, Flowering and Yield of Petunia (*Petunia hybrida*) var. Picotee under Allahabad Agro-Climatic Conditions

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Abstract - The present experiment was conducted to determine Comparative study of bio and chemical fertilizers on plant vigour, flowering and yield of petunia (Petunia hybrida) var. Picotee under Allahabad Agro-climatic conditions in the Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology and Science, Allahabad, (U.P.) during the winter season 2014-2015. Thirteen treatments were included in the trial were tested in three replication. N.P.K. recommended (120:90:60) kg/ha and bio-fertilizer 5 kg/ha. The experiment of design was randomized block design. The results reveal that treatments T13 (Azotobactor + PSB +PMB + 100% doses of NPK)

Key words: Petunia hybrida, PSB, KMB, Azotobactor, Bio-fertilizer.

I. INTRODUCTION

Petunia (*Petunia hybrida* Vilm) belongs to the family Solanaceae and Genus Petunia is a popular, easy to grow and versatile annual with showy flowers and has the longest season of bloom of all garden annuals. A wide range of colors and forms has been developed over the years, which are classified on the basis of characteristics of flowers. Petunia plants are perennials but are generally grown as half-hardy annuls in open gardens. Petunia originated in South America.

Presently the indiscriminate use of chemical fertilizers and pesticides has caused tremendous harm to the environment as well as human health. The

safest answer to this is the use of bio-fertilizer, an environmentally friendly bio-fertilizer which is now used in most countries for sustainable horticulture. Bio-fertilizers are micro organisms that enrich the nutrients quality of soil. The main sources of bio-fertilizers are bacteria, fungi and cynobacteria (blue green algae). The most striking relationship that these have with plants is symbiosis, in which the partners derive benefits from each other **[1].**

Bio fertilizers are important components of integrated nutrients management. These potential biological fertilizers would play key role in productivity and sustainability of soil and also protect the environment as eco-friendly and cost effective inputs for the farmers. They are cost effective, eco-friendly and renewable source of plant nutrients to supplement chemical fertilizers in sustainable agricultural system.

Role of Azotobactor is one of the important and well known non symbiotic nitrogen fixing bacterium. It increases 5-15% crop yield in well manured soil with high organic matter, also it secrets biologically active substance like thiamine, riboflavin, IAA and Gibberllic acid. It also secrets some exudates that can prevent the growth of disease causing microorganism **[2].**

Phosphate Solubilizing Bacteria (PSB) is a group of beneficial bacteria capable of hydrolyzing organic and inorganic phosphorus from insoluble compounds. Some PSB produce phosphatase like phytase that hydrolyses organic forms of phosphate compounds efficiently. The use of phosphate solubilizing bacteria as inoculants simultaneously increases P uptake by the plant and crop yield. Strains from the genera Pseudomonas, Bacillus and Rhizobium are among the most powerful phosphate solubilizers. The principal mechanism for mineral phosphate solubilization is the production of organic acids, and acid phosphatases play a major role in the mineralization of organic phosphorous in soil. Several phosphatase-encoding genes have been cloned and characterized and a few genes involved in mineral phosphate solubilization have been isolated. Therefore, genetic manipulation of phosphate-solubilizing bacteria to improve their ability to improve plant growth may include cloning genes involved in both mineral and organic

phosphate solubilization, followed by their expression in selected rhizobacterial strains. Chromosomal insertion of these genes under appropriate promoters is an interesting approach. **[3].**

Potash mobilizing Bacteria (PMB) plays a vital role in the formation of amino acids and proteins from ammonium ions, which are absorbed by roots, from the soil. PMB are also responsible for the transfer of carbohydrates, proteins, etc. from the level to the roots. It also plays a vital role in the uptakes of other elements particularly nitrogen, phosphorus and calcium, PMB regulates the permeability of the cellular membrane. It activates number of enzymes, e.g. alcohol dehydrogenate and its deficiency decreases photosynthesis. PMB increases the resistance of crops to hot and dry conditions and insect pest and diseases. It improves the quality of flowers.

II. MATERIALS AND METHODS

The field experiment was conducted at the experimental field of the Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Deemed -to-be University, (formerly known as Allahabad Agricultural Institute AAI-DU) during the year 2014-2015. The experiment was laid out in Randomized Block Design (RBD) with thirteen treatments and replicated thrice. Three bio fertilizer Azotobactor, phosphorus Solubilising Bacteria and Potash Mobilising Bacteria @ 5 Kg/ha and two levels of nitrogen, *i.e.* 60 kg/ha and 120 kg/ha with one control were taken. Seedlings of petunia were raised in the beds of the nursery. The experimental field was prepared well by repeated ploughing followed by planking to a fine tilt required was marked and beds were prepared according to the plan of layout.

III. RESULTS AND DISCUSSION

The present investigation entitled Comparative study of bio and chemical fertilizers on plant vigour, flowering and yield of petunia (*Petunia hybrida*) var. Picotee under Allahabad agro-climatic conditions.The results of the investigation, regarding the petunia on growth and flowering quality and yield have been presented in table 1 and 2.

The maximum plant height (29.80 cm) was recorded in treatment T_{13} (Azotobactor + PSB +PMB + 100% doses of NPK followed by T_{12} (*Azotobactor* + PSB + PMB + 50 % N + 100% doses of PK) (28.53cm). which was much better than control (25.60cm). The maximum plant height with T_{13} (*Azotobactor* + PSB +PMB + 100% doses of NPK)may be attributed due to the presence of non-symbiotic nitrogen fixing bacteria which might have given the boosting effect to the roots of the plant and by stimulating plant growth through synthesis of growth promoting substances. These findings are in conformity with the results of **[4]** [5] **[6]** in Petunia and [7] **in** Petunia.

The maximum plant spread was recorded in treatment treatment T_{13} (*Azotobactor* + PSB +PMB + 100% doses of NPK) followed byT_{12} (*Azotobactor* + PSB + PMB + 50 % N + 100% doses of PK) (51.81cm). Minimum plant spread (41.51 cm) was recorded in treatment T_1 control, the ability of *Azotobacter* to synthesize and secrete thiamine, riboflavin, pyridoxine, cyanocobalamin, and indole acetic acid like substances which in turn increased the nutrient absorption from the soil leading to the luxuriant vegetative growth.

The increased number of branches of the bio fertilizer treated plant was observed than control the maximum number of branches per plant was recorded in treatment (*Azotobactor* + PSB +PMB + 100% doses) (20.00). It was followed by treatment T_{12} (*Azotobacto*r + PSB + PMB + 50 % N + 100% doses of PK) (18.86 cm). (13.53) minimum in control, Besides nitrogen fixing plants reported that *Azotobacter* was found to be synthesizing various growth promoting substances like IBA, NAA, which help in enhancing the root biomass. Similar result was finding conformity by [8]**.**

The maximum number of leaves per plant (600.60) was recorded in treatment T_{13} (Azotobactor + PSB + PMB + 100% doses of NPK) followed by T_{12} (*Azotobactor* + PSB + PMB + 50 % N + 100% doses of PK) (562.83). The minimum number of leaves per plant (327.40) control. The increased production of leaves helps to elaborate more photosynthesis and faster the maturity. The promoting effect of bio with chemical and fertilizer in increasing the number of leaves has been reported by **[9] and [7].**

The bio fertilizer treated plants show earliness in bud initiation. Minimum (53.06) days taken in treatment T_{13} (*Azotobactor* + PSB +PMB + 100% doses of NPK) followed by treatment T_{12} (*Azotobacto*r + PSB + PMB + 50 % N + 100% doses of PK) (54.06) and the maximum in control. (68.11). This may be due to the earlier shift to the flowering phase due to rapid completion of vegetative phase because of availability of more nutrients to the plant by the application of bio-fertilizer and the consequent better vegetative growth. The findings are in conformity with the result of **[2]** while working on African marigold.

The fresh and dry weight of flower (1.07g, 0.81 g) was significantly increased in treatment T_{13} (*Azotobactor* + PSB +PMB + 100% doses of NPK) (1.07 g) followed by T_{12} (*Azotobactor* + PSB +PMB + 50 % N + 100% doses of PK) and the minimum in control. (0.79,0.58). The fresh

and dry weight promoting due to inorganic fertilizer Nitrogen percentage increased reported by**[10].**

Similarly bio fertilizers stimulated the increase in flower size. The combine treatment of T_{13} (Azotobactor + PSB +PMB + 100% doses of NPK) gave the best response due to fixation of phosphorus and potash in soil which is mostly unavailable to crops because of its low solubility. The solublising effect of Azospirillum is generally due to the production of organic acids, vitamins, growth promoting substances like IAA, IBA which help in better growth of plants. The findings are in conformity with the result of **[11]** while working on Crossandra.

Biofertilizers stimulated the increase in number of flowers per plant. The combine treatment of T_{13} (Azotobactor + PSB +PMB + 100% doses of NPK) gave the best response due to fixation of phosphorus and potash in soil which is mostly unavailable to crops because of its low solubility. The solublising effect of Azospirillum is generally due to the production of organic acids, vitamins, growth promoting substances like IAA, IBA which help in better growth of plants. The findings are in conformity with the result of **[11].**

IV. CONCLUSION

From present investigation it is concluded that, in respect of cultivation of petunia (*Petunia hybrida*) under Allahabad condition, the application of treatment T_{13} (Azotobactor + PSB +PMB + 100% doses of NPK) was effective in enhancing plant vegetative growth and quality of petunia (*Petunia hybrida).*

V. FUTURE SCOPES

Establishing an environmental eco-friendly soil ecosystem on earth is of vital importance. In recent years, inorganic fertilizers extensively applied to obtain higher yield. Due to leads to several agricultural problems and poor cropping systems. Farmers use more chemical fertilizers than the recommended levels for many crops. Excessive use of chemical nitrogen fertilizer not only accelerates soil acidification. So that we will use beneficial bacteria and fungi has resulted in the development of a wide range of bio-fertilizers, which satisfied the nutrient requirements of crops and increased the crop yield as well as improve the soil health and human health.

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Table 1 Study on effect of bio and chemical fertilizers on plant height (cm), plant spreading (cm), number of leaves pre plant and number of Branches per plant of petunia *(Petunia hybrida*) plants.

Treatments	Plant height (cm)					Plant spreading (cm)					Number of branches					Number of leaves				
	30th days	60th days	90th days	120th days	150th days	30th days	60th days	90th days	120th days	150th days	30th days	60th days	90th days	120th days	150th days	30th days	60th days	90th days	120th days	150th days
T_1	2.53	5	10.93	19.46	25.6	6.46	12.1	18	35.83	41.51	3.33	4.86	9.53	12.06	13.53	12.4	28.56	135.05	210.03	327.4
T_2	3.93	6.2	15.66	23.06	27.86	6.8	13.2	26.43	37.76	48.49	3.8	5.73	10.66	13.4	16	15.33	36.2	151	255.36	414.93
T_3	4.2	6.63	16.2	23.4	28.4	7.53	13.7	28.56	39.03	50.49	4.46	6.66	11.46	14.4	16.33	17.2	43.03	158.23	267.06	442.93
T_4	3.4	6.36	12.96	21.13	27.2	7.46	12.9	24.6	36.73	47.68	3.26	5.13	10.4	12.6	13.46	12.96	32.73	134.66	241.03	362.6
T_5	3.33	6	14.73	21.66	28	7.54	13.2	25.46	37.26	47.83	3.66	6.4	10.46	12.26	14.2	13.26	34.6	130.83	250.9	372.73
T_6	3.4	6.03	12.6	20.26	26.6	7.06	12.6	25.63	36.46	46.96	3.6	5.13	10.66	13.06	14	13.86	35.1	128.33	239.1	384.96
T_7	3.06	5.73	13.4	21.46	27.46	7.36	12.8	26.03	38	48.16	3.2	6.46	11.06	13.93	15.26	16.36	39.73	140.5	247.16	389.96
T_8	4.1	5.6	14.93	22	27.93	7.23	13.5	28.6	38.56	48.34	3.06	7.2	11	14.6	15.93	19.3	46.13	151.16	274.56	507.83
T_9	4.63	6	15.93	23.53	28.2	7.56	14.2	30.06	39.43	49.23	3.53	7.73	11.73	15.26	18.33	21.33	52.13	153.56	285.93	530.6
T_{10}	4.43	5.66	12.16	19.8	27.13	7.2	13.1	26.46	38.03	46.83	3.46	5.73	10.73	12.06	13.8	19.3	40.83	141.26	247.63	456.4
T_{11}	3.8	6.26	12.86	21.13	26.06	7.4	13.2	26.86	38.33	47.3	4.2	6.2	10.46	12.46	14.26	20.36	44.6	142.66	256.63	468.9
T_{12}	4.76	6.73	16.6	23.73	28.53	8.4	15.5	30.18	40.66	51.8	5.53	7.86	11.86	16.2	18.86	22.06	50.9	161.06	275.93	562.83
T_{13}	5.46	7.3	17.2	25.2	29.8	9.46	16.6	31.86	43.43	54.3	6	8.13	12.26	17.66	20	25.93	58.66	174.33	300.8	600.6
F-test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed. (±)	**0.37**	**0.47**	**0.95**	**0.9**	**0.55**	**0.13**	**0.59**	**0.74**	**0.51**	**0.72**	**0.36**	**0.41**	**0.31**	**0.52**	**0.74**	**0.87**	**2.13**	**4.64**	**5.14**	**21.09**
C.D (P=0.05)	**0.77**	**0.97**	**1.97**	**1.86**	**1.13**	**0.28**	**1.23**	**1.54**	**1.05**	**1.5**	**0.74**	**0.85**	**0.65**	**1.07**	**1.54**	**4.4**	**1.79**	**9.59**	**10.16**	**43.53**

Table 2 Study on effect of bio and chemical fertilizers on flower quality (No of days for 1st flower bud emerge, fresh and dry weight (g), diameter of fully opened flower (cm) and no of flower per plant.

Treatments	No. of days for 1st flower bud emerge	Fresh weight of flower (g)	Dry weight of flower (g)	Diameter of fully opened flower (cm)	Number of flower per plant
T_1	68.11	0.79	0.58	5.68	50.33
T_2	66.88	0.85	0.76	6.80	68.53
T_3	67.08	0.87	0.76	7.46	70.66
T_4	60.20	0.88	0.72	7.26	67.43
T_5	57.73	0.90	0.74	7.56	73.40
T_6	62.66	0.82	0.64	6.43	71.40
T_7	63.46	0.84	0.66	6.60	72.40
T_8	62.20	0.90	0.73	6.97	73.86
T_9	63.66	0.92	0.73	7.53	77.20
T_{10}	57.53	0.89	0.68	7.86	69.53
T_{11}	54.86	0.91	0.74	7.93	71.20
T_{12}	54.06	1.01	0.80	7.83	73.20
T_{13}	53.06	1.05	0.81	8.26	76.93
F-test	**S**	**S**	**S**	**S**	**S**
S.Ed.	**0.85**	**0.017**	**0.014**	**0.32**	**2.10**
C.D S(P=0.05)	**1.77**	**0.035**	**0.030**	**8.26**	**4.34**