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Study on effect of bio fertilizers enhancement growth on tomato

G Sankararmmal[1], T Selva Mohan[2], T Arivukkarasi[3], R Uma maheswari[4]
[1-4] Department of Zoology, Rani Anna Govt College for Women, Abishekapatti, Tirunelveli, Tamil Nadu, India

Abstract
The experiment was conducted on a agricultural land in Melapillayarkulam village, Manur, Tirunelveli, Tamil Nadu, India. The evaluate the effect of some agricultural eco friendly treatments included application of biofertilizers. The most important constraint limiting crop yield in developing nations worldwide, and especially among resources poor farmers, is soil infertility. Therefore maintaining soil quality can reduce the problems of land degradation, decreasing soil fertility and rapidly decline production level that occur in large parts of the world needing the basic principles of good farmers practices. Minerals, organic components and microorganisms are three major solid components of the soil. They profoundly affect the physical, chemical and biological properties. The results showed that, application of biofertilizers significantly increased growth characters.

Keywords: Melapillayarkulam, biological, bio fertilizers, agricultural

Introduction
Tomato (*Lycopersicon esculentum Mill*) is one of the most popular and widely grown vegetable in India. It covers 7.9% of total area grown under vegetable crops and 9% of total vegetable production. The average yield of tomato in India is not according to the crop potential. Various factors are responsible for its low yield, inadequate use of fertilizers is one of them. The crop particularly hybrids have higher requirements of nutrients. Low use of fertilizers and imbalance in NPK application ratio is partially responsible for the low yield. Moreover, complete dependence on chemical fertilizers is not sufficient to sustain the higher yields. Also, due to high cost of inorganic fertilizers, sometimes the margin of profit remains poor. The use of biofertilizers along with inorganic fertilizers may be the right answer to above mention problems. Biofertilizers, which are eco-friendly and more economic, can play an important role in reducing the dependence on chemical fertilizers. Biofertilizers fix appreciable amount of atmospheric nitrogen in soil, enhance plant growth by production of organic acid and growth hormones and make available the complex phosphorus to the plant, which may cause an appreciable reduction in consumption of inorganic fertilizers. Keeping these in view, response of inoculation of biofertilizers on growth and yield of tomato were carried out under field condition. (shashi kamal *et al.* 2018) [19-20].
Biofertilizer is a natural product carrying living microorganisms derived from the root or cultivated soil. So they don't have any ill effect on soil health and environment. Besides their role in atmospheric nitrogen fixation and phosphorous solubilisation, these also help in stimulating the plant growth hormones providing better nutrient uptake and increased tolerance towards drought and moisture stress. A small dose of biofertilizer is sufficient to produce desirable results because each gram of carrier of biofertilizers contains at least 10 million viable cells of a specific strain (Anandaraj and Delapierre, 2010) [1]. These beneficial effects of Azotobacter and *Azospirillum* on plants are attributed mainly to an improvement in root development, an increase in the rate of water and mineral uptake by roots, displacement of fungi and plant pathogenic bacteria and, to a lesser extent, biological nitrogen fixation (Okon and Itzigshohn, 1995) [14].
Microbial interactions in the rhizosphere are one of the main importance for plant growth and health Raaijmakers *et al.*, (2009) [16]. Extensive studies were done for the beneficial effect of fluorescent Pseudomonas as plant growth promotion or biological control bacteria (Couillerot *et al.*, 2009) [3]. Plant beneficial effects by fluorescent pseudomonads include the inhibition of soil pathogen fungi involving production of siderophores (Lemanceau *et al.*, 1992) [12] and antibiotic like substances secondary metabolites (Raaijmakers *et al*., 2002) [16]. The use *Pseudomonas fluorescens* as PGPR and/or biological control agents requires the detailed understanding of its interactions with other bacteria and their performance in soil environment Gotz *et. al*., (2006) [4]. Plant-growth-promoting rhizobacteria (PGPRs) are used as inoculants for biofertilization, phytostimulation and biocontrol (Bloemberg and Lugtenberg, 2001) [2]. Plants can acquire resistance to diseases through various biological agents including necrotizing pathogens, non-pathogens and soil born rhizosphere bacteria and fungi (Van loon *et al*., 1998) [24].
Phosphorous is a one of the most abundant metallic elements found in the earth's crust and is present in the soils in both inorganic and organic forms (Gyaneshwar *et al.*, 2002) [5]. It is utilized or absorbed by the plants in inorganic form i.e. in orthophosphate (H2PO4- and HPO42-) (Hinsinger, 2001) [8]. It has a key role in metabolic processes such as photosynthesis, energy transfer, signal transduction, nitrogen fixation in legumes, crop quality and resistance to plant diseases are the main features associated with phosphorous nutrition (Sperber, 1958a; Khan *et al*, 2014) [22, 10].

Material and Methods
The experiment was conducted on a agricultural land in pillayarkulam village, Manur, Tirunelveli, Tamil Nadu, India. The soil and water samples were analyzed for physico – chemical properties. The field selected for these studies

was uniform in fertility. Collections of biofertilizers (*azospirillum*, phosphobacteria, *pseudomonas fluorescens*). Data were collected on the growth parameters (plant height and number of leaves).

Results and Discussion

Soil and water analysis

The result of the soil analysis is shown in table 1. The soil clay loam soil with organic matter and good moisture retaining properties. Which call for the application of soil amendment like inorganic fertilizer? The pH of 6.5 is within the range of pH considered suitable for vegetables (Tindal, 1983) [23] in which tomato belong. (Kaulniky *et al*. 1981). reported that an increase of N 10-30% due to azospirillum inoculation in field growth plant which similar to our data the azospirillum (98%) applied soil increase of normal soil (84%). (Rabi 2006) reported on the lowering in pH of the medium suggests the organic acids by the P- solubilizing microorganisms which similar to our data phosphobacteria applied soil is lower in pH 7.2 in others. The reported on the experimental soil pH 7.7 with available N-160 kg/ha, P-40.02 kg/ha, K- 384.05kg/ha which similar to our data the pH 7.6 and dissimilar to available maximum N- 98%, P-44%, K-415%. The reported on positive experimental the soil analysis showed clearly that the nutrient status of the soil is low except phosphorus which high therefore, crop response to fertilizer application conditions. Which similar to our data available in control Low level in P-3.0% and applied in biofertilizers the higher level in phosphorus 44%.

The results of the water analysis is shown in table 2. Data reveals on the analysis of water sample of pH 7.3, EC 4.41 (dsm^{-1}), bicarbonate (HCO_{3-}) is 4.9 (meq/L), Chloride is 37.7 (meq/L), sulphate (SO_4^{2-}) is 2.1 (meq/L), Nitrate is nil, Calcium is 10.3 (meq/L), Magnesium is 8.8 (meq/L), Sodium is 27.5 (meq/L), Potassium is 0.30 (meq/L).

Growth parameters

The results of the table 3 and table 4. The date reveals that, all the application of biofertilizers significantly superior over control. However application biofertilizers the increasing growth parameters of plant height and number of leaves in phosphobacteria. Singh and kapoor (1992) [21] and Paratey (2001) reported that phosphate solubilising fungal isolates solubilised more phosphate as compared to phosphorus solubilising bacteria. The effect of biofertilizers treatments on vegetative growth of tomato was significantly higher in single or combined inoculation than control plants. A significant variation in plant height and number of leaves dur to application of biofertilizers was found. (Ramasrishanan and selvakumar 2012) [18] reported on the plant height was recorded at azospirillum 50.52 cm which dissimilar to our data 79 cm and number of leaves per plant control is 110.82 and azospirillum 115.3 which dissimilar to our data 36 in control and Azospirillum 43. Enhancing growth response of tomato (kochakinezhad *et al.,* 2012 [11], Molla, *et al*., 2012; [13] Hernandez *et al*., 2013) [7] were noticed by the application of biofertilizers, increasing plant growth by biofertilizers may be due to increasing number of soil microorganisms living in the soil which working on the organic matter to convert organic form of nutrients such as N to minerals N. Shashi kamal *et al* (2018) [19-20] reported on the final harvest control (114.7cm), Azospirillum (120.2cm), Phosphate solubilising microorganisms (116.9cm) which in dissimilar in our data control (69 cm) and Azospirillum (79cm), Phosphobacteria (84cm). Hasan mohsin Mohammed *et al* (2014) [6] reported on the number of leaves in control 30.14 which similar to our data of control plant 36.

Table 1: Analysis of soil parameters

Soil	EC (dSm^{-1})	pH	Macro nutrients		
			N	P	K
Control	8.2	7.4	84	3.0	345
Azospirillum	1.95	7.4	98	44	415
Pseudomonas fluorescens	0.66	7.6	80	41	339
Phospho bacteria	1.38	7.2	56	39	28.3

Table 2: Examinations of the samples

S. No.	Examination	Result
1.	pH	7.3
2.	E.C (dsm^{-1})	4.41
3.	CO_2^- meq/L)	-
4.	HCO_3^- (meq/L)	4.9
5.	CL^- (meq/L)	37.7
6.	SO_4^{2-} (meq/L)	2.1
7.	NO_3^- (meq/L)	-
8.	Ca (meq/L)	10.2
9.	Mg (meq/L)	8.8
10.	Na (meq/L)	27.5
11.	K (meq/L)	0.30
12.	SAR (meq/L)	8.92

Table 3: Plant height (cm)

Dates	Control	Experimental		
		Azospirillum	Psedudomonas fluorescens	Phospho bacteria
7days	11	12	13	15
14 days	15.4	17.7	19.4	19
21 days	16	19	21	19
28days	18	24	23.5	28
35days	26	29	27	30
42days	28	34.5	33	35.7
49days	28.9	35	38.1	39.1
56days	32	39.7	43.7	40.2
63days	36	42.5	45.4	42.3
70days	40.1	48	46.7	46.3
77days	42.2	54.7	49.1	50.1
84days	50	60	55	57
91days	53	65	60	63
98days	57	68	64	67

105days	60	72	68	75
112days	65	75	74	78
120 days	69	79	80	84

Table 4: Leaves numbers

Dates	Control	Experimental		
		Azospirillum	Psedudomonas fluorescens	Phospho bacteria
7days	3	4	3	5
14 days	5	6	7	8
21 days	8	10	11	12
28days	10	13	14	13
35days	13	15	16	14
42days	14	18	17	18
49days	16	19	18	20
56days	18	20	21	22
63days	20	25	22	24
70days	21	27	24	26
77days	23	29	26	28
84days	25	32	30	33
91days	28	36	34	37
98days	30	37	35	39
105days	32	39	41	40
112days	34	42	43	42
120 days	36	43	44	46

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