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**Vamadeva Angadi**  
Department of Genetics and  
Plant Breeding, Sam  
Higginbottom University of  
Agriculture, Technology and  
Sciences, Allahabad, (U.P) India

**Prashant Kumar Rai**  
Department of Genetics and  
Plant Breeding, Sam  
Higginbottom University of  
Agriculture, Technology and  
Sciences, Allahabad, (U.P) India

**Bineeta M Bara**  
Department of Genetics and  
Plant Breeding, Sam  
Higginbottom University of  
Agriculture, Technology and  
Sciences, Allahabad, (U.P) India

**Correspondence**  
**Vamadeva Angadi**  
Department of Genetics and  
Plant Breeding, Sam  
Higginbottom University of  
Agriculture, Technology and  
Sciences, Allahabad, (U.P) India

## Effect of organic manures and biofertilizers on plant growth, seed yield and seedling characteristics in tomato (*Lycopersicon esculentum* Mill.)

**Vamadeva Angadi, Prashant Kumar Rai and Bineeta M Bara**

### Abstract

The experiment was conducted at Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Allahabad during *Kharif* season of 2016, to study the effects of organic manures and biofertilizers on plant growth, seed yield and seedling characteristics in tomato (*Lycopersicon esculentum* Mill) C.V. Arka vikas. The experiment was laid out in a randomized complete block design at spacing 60 cm × 40 cm with 3 replication having 8 treatments comprised of farmyard manure, poultry manure and biofertilizers (*Azospirillum* and P-solubilizing bacteria) with recommend dose of fertilizer. The observations were recorded on different growth, yield and seedling attributes. Among eight treatments under study, treatment T<sub>7</sub> (Biofertilizers with RDF) was recorded maximum plant height (53.08, 87.23 and 136.24 cm), number of leaves per plant (90, 139.13 and 132.40) at 30,60 and 90 days after transplanting respectively and shows minimum days to 50% flowering (37.77). The yield parameters like number of fruits per plant (31.13), fruit weight per plant (1.35 kg), number of seeds per fruit (81.93), seed yield per plant (3.04 g), seed yield per plot (36.58 g) and seed yield per hectare (97.55 kg) recorded highest in treatment T<sub>7</sub> (Biofertilizers with RDF) followed by T<sub>6</sub> (Biofertilizers with 50% PM + 50% FYM). The treatment T<sub>7</sub> recorded highest 1000 seed weight (2.89 g), germination (85.66 %), shoot length (9.98 cm), root length (8.97 cm), dry weight of seedling (26.04 mg) and seedling vigour index (1625.29) followed by T<sub>6</sub>.

**Keywords:** Tomato, Biofertilizers, FYM, Poultry manure, RDF, Growth, seed yield

### 1. Introduction

Tomato (*Lycopersicon esculentum* Mill.) belongs to family solanaceae having chromosome number (2n=24). It is self-pollinated crop and Peru-equator is the centre of origin. Tomato is one of the popular vegetables of great commercial value and is used in various forms. It contains higher quantity of total sugar (2.5-4.5%), starch (0.6-1.2%) and minerals like potassium, calcium, sodium, magnesium, phosphorus, boron, manganese, zinc, copper, iron, etc. Apart from this it also contains organic acids such as citric, malic and acetic acid which are known as health acids in fresh tomato fruit. Nearly 144 countries are involved in Tomato production. Among them major production countries are China, EU, India, US and Turkey, with China accounting for 31% of the total world production followed by India. In India it occupying an area of 791 thousand ha, with production of 17398 thousand tons with an average yield of 22 t/ha (Horticulture statistics data, 2014-15 Government of India).

Organic farming is a production system which avoids or largely excludes the use of synthetically produced fertilizers, pesticides, growth regulators and livestock feed additives. It is well known fact that increased dependence on agro chemicals including fertilizers has led to several ill effects on the environment and also results in decrease of soil fertility. Application of organic manure play an important role on yield and its attributes as well as nutrient uptake and directly increase the soil physical condition. It lowers soil bulk density, Increases water holding capacity, CEC, build up beneficial soil microbes, improve good soil structure and enhance stable soil aggregates (Doran, 1995; Drinkwater *et al.*, 1995) [5, 4]. Use of biofertilizer and organic manure in agriculture is becoming popular nowadays for not only in order to reduce the cost of chemical fertilizers but also to decrease the adverse effects of chemical fertilizers on soil and plant environment and to ensure more crop productivity (Verma and Schuepp, 1995) [17]. In many situations combination of organic and inorganic fertilizers have produced higher yields than alone (Blackshaw, 2005) [3]. Hence, the present investigation was carried out to study the response of organic manure and biofertilizers on plant growth, seed yield and seedling characteristics in Allahabad.

## Materials & Methods

The present investigation was carried out at the field Experimentation Centre, Department of Genetics and Plant Breeding and lab studies in post-graduation Seed Testing Laboratory, Sam Higginbottom university of Agriculture Technology and Sciences, Allahabad during *kharif* season 2016-2017. The experiment was laid out in randomized complete block design (RCBD) at spacing 60 × 40 cm with three replication and eight treatments which comprised of organic manures (farmyard and poultry manure) and biofertilizers (*Azospirillum* and PSB) and their combinations (Table 1). Two biofertilizers were inoculated as root dip of

seedlings and soil application. Five plants were randomly tagged in each treatment as per replication and data was recorded according to growth, yield and seedling characteristics attributes *viz.* plant height (cm), number of leaves per plant at 30, 60 and 90 days after transplanting, days to 50% flowering, number of fruits per plant, fruit Weight per plant (kg), number of seeds per fruit, seed yield per plant (gm), seed yield per plot (gm), seed yield per hectare (kg), 1000 seed weight (g), germination %, shoot length (cm), root length (cm), seedling dry weight (mg) and seedling vigour index.

**Table 1:** Detail of treatments used in the present study

Sr. No	Treatment code	Treatment detail
1	T <sub>0</sub>	Control
2	T <sub>1</sub>	Without bio fertilizer with FYM
3	T <sub>2</sub>	Without bio fertilizer with poultry manure
4	T <sub>3</sub>	Without bio fertilizer with 50% poultry manure + 50% FYM
5	T <sub>4</sub>	Biofertilizer with FYM
6	T <sub>5</sub>	Biofertilizer with poultry manure
7	T <sub>6</sub>	Biofertilizer with 50% poultry manure + 50% FYM
8	T <sub>7</sub>	Biofertilizer with RDF

Farm yard manure (FYM) – 12 t/ha, Poultry manure 7 t/ha, Biofertilizers – 2.5 kg/ha each and RDF (60:50:30) NPK/ha

## Results & Discussion

### Growth characters

The data related to different growth characters shows significant variation among the different treatments under investigation (Table 2). The significant difference in plant height at different stages were noticed. The treatment having (biofertilizer with RDF) Shows the maximum plant height (53.08, 87.23 and 136.24 cm) at 30 DAT, 60 DAT and 90 DAT respectively, followed by T<sub>6</sub> (Biofertilizers with 50 % FYM + 50 % Poultry manure). Effect of organic manure and biofertilizers in tomato the data regarding plant height was significantly best in biofertilizers with RDF among all treatment. These results are in conformity with the findings of P Geetharani, *et al* (2014)<sup>[6]</sup>. The T<sub>7</sub> recorded highest number of leaves per plant (90, 139.13 and 132.40) at 30, 60 and 90 DAT respectively, Followed by T<sub>6</sub>. The control shows longer days to 50 % flowering (45.66) while, T<sub>7</sub> recorded (37.77) minimum number of days to 50% flowering compare to other treatments. The recommended dose of fertilizer with biofertilizers recorded significantly higher values for growth parameters. It is because RDF attributed to the quick and readily availability of major nutrients to plants at earlier stages of plant growth. These results are reported by Sharma (1995)<sup>[12]</sup> in tomato, Wange (2004)<sup>[18]</sup> in brinjal.

### Yield characters

Significant variation was recorded among different treatment combinations for yield attributing characters (Table 3). In the current investigation T<sub>7</sub> (Biofertilizer with RDF) recorded maximum number of fruits per plant (31.13) and fruit weight per plant (1.35 kg) followed by T<sub>6</sub> while control shows lowest values (17.53 and 0.78 kg). It is due to adequate mother plant nutritional balance responsible for enhanced pollen germination ultimately increasing the fruit set. Identical reports were recorded in brinjal, Swamy and Subba rao (1992)<sup>[15]</sup> in chilli. Among various treatment combinations T<sub>7</sub> (Biofertilizer with RDF) recorded maximum number of seeds per fruit (81.93), seed yield per plant (3.04 g), seed yield per plot (36.58 g) and seed yield per hectare (97.55 kg) followed by T<sub>6</sub> (Biofertilizer with 50% poultry manure + 50% FYM)

and minimum values were recorded in T<sub>0</sub> (Control). Seed yield and quality are more imported than total biological yield which results from different combination of many physiological process based on the environment under which crop is grown The increased seed yield was obtained in biofertilizers application (*Azospirillum* and P-solubilizing bacteria) could be attributed to the growth hormones like AA and cytokinin produced by *Azospirillum* which stimulated root morphology. This in return, would have improved assimilation of nutrients and thus seed yield.

Increase in seed yield and its components may be attributed due to increase in seed weight per fruit as a result of improvement in seed number due to adequate plant nutrition. On the other hand, treatment next to control, FYM without biofertilizers recorded lower yield and yield attributing characters as compare to other treatments. This might due to low nutrient supply than that was needed by crop through treatment results were also reported by Suthar *et al.* (2005) in brinjal, Raj *et al.* (2001)<sup>[10]</sup> in brinjal, Thamizh and Nanjan (1998)<sup>[16]</sup> in potato, Kropisz (1992)<sup>[7]</sup>, Oikeh and Asiegbu (1993)<sup>[8]</sup>, Riazuddin (1993)<sup>[11]</sup> (1995) in tomato.

### Seedling characters

The data revealed that the combination of different organic manures and biofertilizers effected seedling parameters of tomato as shown in (Table 4). Among various combination of treatments T<sub>7</sub> (Biofertilizer with RDF) showed maximum 1000 seed weight (2.83), germination (85.66 %), shoot length (9.98 cm), root length (8.97 cm), seedling dry weight (26.04 mg) and seedling vigour index (1625.29) followed by T<sub>6</sub> (Biofertilizer with 50% poultry manure + 50% FYM) while, minimum readings were recorded in T<sub>0</sub> (Control). Increased in seedling parameters is due to increase in availability of essential nutrients like N and P available in the presence of biofertilizers. Minimum values due to lack of availability of sufficient nutrients similar findings were reported in Shashidhara (2000)<sup>[13]</sup>, In chilli, Geetharani (2014)<sup>[6]</sup> and, Rahman *et al.* (1996)<sup>[9]</sup> in tomato.

**Table 2:** Effect of organic manures and bio-fertilizers on growth characters in Tomato

Treatment Code	Plant height (cm) at			Number of leaves at			Days to 50% flowering
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	
T <sub>0</sub>	26.72	66.38	96.37	45.86	75.53	72.60	45.66
T <sub>1</sub>	29.78	70.51	104.32	53.13	85.13	78.40	44.66
T <sub>2</sub>	32.17	73.92	107.16	58.53	97.66	90.86	43.88
T <sub>3</sub>	35.99	75.30	108.93	66.40	108.66	101.06	43.11
T <sub>4</sub>	39.09	78.05	116.53	74.86	117.66	111.13	42.55
T <sub>5</sub>	44.14	81.43	124.55	80.06	124.46	121.6	41.55
T <sub>6</sub>	47.07	83.84	131.69	86.00	132.06	127.8	39.66
T <sub>7</sub>	53.08	87.23	136.24	90.00	139.13	132.4	37.77
SE.d	0.75	0.57	0.68	1.23	2.44	1.17	0.37
CD	161	1.22	1.46	2.63	5.23	2.52	0.80

**Table 3:** Effect of organic manures and bio-fertilizers on yield characters in Tomato

Treatment Code	Number of fruits per plant	Fruit weight kg/plant	Number of seeds per fruit	Seed yield per plant (g)	Seed yield per plot (g)	Seed yield per hectare (kg)
T <sub>0</sub>	17.53	0.78	66.53	2.71	32.54	86.78
T <sub>1</sub>	19.26	0.86	70.20	2.78	33.39	89.04
T <sub>2</sub>	21.60	0.97	71.26	2.81	33.72	89.91
T <sub>3</sub>	22.86	1.04	72.26	2.84	34.15	91.07
T <sub>4</sub>	24.73	1.16	75.93	2.89	34.68	92.50
T <sub>5</sub>	26.46	1.25	78.73	2.92	35.04	93.43
T <sub>6</sub>	29.20	1.28	80.33	2.97	35.68	95.16
T <sub>7</sub>	31.13	1.35	81.93	3.04	36.58	97.55
SE.d	0.34	0.02	0.39	0.01	0.16	0.42
CD	0.72	0.04	0.83	0.03	0.34	0.91

**Table 4:** Effect of organic manures and bio-fertilizers on seedling characters in Tomato

Treatment Code	1000 seed weight (g)	Germination (%)	Shoot length (cm)	Root length (cm)	Dry weight of seedling (mg)	Seedling vigour index-I
T <sub>0</sub>	2.18	78.33	5.36	4.40	17.05	764.71
T <sub>1</sub>	2.32	79.66	6.21	5.28	17.44	915.83
T <sub>2</sub>	2.42	80.00	6.71	5.78	18.80	999.73
T <sub>3</sub>	2.52	81.33	7.26	6.33	20.25	1105.80
T <sub>4</sub>	2.50	81.66	7.78	6.91	22.44	1199.99
T <sub>5</sub>	2.64	84.33	8.36	7.56	25.02	1343.07
T <sub>6</sub>	2.81	85.00	9.48	8.51	25.74	1529.71
T <sub>7</sub>	2.83	85.66	9.98	8.97	26.04	1625.29
SE.d	0.018	0.28	0.11	0.11	0.19	16.63
CD	0.053	0.86	0.35	0.33	0.57	49.88

## Conclusion

From present investigation, it can be concluded that tomato crop receiving the recommended dose of fertilizers (60:50:30 kg NPK/ha) along with the biofertilizers (Azospirillum + P solubilizing bacteria 2.5kg/ha) recorded superior plant growth, yield and seedling parameters which was followed by combination of FYM 50% (6t/ha) + poultry manure 50% (3.5 t/ha). The treatments with biofertilizers recorded higher values compare to without biofertilizers.

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