



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(3): 180-184

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Received: 06-03-2019

Accepted: 10-04-2019

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International Journal of Chemical Studies

Response of bio-enhancer on growth and yield of tomato [*Solanum lycopersicum* (L.) Mill]

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Abstract

A field experiment entitled with Response of Bio-enhancer on growth and yield of tomato [*Solanum lycopersicum* (L.) Mill] was conducted at the Research field, Department of Horticulture, School of Agriculture, ITM University Gwalior (M.P.) during the year 2014-15. The soil type of experimental field was sandy loam in nature with 139.5, 23.45, 246.80 kg/ha available NPK, respectively. The pH, EC and OC % of experimental field were 7.8, 0.40 dsm⁻¹ and 0.31 %, respectively. The experimental was laid out in Factorial Randomized Block Design with three replication. Two factor at three levels viz Panchgavya (P₀: 0 %, P₁: 2 %, P₂: 4 %) and Jiwamrita (J₀: 0 %, J₁: 20 %, J₂: 30 %) were used as a treatment. Growth parameter, yield and yield attributes were studied in the experiment. The result revealed that spray of 4% panchgavya gave higher growth and yield attributing character, fruit yield compared to other panchgavya treatments. Among jiwamrita application of 30% spray of was found effective for the obtaining higher growth, yield attributes and fruit yield of tomato.

Keywords: Bio-enhancer, jiwamrita, panchgavya, and tomato

Introduction

Tomato (*Solanum lycopersicum* mill) belong to family Solanaceae, having chromosome number 2n = 24. According to Indian Horticulture Database (NHB) 2013-14 tomato is one of the important vegetable crops, grown in 882.03 thousand ha area with 18735.91 ton production. Tomato plays a vital role in Indian economy by virtue of its various mode of consumption as fresh and processed forms and their perennial demand. It is also important vegetable because of its high nutritive value and wide consumption. Tomato are used directly as raw vegetables in sandwich, salad etc. Several processed items like paste, puree, soup, juice, ketchup, drinks, whole peeled tomato etc. are prepared on a large scale. It is a very good appetizer and its soup said to be good remedy for patients suffering from constipation.

In India, organic farming was a well developed and systematized agricultural practice during the past and this 'ancient organic' obtained through Indian knowledge systems such as *Vedas* specify the use of various preparation in agriculture for improving soil and plants health and protective measure against plant diseases. These organic preparations have been termed as bio enhancer are organic preparation obtain by active fermentation of animal and plant residues over specific duration. These are resource of microbial consortia, macro, micronutrients and plant growth promoting substances including immunity enhancer. In general these are utilized to treat seed / seedling, enhance decomposition of organic materials thereby enrich soil and induce plant vigour.

Bio-enhancers such as Amritpani, Dasagavya, Beejamruth, Panchgavya etc. are used by the farming community and number of organization to improve production, productivity and quality of produce besides improving soil health.

Panchgavya is a special bio-enhancer prepared from five products obtained from cow i.e. Dung, urine, milk, curd and ghee. When these are properly mixed and incubated for recommended period are ready fermented solution has miraculous effect of crops preparation in reach in nutrients, auxins, gibberellins, and microbial fauna and acts as tonic to in reach soil induce plant vigor with quality production.

Jiwamirta is prepared by fermenting cowdung cow urine, jiggery, pulse flour and vergin soil and other simple facilities created in village with minimum expenditure. Credit for development of recipes for Jiwamirta and its extensive use goes to Palekar (2006)^[10] a strong

promoter of natural farming. Jiwamrita is a rich bio-formulation contains consortia of beneficial microbes.

It is an age old concept that is being practiced traditionally in agriculture. Now days, it has acquired a better position due to the need for continued increase in agricultural produces along with shrinking land resources. At present most of the soluble fertilizer are important in the country and these are very expensive beyond the reach of the common farmers soluble fertilizer are not available for number of nutrients. Therefore change in the mind set is required for addressing this issue. After working for a decade scientist are of the view that bio enhancer could be cheap and alternative for to resolve many issues. In addition to this, it also restores and sustains soil fertility and productivity. Not only this, the economy of production can be increased and fertilizer use efficiency may also be pushed up which ultimately affects the physical and biological environment of the soil for sustainable production. Therefore considering the above fact there is a need to judge the Response of Bio-enhancer (Panchgavya, Jiwamrita) on growth and yield of tomato [*Solanum lycopersicum* (L.) Mill

Materials and Methods

The present investigation entitled “Response of Bio-enhancer on growth and yield of tomato [*Solanum lycopersicum* (L.) Mill]” was conducted at the Research field, Department of Horticulture, School of Agriculture, ITM University Gwalior (M.P.) during the year 2014-15. The soil type of experimental field was sandy loam in nature with 139.5, 23.45, 246.80 kg/ha available NPK, respectively. The pH, EC and OC % of experimental field were 7.8, 0.40 dsm⁻¹ and 0.31 %, respectively. Before ploughing of the experimental field, a light irrigation was given. As soon as the field came into field capacity, a deep ploughing with the help of disc plough was done and again ploughed twice with cultivator followed by planking in order to break the clods as well as to make the soil pulverize. Before preparation of layout weeds and stubbles and other grasses were removed manually to make the soil free from off all material and weeds etc. The experimental was laid out in Factorial Randomized Block Design with three replication. Two factor at three levels viz Panchgavya (P₀: 0 %, P₁: 2 %, P₂: 4 %) and Jiwamrita (J₀: 0 %, J₁: 20 %, J₂: 30 %) were used as a treatment. The component of Panchgavya and Jiwamrita were as:

Panchgavya

Earthen Pot:	2 Kg
Cow Dung:	5 Kg
Cow Urine:	5 liter
Sugarcane juice:	5 liter
Cow Ghee:	200 gm
Cow Curd:	250 gm
Cow milk:	250ml
Banana Riped:	6
Yeast:	50 gm

Jiwamitra

Cow dung:	5 kg
Cow urin:	5 liter
Jigger:	250gm
Pulse flour:	250gm

The seed of Dhanya, S-22 were used for raising seedling. Seed were sown in the nursery bed on September 2014. Seed were treated with Thiram @ 2 g/kg of seed before sowing in

nursery bed. Treated seeds were sown in well prepared raised bed by opening the miniature furrows at 5 cm distance; after sowing the seeds, miniature furrows were covered with a light film of well rotten farm yard manure. After covering the seed, a light irrigation was given with the help of watering cane and dry grasses were used mulch to cover the beds. Just after germination of seeds, the mulch from the beds were removed and irrigated when required. Recommended dose of fertilizer i.e., NPK @ 120:80:60 Kg ha⁻¹ was applied in all treatments. Panchgavya and Jiwamitra were spray on the basis of required treatment. Full dose of phosphorus, potassium and ½ dose of nitrogen applied as basal application in marked plots respectively. Remaining, ½ nitrogen was applied as top dressing in two equal doses at 30 and 45 days after transplanting. The spray of Panchgavya and Jiwamrita were practiced a 20 days after transplanting. Total 600 liter /ha water were used for spray the bio enhancer. Three weeding followed by hoeing were done manually after 30 and 45 days of transplanting. To protect the crop from insects and diseases spray of Rogor (0.05%) and Dithane M-45 (0.25%) were done, respectively. Pickings of half ripe fruits of tomato were done carefully. There were six picking in entire crop period. Growth attributes, yield and yield attributes were recorded from five tagged plants. Statistical analysis of data recorded in all observations was computed by method of analysis of variance and treatments were compared with the help of vertical difference as suggested by Panse and Sukhatme (1989) [11].

Results and Discussion

Growth Parameters

Effect of Panchgavya

Growth attributes viz. height of plant (cm), number of branches plant⁻¹ and plant spread (cm) was significantly influenced at all the stages of observation due to panchgavya spray. Significantly higher plant height was recorded under P₂ (4% spray of panchgavya), while lower was found in P₀ (no spray of panchgavya) at 30 and 60 DAT and at harvest respectively. The growth in plants may be attributed to the spray of panchgavya. Its positives effect on growth and productivity of crops has been reviewed and documented by many workers (Pathak and Ram, 2013). Chemical analysis revealed that panchagavya possess almost all macro, micronutrients and growth promoting hormones (IAA, GA) required for plant growth (Selvaraj *et al.* 2006) [15]. The Similar findings supported by previously finding of Yadav and Tripathi (2013) who reported that plant height significantly increased with application of panchgavya over control in black gram. Maximum number of branches and plant spread were registered under treatment P₂ (4% spray of panchagavya). However, treatment P₁ also gave significantly higher values of all these growth parameters over P₀ (no spray of panchagavya) at all the stages. The possible reason for higher growth characters might be due to the growth enzyme present in panchagavya which favoured rapid cell division and multiplication. Due to presence of macro (N,P,K and Ca) and micro (Zn, Fe, Cu, Mn) nutrients and bio agents such as *Azospirillum*, *Azotobacter*, *Phosphobacteria* and *Pseudomonas* (Yadav and Lourduraj, 2005), growth promoting enzymes along with essential plant nutrients (Vasumathi, 2001; Perumal, *et al.*, 2006; Swaminathan, 2005., Sreeni vas, *et al.*, 2011) [19, 13, 17, 16]. Similar results were also obtained by Tharmaraj *et al.* (2011) [18] and Sanjutha *et al.* (2008) [17].

Effect of Jivamrita

Growth character viz. height of plant (cm), number of branches plant⁻¹, plant spread (cm) were found to maximum on the plant treated with jivamrita. Jenny and Malliga (2014) [3] reported that the use of jivamrita organic manure in tomato

induces morphological parameters such as shoot length, shoot width, number of leaves, number of branches, number of flowers, shoot fresh and dry weight, root fresh and dry weight, and also gave good yield of tomato (*Solanum lycopersicum* L.) plant as compared to control.

Table 1: Effect of different level of panchgavya and jivamrita on plant height, no of branches, plant spread, no of flowers, no of fruits and fruit size.

Treatments	Plant height cm. at			No of branches/plant			Plant spread			No of Flower/Plant		No of Fruits/Plant		Fruit size
	30	60	Harvest	30	60	Harvest	30	60	Harvest	60	Harvest	60	Harvest	
Panchgavya%														
(0)	26.06	40.22	58.28	2.68	3.80	3.94	17.02	24.00	29.09	11.27	11.43	7.79	8.03	3.51
(2)	33.18	49.96	66.91	4.46	5.26	5.40	27.10	36.13	40.63	12.52	12.74	9.53	9.77	5.03
(4)	36.23	55.22	74.03	4.94	5.89	6.00	30.87	40.24	44.13	13.10	13.28	10.72	10.93	5.63
SEm±	0.54	0.62	0.59	0.06	0.09	0.09	0.50	1.00	0.56	0.15	0.13	0.15	0.14	0.08
C.D. at 5%	1.61	1.87	1.76	0.23	0.27	0.27	1.50	3.00	1.68	0.46	0.39	0.46	0.43	0.23
Jivamrita%														
(0)	27.37	42.58	61.00	2.93	4.26	4.41	18.80	33.83	32.17	11.54	11.62	7.94	8.22	3.92
(20)	32.84	49.23	67.82	4.48	5.27	5.39	26.61	43.47	39.68	12.50	12.73	9.88	10.03	4.93
(30)	35.26	53.59	70.40	4.68	5.42	5.54	29.68	44.08	42.01	12.84	13.10	10.22	10.48	5.32
SEm±	0.54	0.62	0.59	0.06	0.09	0.09	0.50	1.00	0.56	0.15	0.13	0.15	0.14	0.08
C.D. at 5%	1.61	1.87	1.76	0.23	0.27	0.27	1.50	3.00	1.68	0.46	0.39	0.46	0.43	0.23
Interaction	S	S	S	S	NS	NS	S	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of different level of panchgavya and jivamrita on av. fruit wt., fruit yield, days to first flower initiation, days to fruit setting and days to edible fruit production.

Treatments	Av. Fruit wt. (g)	Fruit Yield	Days to First Flower Initiation	Days to Fruit Setting After Flowering	Days to Edible Fruit Production After Flowering
Panchgavya%					
(0)	37.98	24645	52.78	11.99	16.06
(2)	47.23	31612	48.00	11.52	15.38
(4)	53.72	34497	44.67	10.65	14.88
SEm±	0.68	0.78	0.41	0.16	0.064
C.D. at 5%	2.05	2.34	1.22	0.48	0.19
Jivamrita%					
(0)	38.88	25541	52.33	11.95	16.01
(20)	48.57	30880	47.56	11.17	15.27
(30)	51.49	34334	45.56	11.04	15.03
S.E.m±	0.68	0.78	0.41	0.16	0.064
C.D. at 5%	2.05	2.34	1.22	0.48	0.19
Interaction	NS	S	S	N	N

Yield and yield attributes

Effect of Panchgavya

Yield attributes and yield were also significantly differed due to panchgavya application. Maximum days of first flower initiation were noted with treatment P₀, while minimum days to first flower initiation were registered in treatment P₂. Spray of panchagavya significantly increased number of flowers per plant, number of fruit per plant, size of fruit and weight of fruit per plot as compared to control plot (P₀). Treatment P₂ (4% spray of panchgavya) gave significantly higher number of flowers, number of fruits, size of fruit and weight of fruit followed by P₁ (2% spray of panchgavya). The significant improvement in yield attributes to increased supply of plant nutrient with the application of panchgavya. Improved nutrient ion present in foliar sources might be facilitated greater leaf area production that resulted in larger interception of light thereby improving dry matter productivity. Apart from nutrient supply, panchgavya contains proven biofertilizer, such as *Azospirillum*, *Azotobacter*, *Phosphobacter*, *Pseudomonas* that played important role in stimulation of plant growth by secreting IAA and GA₃ (Mahalingam and Sheela, 2003) [5]. Higher weight of fruit with foliar spray of panchgavya was attributed to increased

crop growth and translocation of more carbohydrates towards developing fruits. Increased allocation of food material to fruit in turn enhanced the fruits weight. Highest fruit yield of tomato was found with treatment P₂, followed by P₁ and both treatments were significantly superior over P₀ but significantly differed to each other. It may possible due to significantly improvement in growth and yield attributes of the plant that lead to increased yield. These results accordance of finding of Mohan (2008) [7], who reported that yield of tomato significantly increased with spray of panchgavya as compared to control.

Table 3: Interaction effect of panchgavya and jivamrita on fruit yield and plant height

Treatments	Fruit Yield (kg ha ⁻¹)			
	P ₀	P ₁	P ₂	Mean
J ₀	19839	27454	29331	25541
J ₁	24875	32339	35426	30880
J ₂	29222	35044	38735	34334
Mean	24645	31612	34497	
S.E.(m)±		1.35		
C.D. (at 5%)		4.04		

Treatments	Plant height								
	30			60			At harvest		
Jiwamrita spray %	Panchgavya (%)			Panchgavya (%)			Panchgavya (%)		
	P ₀ (0)	P ₁ (2)	P ₂ (4)	P ₀ (0)	P ₁ (2)	P ₂ (4)	P ₀ (0)	P ₁ (2)	P ₂ (4)
J ₀ (0)	19.80	31.20	31.10	26.33	36.30	35.10	55.30	62.23	65.47
J ₁ (20)	28.27	33.10	37.17	30.47	39.47	47.77	58.77	67.30	77.40
J ₂ (30)	30.10	35.23	40.43	33.87	44.10	52.80	60.77	71.20	79.23
SEm±	0.93			1.08			1.02		
C.D. at 5%	2.79			3.23			3.05		

Table 4: Interaction Effect of Panchgavya and Jiwamrita on no of branches, plant spread and days to first flower initiation

Treatments	No of branches/ plant at 30 DAT				Plant spread at 30 DAT				Days to First Flower Initiation			
	P ₀	P ₁	P ₂	Mean	P ₀	P ₁	P ₂	Mean	P ₀	P ₁	P ₂	Mean
J ₀	0.75	3.80	4.23	2.93	8.23	22.43	25.73	18.80	55.33	54.00	47.67	52.33
J ₁	3.60	4.67	5.17	4.48	19.40	28.00	32.43	26.61	53.00	45.33	44.33	47.56
J ₂	3.70	4.90	5.43	4.68	23.43	30.87	34.73	29.68	50.00	44.67	42.00	45.56
Mean	2.68	4.46	4.94		17.02	27.10	30.97		52.78	48.00	44.67	
SEm±	0.13				0.86				0.71			

Effect of Jiwamrita

Yield attributes viz. days of first flower initiation, number of flowers and fruits per plant, size of fruit (cm²), weight of fruit (g /plant as well as q/ha) were significantly increased due to jiwamrita spray. Significantly higher values of all these growth and yield attributing characters were recorded under J₂ (30% spray of jiwamrita), followed by J₁ (20% spray of jiwamrita) and both these treatments were found significantly superior over J₀ (no spray of jiwamrita) at different stages of observations. Yield of tomato significantly enhanced with application of jiwamrita over control. Significantly higher yield of tomato was obtained under treatment J₂ followed by J₁. However, both these treatments significantly differed to each other but found significantly as compared to J₀ (control). The reason for the effectiveness of Jeevamrit may be due to the fact that Jeevamrita is a rich bio-formulation contains consortia of beneficial microbes. These results are in line with the finding of Chadha *et al.* (2012) [1], who reported that jiwamrita as foliar spray quite effective in enhancing productivity of different crops and efficacy against various plant pathogens. Similar results were also obtained by Vasumathi (2001) [19], Mohan (2008) [6], Tharmaraj *et al.* (2011) [18] and Sanjutha *et al.* (2008) [17].

Conclusion

On the basis of above findings, it may be concluded that spray of 4% panchgavya gave higher growth and yield attributing character, fruit yield compared to other panchgavya treatments. Among jiwamrita, application of 30% spray of was found effective for the obtaining higher growth, yield attributes and fruit yield of tomato.

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