



Influence of Panchgavya and Jeevamrit on Growth, Yield and Quality of Tomato (*Solanum lycopersicum* L.)

Premprakash Singh^{a*}, Deepanshu^{a#} and Urfi Fatmi^{a#}

^a Horticulture (Vegetable Science), Sam Higginbottom University of Agriculture Technology and Sciences, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted on "Influence Of Panchgavya And Jeevamrit On Growth, Yield And Quality Of Tomato (*Solanum Lycopersicum* L.)" during the period of October 2021 to March 2022 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom, University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh). The experiment was planned in a factorial randomized block design (FRBD) with three replications and nine treatments which comprised of T₀-(RDF only), T₁-(RDF + 2.5% Spray of Panchgavya), T₂-(RDF + 4.5% Spray of Panchgavya), T₃-(RDF + 7.5% spray of Jeevamrit), T₄-(RDF + 10.5% spray of Jeevamrit), T₅-(RDF + 2.5% Spray of Panchgavya+7.5% spray of Jeevamrit), T₆-(RDF + 4.5% Spray of Panchgavya+10.5% spray of Jeevamrit), T₇-(RDF + 2.5% Spray of Panchgavya+10.5% spray of Jeevamrit), T₈-(RDF + 4.5% Spray of Panchgavya+7.5% spray of Jeevamrit), The treatments comprised of two different levels of panchgavya and jeevamrit in which the recommended dose of fertilizer (RDF N:P:K::120:100:80) was common and based on the interaction of both the bio-fertilizer various observations were recorded on various growth, quality and yield contributing characters. Based on the results obtained from the present investigation, it is concluded that the interaction of panchgavya 4.5% and jeevamrit 10.5% that is treatment T₈ was superior followed by the interaction of panchgavya 4.5% and jeevamrit 7.5% that is treatment T₆. In

^o Students of MSc (Ag);

[#] Assistant Professor;

*Corresponding author: E-mail: singhprem3438@gmail.com;

this investigation, the T8 was found most suitable for cultivation and getting better yield per hectare of tomatoes and best returns in terms of the economics of the crop with high net returns and Benefit-cost ratio.

Keywords: Tomato; panchgavya; jeevamrit.

1. INTRODUCTION

One of the most important vegetables in the world, the tomato (*Solanum lycopersicum* L.) is a very popular plant species and belongs to the Solanaceae family with chromosome number $2n = 24$ native to Peru. Tomato has great economic importance all over the world. Tomato ranks 7th position in worldwide production after maize, rice, wheat, potatoes, soybeans and cassava. According to World Atlas; [1] the total worldwide production of tomatoes was around 170.8 million tons in 2017, which covers around 5.02 million hectares of farming area. China being the leading production hub of tomatoes in the world, which accounted for 31% of the total produce. Tomatoes are the major dietary source of potassium and antioxidants such as ascorbic acid, vitamin A, lycopene and Tocopherols, that has been linked to several health benefits for human.

Organically grown fruits, vegetables, spices, useful plants, medicinal plants, aromatic plants, etc. have a longer shelf life than products grown by traditional methods. Sustainable agriculture practices can effectively prevent the invasion of pesticides and toxins into the food chain and soil and water pollution. It is used in a combination of ecologically sound modern techniques. Organic farming, although not its orthodox version, may be acceptable to farmers [2,3].

Since cattle have played an important role in the field of agriculture since Vedic times, Panchgavya and Jeevamrit can not only reduce farmers' sole dependence on synthetic fertilizers, pesticides and insecticides but also improve the microflora in the soil. It contains millions of microorganisms that help restore the soil, thus bringing new life to the soil. Using naturally prepared liquids like Jeevamrit and Panchagavya improves plant growth, yield and quality. These liquid solutions are prepared from cow dung, urine, milk, cottage cheese, ghee, legume flour, and jaggery. They contain macronutrients, essential micronutrients, many vitamins, essential amino acids, growth-promoting factors such as IAA, GA, and beneficial microorganisms [4,5,6]. Panchagavya and Jeevamrit are

inexpensive, eco-friendly organic supplements made from cow products such as cow manure, urine, milk, curds and ghee. Panchagavya is a powerful plant growth promoter that improves the biological efficiency of crops. It is used to rejuvenate the soil, protect plants from disease, and enhance the nutritional value of fruits and vegetables. It is used for foliar spraying, soil spraying combined with irrigation water, seedling treatment, etc. Panchagavya is best suited for foliar application. Jivamrit promotes bioactivity in the soil and provides the nutrients needed for the harvest.

1.1 Formulation of Panchgavya and Jeevamrit

1.1.1 Preparation of jeevamrit

It can be easily prepared by mixing 20 kg fresh cow dung, 20 liter fresh cow urine, 4 kg pulse flour and 1 kg jaggery in 200 liters of clean water and mixing all the ingredients thoroughly in a barrel. For the fermentation process, keep this solution for 5- 10 days. Three times a day, regularly stir the solution with the help of a wooden stick. After the fermentation process, Jeevamrit solution will be ready to use in plants. The ready solution of Jeevamrit can be applied through either sprinkler, on the soil or with foliar application [2] (Pathak and Ram, 2007).

1.1.2 Preparation of panchgavya

The procedure for the preparation of Panchagavya was outlined by Selvaraj (2006), that can be easily prepared by mixing 7 kg of fresh cow dung, 10 litres of fresh cow urine, 3 liters of cow milk, 1 kg of desi ghee, 2 litres of curd, 3 litres of tender coconut water, 3 kg Jaggery, 10 liters fresh water and 12 number of well-ripened banana. First, mix fresh cow dung and ghee of desi cow in a plastic container and mix exhaustively two times a day and keep separate for 3 days. After 3 days, mix fresh cow urine and water in the mixture and kept aside for 15 days and stir in the morning and evening hours. After 15 days, add the rest of the ingredients in the mixture in a barrel or drum and keep the solution for the fermentation process.

Panchgavya solution will be ready in 30 days, spray the solution after sieving through a fine cloth so that a fine sieved liquid manure is obtained which can be directly applied to the plants through foliar spray or drenching for better nutrient absorption.

2. MATERIALS AND METHODS

2.1 Experimental Site

The present investigation “Influence Of Panchgavya And Jeevamrit On Growth, Yield And Quality Of Tomato (*Solanum Lycopersicum* L.)” was conducted in October, 2021-March, 2022 at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom, University of Agriculture, Technology and Sciences, Prayagraj (Uttar Pradesh). All the facilities necessary for cultivation, including labour, were made available in the department. Prayagraj is situated at an elevation of 78 meters above sea level at 25.87° North latitude and 81.15° E longitudes. This region has a sub-tropical climate prevailing in the South-East part of the U.P. with extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 0°C from December – January and very hot summer with temperatures reaching up to 46°C in May and June. During winter, frosts and summer, hot scorching winds are also not uncommon. The average rainfall is around 1013.4 (cm) with maximum concentration during July to September months with occasional showers in winters. The meteorological data for the experimental period was collected from the Meteorological Observatory at the College of Forestry and Environment, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj.

The present investigation was carried out in Factorial Randomized Block Design (FRBD) consisting of three replications and nine treatments which consisted of two different levels of panchgavya and two different levels of Jeevamrit in which the Recommended Dose OF Fertilizer (RDF) were common and the observations were recorded based upon the interaction of different levels of panchgavya and jeevamrit on the tomato plant.

Spraying of jeevamrit and panchgavya took place at an interval of 15 days regularly after plants were established at 30 Days after transplanting

such that sprays were done at vegetative stage, flowering stage, and fruit development stage.

* Recommended Dose of Fertilizer (N: P: K :: 120 kg:100 kg: 80 kg per ha) is common in all the treatments

2.2 Collection of Experimental Data

Collection of different observational data was done at different time intervals according to the given parameters.

Growth parameters:

Plant height:

Plant height was taken at an interval of 30, 60, 90 days after transplanting of seedling in to the field. The plant height was measured from the ground level to the tip of the plant and an average data of five plants were recorded.

Earliness parameter:

Days to first flowering:

The days to first flowering data was taken at the time of first flowering from the date of transplanting and data of an average of five plants were recorded.

Days to 50% flowering:

Days to 50% flowering of data was recorded when the average plants of a replication attained 50% flowering from the day of transplanting.

Days to first harvest:

Data of mean average of five plants of a plot of each replication were recorded from the day of transplanting to 1st harvest.

Yield attributing characters:

Polar diameter:

Average mean data of polar diameter of fruits were recorded from the 5 plants of a plot in each replication and were expressed as a mean data of each replication.

Radial diameter:

Radial diameter was recorded of fruits from the five plants of the plots of each replication.

Yield parameters:

No. of fruits per plant:

The matured fruits were harvested till fifth picking in five plants of each plot, then the mean of replications represented the no of fruits per plant.

Fruit weight per plant:

The fruit weight per plant was recorded at harvest and the mean fruit weight per plant was expressed in grams per plant.

Yield/ ha:

The average fruit weight data and average no of fruits per plant data were recorded and thus the average yield per hectare data was expressed.

Quality parameters:

T.S.S:

The average TSS data was collected from fresh fruits at the time of harvesting.

3. RESULTS AND DISCUSSION**3.1 Growth Parameters**

The maximum plant height at 30 days (cm) was recorded in the T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 35.06 cm, while the minimum plant height at 30 days (cm) was recorded in T₀ (Control) in 21.02cm. The maximum plant height at 60 days (cm) was recorded in T₈ treatment that received RDF + (4.5% Spray of

Panchgavya+10.5% spray of Jeevamrit) as 52.03 cm, while the minimum plant height at 60 days (cm) was recorded in T₀ (Control) in 35.59 cm. The maximum plant height at 90 days (cm) was recorded in T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 72.1 cm,), while the minimum plant height at 90 days (cm) was recorded in T₀ (Control) in 52.80 cm. The plant height was significantly increased with the combined application of Panchgavya and RDF. This may be due to the ample supply of essential nutrients for crops that assist to enhance nitrogen metabolism, auxin content, photosynthetic activity and chlorophyll content in plant tissue. Similar results were observed by Arivazhagan et.al [7].

3.2 Earliness Parameters

The earliest flower was recorded in T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 43.16 days), while the last flower was recorded in T₀ (Control) in 57.26 days. Early flowering may be due to the integration effect of panchgavya and jeevamrit which contains soil microbes, cyanobacteria, PSB and growth hormones such as auxin, gibberellin, and cytokinins all of which influence and enhance nitrogen efficiency in a way that chemical fertilizers do not. The appropriate integration of panchgavya and jeevamrit with inorganic fertilizer is capable of providing an optimal level of nutrients triggering early blooming in the treatment. Similar results were observed by Robin et al. [8].

Table 1. Growth parameters

Treatments	Plant height 30 days (cm)			Plant height 60 days (cm)			Plant height 90 days (cm)			F- TEST
T ₀ (P ₀ +j ₀)	21.03			35.6			52.81			S
T ₁ (P ₁ +j ₀)	28.21			44.03			62.93			S
T ₂ (P ₂ +j ₀)	31.99			45.7			66.64			S
T ₃ (P ₀ +j ₁)	26.13			40.92			58.74			S
T ₄ (P ₀ +j ₂)	28.32			43.29			60			S
T ₅ (P ₁ +J ₁)	29.16			45.02			64.19			S
T ₆ (P ₂ +J ₂)	32.64			49.96			69.31			S
T ₇ (P ₁ +J ₂)	30.4			46.4			66.07			S
T ₈ (P ₂ +J ₁)	35.07			52.03			72.11			S
CV	4.66			2.8			2.1			
	A	B	A*B	A	B	A*B	A	B	A*B	
SE.d(±)	0.45	0.45	0.78	0.41	0.41	0.71	0.43	0.43	0.75	
C.D 0.05	1.36	1.36	2.35	1.23	1.23	2.14	1.31	1.31	2.27	

Table 2. Earliness parameters

Treatments	Days to first flowering			Days to 50% flowering			Days to first harvest			F- TEST
T ₀ (P ₀ +j ₀)	57.26			61.33			97.94			S
T ₁ (P ₁ +j ₀)	56.48			59.36			92.37			S
T ₂ (P ₂ +j ₀)	48.87			52.55			90.56			S
T ₃ (P ₀ +j ₁)	54.3			58.32			92.42			S
T ₄ (P ₀ +j ₂)	51.6			54.85			92.37			S
T ₅ (P ₁ +J ₁)	47.41			53.16			92.09			S
T ₆ (P ₂ +J ₂)	45.5			51.43			84.56			S
T ₇ (P ₁ +J ₂)	46.04			52.14			91.02			S
T ₈ (P ₂ +J ₁)	43.17			49.06			83.65			S
CV	1.7			2.04			1.23			
	A	B	A*B	A	B	A*B	A	B	A*B	
SE.d(±)	0.28	0.28	0.49	0.37	0.37	0.64	0.37	0.37	0.64	
C.D 0.05	0.85	0.85	1.47	1.11	1.11	1.93	1.12	1.12	1.94	

Table 3. Yield attributing characters

Treatments	Polar diameter (cm)			Radial diameter (cm)			F- TEST
T ₀ (P ₀ +j ₀)	3.06			4.11			S
T ₁ (P ₁ +j ₀)	3.23			4.50			S
T ₂ (P ₂ +j ₀)	3.76			5.16			S
T ₃ (P ₀ +j ₁)	3.08			4.28			S
T ₄ (P ₀ +j ₂)	3.15			4.40			S
T ₅ (P ₁ +J ₁)	3.32			4.70			S
T ₆ (P ₂ +J ₂)	3.85			5.29			S
T ₇ (P ₁ +J ₂)	3.60			4.94			S
T ₈ (P ₂ +J ₁)	3.91			5.9			S
CV	1			2.9			
	A	B	A*B	A	B	A*B	
SE.d(±)	0.01	0.01	0.01	0.04	0.04	0.07	
C.D 0.05	0.03	0.03	0.05	0.13	0.13	0.23	

Table 4. Yield parameters

Treatments	No. of fruits per plant			Fruit weight (g)			Fruit yield (q/ha)			F- TEST
T ₀ (P ₀ +j ₀)	8.02			150.45			413.4			S
T ₁ (P ₁ +j ₀)	9.66			156.47			569.9			S
T ₂ (P ₂ +j ₀)	10.82			201.26			782.3			S
T ₃ (P ₀ +j ₁)	8.79			152.18			497.1			S
T ₄ (P ₀ +j ₂)	9.63			171.9			594			S
T ₅ (P ₁ +J ₁)	9.73			172.68			585.2			S
T ₆ (P ₂ +J ₂)	11.94			205.4			859.2			S
T ₇ (P ₁ +J ₂)	9.8			181.75			639.1			S
T ₈ (P ₂ +J ₁)	12.53			211.96			935.5			S
CV	2.9			4.4			6.2			
	A	B	A*B	A	B	A*B	A	B	A*B	
SE.d(±)	0.15	0.15	0.25	1.72	1.72	2.98	1.35	1.35	2.33	
C.D 0.05	0.44	0.44	0.77	5.17	5.17	8.95	4.04	4.04	7.01	

Table 5. Quality parameters

Treatments	T.S.S (°BRIX)			F- TEST
T ₀ (P ₀ +j ₀)	4.84			S
T ₁ (P ₁ +j ₀)	4.97			S
T ₂ (P ₂ +j ₀)	5.48			S
T ₃ (P ₀ +j ₁)	4.89			S
T ₄ (P ₀ +j ₂)	4.93			S
T ₅ (P ₁ +J ₁)	5.17			S
T ₆ (P ₂ +J ₂)	5.58			S
T ₇ (P ₁ +J ₂)	5.33			S
T ₈ (P ₂ +J ₁)	5.77			S
CV	1.4			
	A	B	A*B	
SE.d(±)	0.02	0.02	0.04	
C.D 0.05	0.07	0.07	0.12	

The earliest 50% flowering was recorded in T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 49.06 days, while the last 50% flowering was recorded in T₀ (Control) in 61.33 days. The earliest harvest was recorded in T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 83.64 days, while the last harvest was recorded in T₀ (Control) in 97.93 days. The presence of growth regulators due to the application of panchagavya and jeevamrit may be the reason for the early days to 50% flowering. Similar results were observed by Robin et al. [9].

3.3 Yield Attributing Characters

The maximum polar diameter was recorded in the T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 3.91 cm, while the minimum polar diameter was recorded in T₀ (Control) at 3.06cm. The maximum radial diameter was recorded in the T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 5.9 cm, while the minimum radial diameter was recorded in T₀ (Control) at 4.11cm. The phytohormonal effect attributed to the application of jeevamrit and panchagavya may be the reason for the higher radial diameter of the fruit in tomatoes. Similar results were observed by Robin et al. [8].

3.4 Yield Parameters

The maximum number of fruits per plant was recorded in the T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 12.53, while the minimum number of fruits per plant was recorded in T₀ (Control) in

8.02. The maximum fruit weight was recorded in the T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 211.96gm, while the minimum fruit weight was recorded in T₀ (Control) at 150.43 gm. The presence of macronutrients, essential micronutrients, numerous vitamins, essential amino acids, growth-promoting substances like IAA, GA, and beneficial microorganisms in the liquid organic manures (panchagavya and jeevamrutha) may have improved the source-sink relationship, which may have contributed to the increase in fruit production. Similar results were observed by Nileema et al. [9] The maximum yield per hectare was recorded in T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 935.5q/ha, while the minimum yield per hectare was recorded in T₀ (Control) in 413.4q/ha. The stimulation of root growth due to the soil application of jeevamrit and panchagavya was helpful in better absorption of water and nutrients from the soil and this may be the reason behind the better yield. Similar results were observed by Sanjiv et al. [10].

3.5 Quality Parameters

The maximum TSS was recorded in the T₈ treatment that received RDF + (4.5% Spray of Panchgavya+10.5% spray of Jeevamrit) as 5.77°Brix, while the minimum TSS was recorded in T₀ (Control) in 4.84°Brix. TSS means the amount of Total Soluble Solids present in fruits. It means the sugar content in fruits and includes carbohydrates, proteins, fats, minerals and organic acid of the fruit. A higher TSS value means a higher number of soluble solids present in fruits. It showed TSS becomes high with the combined application of both Jeevamrit and

panchgavya compared to the sole application of both the liquid bio-manures. Similar results were observed by Kachave [11].

3.6 Economics

The economically best treatment was T8, which gave the highest net return up to an income of 563900.00 Rs./ha as well as a BC ratio of 6.84.

4. CONCLUSION

The result from the present investigation concluded that the treatment T₈ which received RDF+ 4.5% spray of Panchagavya + 10.5% spray of Jeevamrit was found superior in plant height, days to first flowering, days to 50% flowering, days to the first harvest, polar and radial diameter, No. of fruits/plant, fruit weight (gm), fruit yield (q/ha), T.S.S content of tomato with high net income and BC ratio.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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