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Effect of natural farming inputs on growth and yield of tomato (*Solanum lycopersicum* L.)

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Abstract

A field experiment was conducted during the Rabi season of 2024–25 at the Department of Horticulture, College of Agriculture, Jabalpur, Madhya Pradesh. The experiment was laid out in Randomized Block Design (RBD) with eleven treatments and three replications comprising different combinations of vermicompost, *Jeevamrit*, *GhanJeevamrit*, mulching and recommended dose of fertilizers. The objective of the study was to evaluate the effect of difference source of inputs on growth and yield attributes of tomato. The results revealed significant variation among treatments for growth and yield parameters. Among all the treatments, T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN) recorded maximum plant height (87.20 cm and 106.73 cm at 90 and 120 DAT, respectively), number of primary branches per plant (10.48 and 12.34 at 90 and 120 DAT, respectively), number of inflorescences per plant (32.34), number of fruits per plant (54.60), fruit yield per plant (2.44 kg) and total fruit yield (557 q ha⁻¹). Improved fruit diameter was also observed under integrated nutrient treatments. Treatments involving *Jeevamrit* and *GhanJeevamrit* in combination with vermicompost and mulching also showed superior performance over control. The enhanced growth and yield under integrated treatments might be due to balanced nutrient availability, improved soil fertility, enhanced microbial activity and better nutrient uptake. The study indicated that integrated application of vermicompost along with reduced inorganic fertilizers and natural farming formulations can be considered an effective and sustainable approach for improving growth and productivity of tomato under field conditions.

Keywords: Tomato, *Jeevamrit*, *GhanJeevamrit*, vermicompost, natural farming, yield, growth

Introduction

Tomato is one of the major vegetable crops grown globally and is an important food source because of its nutritional value, which includes high levels of vitamin, minerals and antioxidants. Tomato is one of the significant sources of vitamin C, lycopene and β -carotene that are beneficial for human health and nutrition security (Patel *et al.*, 2024) [13]. Tomato is a crop grown in various agro-climatic conditions and plays a significant role in vegetable production in India. But repeated and overuse of chemical fertilizers has led to the deterioration of soil fertility, microbial activity and long-term productivity of soils (Dwivedi and Dwivedi, 2015; Verma *et al.*, 2020) [6, 16].

Natural farming has become a realistic choice in recent years to decrease the use of chemical goods and promote the ecological balance and the health of the soil. Bharucha *et al.* (2020) [3] mentioned that crop nutrition and soil improvement in natural farming primarily rely on the indigenous organic formulations and the use of locally available resources. *Jeevamrit* is one of those natural farming inputs that has a positive impact on soil microorganism activity and nutrient availability and hence is widely used. Microbial multiplication in rhizosphere and good plant growth is promoted by *Jeevamrit* (Sreenivasa *et al.* 2010 and Gangadhar *et al.* 2020) [14, 8]. Another organic formulation which is important is *Ghanjeevamrit*, it promotes soil fertility and biological activity. Choudhary *et al.*, 2017 [4] reported an increase in the enzymatic activity and the processes of nutrient transformation in soil due to *Ghanjeevamrit*. Likewise, vermicompost is also playing an important role in sustainable crop production with regard to soil structure, nutrient availability and microbial activity. Vermicompost has plant growth promoting

substances and essential nutrients that improve root growth and nutrient absorption (Atiyeh *et al.* 2002) ^[2]. Vermicompost application also resulted in higher height, more biomass in tomato and its fruit yield as reported by Arancon *et al.* (2004) ^[1]. The mulching method is also an effective activity in the natural farming system that can retain soil moisture, control soil temperature and reduce weed growth. El-Beltagi *et al.* (2022) ^[7] found that organic mulches increase the soil moisture available and the productivity of crops in a field condition. This was also found by Diwan *et al.* (2022) ^[5] in the case of tomato cultivation. Studies in the recently have highlighted the advantages of integrated application of *Jeevamrit*, vermicompost and organic mulching in the nutrient uptake, vegetative growth and yield performance of vegetable crops (Garg *et al.*, 2024) ^[9]. Comparative data on the growth and yield of tomato in response to various mixes of *Jeevamrit*, *Ghanjeevamrit*, vermicompost and mulching under field conditions however is still inadequate. The study was aimed at assessing the effectiveness of integrated use of organic and natural farming formulations in improving vegetative growth and fruit yield of tomato while promoting sustainable soil health management.

Materials and Methods

Experimental Site

The field experiment was carried out in the experimental field of the Vegetable Research Farm, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Maharajpur, Jabalpur, Madhya Pradesh in the Rabi season 2024-25. The experimental site is located where climatic condition is of semi-arid type of central India with favorable environmental condition for tomato production.

Experimental Design and Treatments

The experiment was designed in Randomized Block Design (RBD) having 11 treatments and 3 replications. Different combinations of recommended dose of fertilizers, vermicompost, *Jeevamrit*, *Ghanjeevamrit* and crop residue mulching were the treatments. The treatment details used in the experiment are presented below:

Table 1: Treatment details

Treatment	Details
T ₁	Control
T ₂	100% RDN (150:80:60 kg N:P ₂ O ₅ :K ₂ O ha ⁻¹)
T ₃	50% RDN (75:40:30 kg N:P ₂ O ₅ :K ₂ O ha ⁻¹)
T ₄	Vermicompost @ 15 t ha ⁻¹
T ₅	Vermicompost @ 7.5 t ha ⁻¹
T ₆	Vermicompost @ 7.5 t ha ⁻¹ + 50% RDN
T ₇	Vermicompost @ 7.5 t ha ⁻¹ + <i>Jeevamrit</i> 500 L ha ⁻¹
T ₈	<i>Jeevamrit</i> 500 L ha ⁻¹
T ₉	<i>Jeevamrit</i> 500 L ha ⁻¹ + crop residue mulching
T ₁₀	<i>Ghanjeevamrit</i> @ 2.0 t ha ⁻¹ + <i>Jeevamrit</i> 500 L ha ⁻¹
T ₁₁	<i>Ghanjeevamrit</i> @ 2.0 t ha ⁻¹ + <i>Jeevamrit</i> 500 L ha ⁻¹ + mulching

Crop Raising and Treatment Application

Healthy seedlings of tomato were transplanted into the field according to the 60cm x 60cm spacing at standard agronomic practices. Vermicompost was added to the soil in advance of transplanting per treatment requirements. Inorganic fertilizers were applied as recommended dose of fertilizer for tomato was applied at the rate of 150:80:60 kg N:P₂O₅:K₂O ha⁻¹ according to the treatment requirement. *Jeevamrit* was applied at 15 days interval at the rate of 500 L ha⁻¹ during the crop growth period.

Pre-transplanting application of *Ghanjeevamrit* was done near the root zone. Crop residue mulch was evenly applied in each treatment area for moisture conservation and weed control.

Statistical Analysis

The experimental data were statistically analyzed by analysis of variance (ANOVA) appropriate to Randomized Block Design as described by Gomez and Gomez (1984) ^[10]. The significance of treatment differences was tested at 5 per cent level of significance

Results and Discussion

Plant height at 90 and 120 DAT

The data presented in Table 1 revealed that different source of inputs significantly influenced plant height of tomato at both 90 and 120 DAT. Among all treatments, T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN) recorded the maximum plant height of 87.20 cm at 90 DAT and 106.73 cm at 120 DAT, followed by T₇ (81.07 cm and 104.80 cm) and T₁₁ (79.07 cm and 104.53 cm), whereas the minimum plant height was recorded under T₁ (72.53 cm and 96.67 cm). The increased plant height under T₆ might be due to balanced nutrient availability and improved microbial activity resulting from combined application of vermicompost and inorganic fertilizers. The present findings are in close agreement with Meenakumari and Shekhar (2012) ^[11], who reported superior growth and yield of tomato under vermicompost integrated with fertilizers. Similar observations were also reported by Gopal and Gurusiddappa (2022), who observed that *Jeevamrutha* application significantly increased plant height and vegetative growth in tomato due to enhanced microbial activity and nutrient availability. Higher plant height recorded under T₇, T₁₀ and T₁₁ may be attributed to the beneficial effect of *Jeevamrit* and *Ghanjeevamrit* in improving soil biological activity and nutrient transformation. Panda *et al.* (2020) ^[12] also reported enhanced growth and yield attributes of tomato with Panchagavya and *Jeevamrit* application. Likewise, Suthar *et al.* (2025) ^[15] reported maximum plant height in tomato with application of vermicompost along with *Jeevamrit* and organic growth stimulants under polyhouse conditions.

Number of Primary Branches per Plant

The data presented in Table 1 indicated significant variation in number of primary branches per plant due to different source of inputs at both 90 and 120 DAT. Among all treatments, T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN) recorded the maximum number of primary branches per plant (10.48 and 12.34 at 90 and 120 DAT, respectively), followed by T₇ (10.01 and 11.95) and T₂ (8.99 and 11.21), whereas the minimum number of branches was recorded under T₁ (6.05 and 7.19). The increased number of branches under T₆ might be attributed to balanced nutrient availability and improved soil biological activity resulting from integrated application of vermicompost and inorganic fertilizers. Enhanced nutrient uptake and better root development may have promoted vigorous vegetative growth and branching in tomato plants. Similar findings were reported by Meenakumari and Shekhar (2012) ^[11], who observed increased branching and vegetative growth in tomato with integrated nutrient management practices. Higher branching observed under T₇ and T₉ may also be due to the beneficial effect of *Jeevamrit* in stimulating microbial activity and nutrient transformation in the rhizosphere region. Panda *et al.* (2020) ^[12] reported improved growth attributes of tomato with *Jeevamrit* and *Panchagavya* application under organic production systems. Similar results were also reported by Suthar *et al.* (2025) ^[15],

who found that application of vermicompost along with *Jeevamrit* significantly enhanced vegetative growth and branching in tomato.

Number of Inflorescences per Plant

The data in presented Table 1 pertaining to number of inflorescences per plant revealed significant variation among different natural farming treatments. The maximum number of inflorescences per plant (32.34) was recorded under T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN), followed by T₇ (30.85), T₂ (29.88) and T₉ (28.87), whereas the minimum number of inflorescences (18.79) was observed under T₁ (Control). The increased number of inflorescences under T₆ may be attributed to balanced nutrient availability, improved soil fertility and enhanced microbial activity resulting from integrated application of vermicompost and inorganic fertilizers. Adequate nutrient supply might have promoted better vegetative growth and reproductive development, leading to increased flower cluster formation. Similar findings were reported by Meenakumari and Shekhar (2012) ^[11], who observed enhanced flowering and reproductive growth in tomato under integrated nutrient management practices. Higher number of inflorescences recorded under T₇ and T₉ may also be due to the beneficial influence of *Jeevamrit* and mulching in improving nutrient transformation, soil moisture conservation and microbial activity in the rhizosphere. Panda *et al.* (2020) ^[12] also reported increased flowering and yield attributes in tomato with *Jeevamrit* and *Panchagavya* application. Similar observations were reported by Suthar *et al.* (2025) ^[15], who found that application of vermicompost along with *Jeevamrit* significantly improved flowering and growth parameters in tomato.

Phenological parameters of Tomato

The data related to days to first flowering, days to 50% flowering and days taken to first picking revealed noticeable variation among different natural farming treatments. The minimum days to first flowering (40.33 days) were recorded under T₂ (100% RDN), followed by T₆ (41.00 days) and T₇ (41.33 days), whereas the maximum days (43.33) were observed under T₉. Early flowering under integrated nutrient treatments might be due to better nutrient availability and enhanced physiological activity, which promoted faster vegetative growth and earlier transition from vegetative to reproductive phase. Similarly, minimum days to 50% flowering (46.33 days) were recorded under T₂, T₃, T₇ and T₈, while maximum days to 50% flowering (48.67 days) were observed under T₁ (Control). The reduction in flowering duration under integrated nutrient management treatments may be associated with improved nutrient uptake and enhanced metabolic activities of plants. Similar findings were reported by Panda *et al.* (2020) ^[12], who observed earlier flowering in tomato with *Jeevamrit* and *Panchagavya* application under organic production systems. With respect to days taken to first picking, the minimum duration (104.40 days) was recorded under T₂, followed closely by T₃ (104.47 days), whereas the maximum duration (108.67 days) was observed under T₁. Earlier picking under nutrient enriched treatments may be due to accel.

Fruit Diameter of Tomato

The data pertaining to polar diameter and equatorial diameter of

tomato fruits showed considerable variation among different natural farming treatments. The maximum polar diameter (5.01 cm) was recorded under T₁₀ (*GhanJeevamrit* 2.0 t ha⁻¹ + *Jeevamrit* @ 500 L ha⁻¹), followed by T₆ (4.98 cm) and T₇ (4.89 cm), whereas the minimum polar diameter (4.55 cm) was observed under T₁ (Control). Increased fruit diameter under integrated nutrient treatments might be due to improved nutrient availability, enhanced cell division and better translocation of photosynthates towards developing fruits. Similarly, the maximum equatorial diameter (5.65 cm) was recorded under T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN), followed by T₃ (5.56 cm), T₁₀ (5.52 cm) and T₂ (5.48 cm), whereas the minimum equatorial diameter (5.15 cm) was observed under T₁. Better fruit development under integrated treatments may be attributed to balanced nutrient supply and improved soil microbial activity resulting from vermicompost and *Jeevamrit* application. The present findings are in agreement with Panda *et al.* (2020) ^[12], who reported increased fruit size and improved yield attributes in tomato with *Jeevamrit* and *Panchagavya* application under organic production systems. Similar observations were also reported by Suthar *et al.* (2025) ^[15], who found that application of vermicompost along with *Jeevamrit* significantly improved fruit diameter and yield parameters in tomato. Meenakumari and Shekhar (2012) ^[11] also observed enhanced fruit growth in tomato under integrated nutrient management involving vermicompost and fertilizers.

Yield parameter

The data presented in Table 2 and visual presentation in figure 1-3 pertaining to number of fruits per plant, fruit yield per plant and total fruit yield revealed significant variation among different treatments. The maximum number of fruits per plant (54.60), fruit yield per plant (2.44 kg) and total fruit yield (557 q ha⁻¹) were recorded under T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN), followed by T₇ with 49.60 fruits per plant, 2.29 kg fruit yield per plant and 538 q ha⁻¹ total fruit yield. The minimum values for these parameters were observed under T₁, which recorded 32.93 fruits per plant, 1.48 kg fruit yield per plant and 333 q ha⁻¹ total fruit yield.

The increased yield attributes under T₆ might be attributed to balanced nutrient availability, improved soil fertility and enhanced microbial activity resulting from integrated application of vermicompost and inorganic fertilizers. Better nutrient uptake and photosynthetic activity may have promoted higher flower retention, fruit set and fruit development, ultimately leading to increased yield. Similar findings were reported by Meenakumari and Shekhar (2012) ^[11], who observed higher fruit yield and improved yield attributes in tomato under integrated nutrient management involving vermicompost and fertilizers.

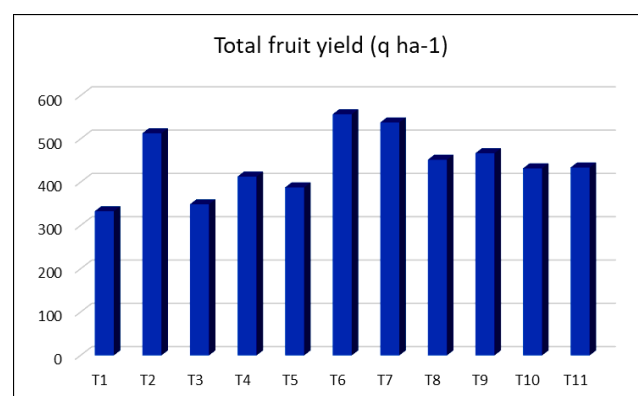
Higher fruit yield recorded under T₇ and T₉ may also be due to the beneficial effect of *Jeevamrit* and mulching in improving soil biological activity, nutrient transformation and moisture conservation. Panda *et al.* (2020) ^[12] reported enhanced fruit yield and growth attributes in tomato with *Jeevamrit* and *Panchagavya* application under organic production systems. Similar observations were also reported by Suthar *et al.* (2025) ^[15], who found that application of vermicompost along with *Jeevamrit* significantly improved fruit yield and productivity of tomato.

Table 1: Effect of different source of inputs on growth parameters

Treatment notation	Plant height (cm)		Number of Primary Branches		Number of Inflorescences	Days to first flowering	Days to 50% flowering	Days taken to first picking	Polar diameter (cm)	Equatorial diameter (cm)
	90 DAT	120 DAT	90 DAT	120 DAT						
T ₁	72.53	96.67	6.05	7.19	18.79	43.00	48.67	108.67	4.55	5.15
T ₂	76.47	102.87	8.99	11.21	29.88	40.33	46.33	104.40	4.80	5.48
T ₃	75.93	99.20	6.97	8.38	21.83	41.67	46.33	104.47	4.79	5.56
T ₄	75.87	98.87	7.53	8.92	23.20	43.00	48.33	107.87	4.81	5.32
T ₅	75.13	98.67	7.29	8.55	22.22	42.67	48.17	108.53	4.69	5.23
T ₆	87.20	106.73	10.48	12.34	32.34	41.00	47.33	106.93	4.98	5.65
T ₇	81.07	104.80	10.01	11.95	30.85	41.33	46.33	107.20	4.89	5.43
T ₈	76.40	100.13	8.72	10.36	27.55	43.00	46.33	107.40	4.79	5.22
T ₉	72.60	101.93	9.34	10.75	28.87	43.33	48.33	107.27	4.75	5.21
T ₁₀	78.33	103.53	8.28	9.35	24.82	42.00	46.67	106.53	5.01	5.52
T ₁₁	79.07	104.53	8.02	10.01	26.32	42.00	47.00	106.13	4.68	5.41
SEm±	2.15	1.57	0.31	0.39	0.69	0.48	0.47	0.74	0.06	0.09
CD at 5%	6.34	4.64	0.90	1.15	2.03	1.40	1.40	2.18	0.18	0.26

Table 2: Effect of different source of inputs on Yield parameters

Treatment notation	Number of fruits per plant	Fruit yield per plant (kg)	Total fruit yield (q ha ⁻¹)
T ₁	32.93	1.48	333
T ₂	47.87	2.27	513
T ₃	37.87	1.76	349
T ₄	38.73	1.86	413
T ₅	37.67	1.76	388
T ₆	54.60	2.44	557
T ₇	49.60	2.29	538
T ₈	43.27	2.02	452
T ₉	45.33	2.24	467
T ₁₀	38.73	1.87	432
T ₁₁	38.93	1.88	434
SEm±	1.31	0.07	19.47
CD at 5%	3.86	0.21	57.42

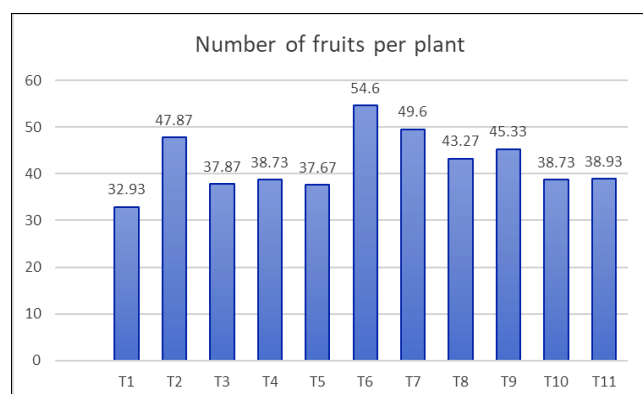
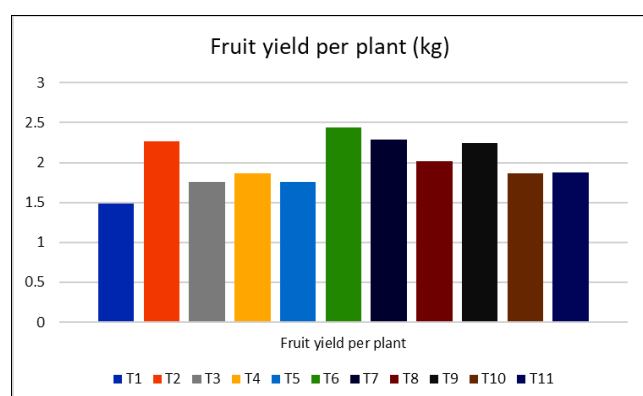
**Fig 2:** Effect of different source of nutrient on Total fruit yield (q ha⁻¹)

Conclusion

On the basis of the present investigation, it may be concluded that different source of inputs significantly influenced the growth and yield of tomato. Among different treatments, T₆ (Vermicompost @ 7.5 t ha⁻¹ + 50% RDN) proved to be the most effective treatment for improving plant height, number of primary branches, number of inflorescences, fruit diameter and yield attributes of tomato. The treatment recorded maximum number of fruits per plant (54.60), fruit yield per plant (2.44 kg) and total fruit yield (557 q ha⁻¹). Treatments involving *Jeevamrit* and *GhanJeevamrit* in combination with vermicompost and mulching also showed better performance over control. The improved growth and yield under integrated treatments might be due to balanced nutrient availability, enhanced microbial activity, improved soil fertility and better moisture conservation. Therefore, integrated application of vermicompost along with reduced inorganic fertilizers and natural farming formulations can be considered an effective and sustainable approach for enhancing growth and productivity of tomato under field conditions.

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**Fig 1:** Effect of different source of nutrient on Number of fruits per plant**Fig 2:** Effect of different source of nutrient on Fruit yield per plant (kg)

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