



Tomato (*Lycopersicon esculentum* Mill cv.VL-1) Seed Production through Organic Farming”

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Received: 09.11.2022; Revised: 09.12.2022; Accepted: 10.12.2022

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Abstract: Present investigation entitled ‘Tomato (*Lycopersicon esculentum* Mill cv.VL-1) Seed Production through Organic Farming’ was carried out with the objectives to produce the fruit of high nutritional quality in sufficient quantity, maintaining and increasing the long-term fertility of soil and to avoid all kinds of pollutions that may result from agricultural techniques. It was also an objective to use renewable resources in locally organized production systems and work with a close system with regard to organic matter and nutrient. The variety of tomato used in this study namely, VL Tamator -1, released in 2003 was collected from VPKAS, Almora, Uttarakhand. The experiment was laid out in Randomized Block Design with 13 treatments and 3 replications with the combination of organic and inorganic manure namely Farmyard Manure (FYM), Vermicompost, and inorganic fertilizers NPK during the two-year cropping seasons. In the first year, the maximum field emergence per cent, maximum average height of the plants, maximum average number of leaves per plant, maximum average thickness of stem, Maximum leaf area and maximum number of flowers per plant have been recorded in T₂ (15t/h vermi-compost) in comparison to T₀ used as a control. This T₂ combination of 15 ton per hectare vermi compost exhibited the maximum number of fruit/plants, maximum number of seed per fruit and highest weight of fruit. It was recorded that T₂ exhibited the maximum average length of roots per plant and plant yield. During the second year, similar observation has been recorded where maximum achievements were obtained in field emergence per cent, height of plant, number of leaves per plant and thickness of stem. The difference among the treatments found significant for leaf area, number of flowers per plant and number of fruit per plant in T₂ (15t/h vermi-compost). Similarly, the maximum numbers of seed per fruit, weight of fruit, average diameter of roots per plant, plant yield (kg/plot) were recorded highest. With the maximum adoption of organic manures can lead in high yielding of above-mentioned variety to fulfill demand of the organic produce.

Keywords: Organic • Field emergence • Plant height • Leaves • Stem and flowers

Introduction

Tomato (*Lycopersicon esculentum* Mill) also known as *Solanum Lycopersicon* L.) is one of the most popular and widely grown vegetables in the world, ranking second in importance to potato in many countries. Various factors are responsible for its low yield; inadequate use of fertilizers is one of them. The crop, have high requirements of nutrients. Low use of fertilizers and serious imbalances in N: P: K application ratio is partially responsible for the low yield. Moreover, complete dependence on chemical fertilizers is not sufficient to sustain the higher yields. Organic tomatoes are always in high demand in both local and wholesale markets. With proper production techniques, they can yield a high return on investment.

Organic fertilizers, which are eco-friendly and more economic, can play an important role in reducing the dependence on chemical fertilizers. They activate beneficial microorganisms present in soil (Singh and Kalloo, 2000), utilize atmospheric nitrogen for fixation in soil and improve the availability and uptake of existing nutrients, besides exerting other beneficial effects. They also solublize soil nutrients such as phosphorous, zinc, copper, iron, sulphur etc. in available form. Organic fertilizers are usually required in a very small amount, hence are cost effective and they also can replace organic fertilizers up to 25%. Therefore, in developing countries like India, it can solve the problem



of high cost of fertilizers and help in saving the economy of the country (Dubey, 1998).

Organic fertilizers are simply living fertilizers composed of microbial inoculants. Also, according to Subha Rao (1982), Biofertilizer denotes all the nutrient inputs of biological origin for plant growth. They possess unique ability to enhance productivity by biological N₂-fixation or solubilization of insoluble phosphate or producing hormones, vitamins or other growth factors required for plant growth. In view of the renewed interest in organic farming and demand for organic products worldwide including India, these areas have vast potential to emerge as major suppliers of organic products. Thus, there is a need to test the suitability of these varieties in an organic production system.

The pesticides also destroy earthworm, insects, the soil micro-organisms and microorganism which are farmers friendly and reduce mineral supply. Pesticides remain in the soil for many years and reduce the soil fertility. Vermicomposts contain nutrients in forms that are readily taken up by the plants such as nitrates, exchangeable phosphorus and soluble potassium, calcium, and magnesium (Edwards and Burrows 1988; Orozco *et al.* 1996). Not

Field Experiments

No. of treatment	: 13
Total no. of bed	: 39
Bed size	: 5 x 2m (10.00m ²)
Net Experimental Area	: 390.00 m ²
Spacing Row to row	: 75 cm
Plant to plant	: 60 cm
Rows per plot	: 6
Plants per row	: 3
Plants per plot	: 18
Width of irrigation channel	: 1.2 m

Treatment

Preparation of Beds and Cultural Operations: Experimental Field was ploughed and harrowed. Pre sowing irrigation was applied for the preparation of the field. The beds size 5x 2m were prepared and well leveled.

using any chemicals may lead to a more enjoyable lifestyle and better health. Organic farming is based on use of organic material and inputs of agriculture. The organic farming contains all process of farming which contribute towards environmental safety, social acceptability and economics benefits.

Material and Methods

The present investigation entitled 'Tomato (*Lycopersicon esculentum* Mill cv.VL-1) Seed Production through Organic Farming' was carried out through RBD design using 3 replicates in Experimental Field at Rampur village district of Tehri Garhwal near Kirtinagar, one of the experimental site and Seed Testing Laboratory of Department of Seed Science & Technology, HNB Garhwal, Srinagar Garhwal (Uttarakhand). The experimental material constituted (organic variety) namely, VL Tamator-1, Collected from Vivekananda Parvatiya Krishi Anushandhan Sasthan (VPKAS), Almora regional research station of Indian Council of Agricultural Research (ICAR).

Seeds sowing and Nursery raising: Seeds of Tomato cv.VL-1 and VL-3 were sown randomly by hand at proper distance in all the experimental beds. Already treated (with fungicide) seeds of VL-1 and VL-4 were sown in two nursery beds measuring 2x1 m. Then



seed bed was covered with dry mulch and irrigated lightly just after sowing. After 15 days, the mulch was removed on the emergence of seedlings.

Field preparation and fertilizer application:

The bunds were made manually by labors as per layout. For organic manure treatment Vermi-compost and Farm yard manure were used and urea was used as a inorganic manure.

Transplanting of seedlings: 30 days old seedlings were transplanted in nursery beds during first and second growth season. Plant space density was maintained as 75x60cm. Uniform sizes of seedlings were used for transplantation in different selected treatments. Intercultural Operations were follows as per specification. No chemical insecticides, fungicides or herbicides were used keeping with organic standards. Weeds were managed by hand-weeding once followed by two hoeing by using a manually operated. The crop was not infested by any major insect-pests and diseases in both the years. However, azadirachtin (a neem-based formulation) was sprayed two times during crop growth.

Observations and Growth characters selected for the Study:

During the experimentation, the following observation with regard to the growth, yield and quality character were recorded. 5 plants under each treatment combination were randomly selected and tagged for recording the observation on growth, yield and quality characters. Field emergence (%), Plant height, Number of leaves and Leaf area per plant, Thickness of stem, Root length are selected for the growth characters. For the yield characters, number of flowers per plant, number of fruits per branch, number of seeds per fruit, fresh weight of fruit, yield per plot, and yield per hectare were selected.

Standard seed germination test has been conducted to observe seed vigour test, speed of germination (SG), seedling growth rate (SGR), seedling length (SL), seedling dry

weight (SDW) and field Emergence (FE) using following methodology.

1. Field seedling emergence: Field emergence was recorded 3 times by 5 days intervals and continued until no further germination occurred. Field emergence (%) was computed as follows,

$$\text{Field emergence (\%)} = \frac{\text{Number of seedlings emerged}}{\text{Total number of seed sown}} \times 100$$

2. Standard Seed Germination Tests were conducted to observe Plant height, Number of leaves, Leaf area, Thickness of stem, Number of flowers, Number of fruits per plant, Number of seeds per fruit, Fresh weight of fruit, Root length and Yield per plot and Yield per hectare taken as per prescribed agronomic standards.

Analysis of variance: The experiment was laid in RBD with three replications. The data obtained from selected plants were subjected to the analysis variance as suggested by Fisher and Yates (1938) at n-2 treatment degree of freedom (d.f.) at 5%, 1% level of significance.

3. Seed germination and seedling dry weight:

The standard germination test was performed on four replications being of 50 seeds. The seeds were kept in between paper (B.P.) and then placed in germination chamber at 20°C for tomato seed (ISTA, 2008). Germination count for normal developing seedlings was made on (5th) and seventh (14th) day from the date of sowing as a first and final count respectively. Seedlings were evaluated in accordance with the International Seed Testing Association's (ISTA) rules for normal development, and results were expressed as percent normal seedlings for each replicate. The weight of seedling for each replicate was taken in gm, excluding the cotyledon on 8th day after oven drying at 100°C for 24 hr and noted. The sample exhibiting the maximum seedling dry weight (biomass) was recorded and considered as vigorous (Anonumous, 1996).



Table 1. The experiment comprised of the following treatments:

S. No.	Treatments	Notations
1.	10t/h h Vermi-compost	T ₁
2.	15t/h Vermi-compost	T ₂
3.	20t/h Vermi-compost	T ₃
4.	10t/h FYM	T ₄
5.	15t/h FYM	T ₅
6.	20t/h FYM	T ₆
7.	10t/h Vermicompost + Recommended NPK (100:50:50)	T ₇
8.	15t/h Vermicompost + Recommended NPK (100:50:50)	T ₈
9.	20t/h Vermicompost + Recommended NPK (100:50:50)	T ₉
10.	10t/h FYM + Recommended NPK (100:50:50)	T ₁₀
11.	15t/h FYM + Recommended NPK (100:50:50)	T ₁₁
12.	20t/h FYM + Recommended NPK (100:50:50)	T ₁₂
13.	Control	T ₁₃

Table 2: Effect of different treatments on growth character of Tomato (VL-1) during first year of experimentation

Treatments	Field emergence (%)	Height of plant (cm)	Number of leaves	Thickness of stem (cm ²)	Leaf area (cm ²)	Root length (cm)
T ₁	30.25	43.73	38.53	4.33	5.52	18.88
T ₂	32.10	49.73	55.86	5.53	9.67	20.88
T ₃	29.63	43.26	49.66	5.13	7.11	18.44
T ₄	30.86	41.86	52.2	5.33	6.68	18.33
T ₅	28.40	43.40	48.8	4.83	9.26	13.88
T ₆	25.31	39.06	38.00	5.13	6.25	16.88
T ₇	19.14	26.76	10.13	4.43	5.28	15.32
T ₈	18.52	30.66	12.33	4.56	7.35	17.21
T ₉	18.52	28.46	14.32	4.63	7.16	14.66
T ₁₀	19.14	23.43	12.16	4.06	6.57	13.67
T ₁₁	19.75	23.11	11.33	3.92	6.29	14.88
T ₁₂	14.20	20.13	12.96	3.53	5.82	12.33
T ₀	11.11	18.13	11.66	3.30	4.58	11.16
SEm±	2.00	3.08	5.44	0.20	0.42	0.82
CD at5%	1.94	7.95	14.09	0.33	0.58	1.52

Experimental Results

The present investigation was carried out at the experimental fields of the Department of Seed Science & Technology, HNB Garhwal University adopted at Rampur village near Kirtinagar, District Tehri Garhwal, (UK). The

experimental data recorded on various aspects under two sets of experiments one in field and another in laboratory conditions during Kharif season (2008-09) and were subjected to the appropriate statistical analysis for means and variances.



1. Field emergence %, Height of plants and number of leaves

During the course of investigation observations were recorded at initial days for field emergence. A close perusal of data indicated that treatments have a significant influence on the above parameters in comparison to control. The maximum field emergence percent (32.10%), maximum average height of the plants (49.73 cm) and leaves per plant (55.86) was recorded in T₂ (15t/h vermi-compost) followed by (30.25%) in T₁ (10t/h vermi-compost) over control (Table 2).

2. Thickness of stem, Leaf area, Number of flowers and Number of fruits

With regards to the thickness of stem per plant, the treatment was found significant. The maximum average thickness of stem (5.53cm) per plant was recorded under T₂ (15t/h vermi-

compost) treatment followed by (5.33cm) under T₅ (15t/h FYM) treatment (Table 2). Maximum leaf area was found (9.67 cm²); number of flowers (34.6) and number of fruits per plant (18.13) was found under T₂ (15t/h vermi-compost)

3. Number of seeds, Fresh weight of fruit, Root length, Yield per plot (kg.) and Yield per plot (q/ha)

The maximum number of seed per fruit (17.83) was found under T₁₀ treatment, however, this attribute was recorded low (11.26) in T₂ (15t/h vermi-compost) treatment. The results were found positive in gaining weight of fruit which was highest (48.86g) with maximum average length of roots per plant (20.88cm) under T₂ (15t/h vermi-compost) treatment. As far as the plant yield is concerned, this was also maximum (17.48 kg/plot) under this treatment.

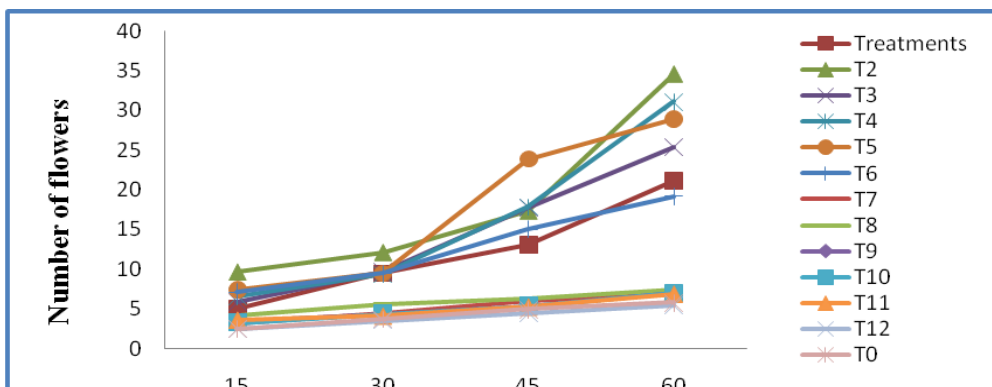


Fig.1: Effect of different treatment on number of flowers at harvesting time

VL-1 Second year:

1. Field emergence (%), Height of the plant, Number of leaves, and Thickness of stem

During the second year of the observation, this trend was continued where effect of different treatments on field emergence was found significant over control (Table-3). The maximum field emergence per cent (33.33%); maximum average height of the plant (51.56 cm); maximum average number of leaves per plant (57.56) and maximum average thickness of stem (6.13cm) per plant was recorded in T₂ (15t/h vermi-compost) in VL-1 cultivar.

2- Leaf area, Number of flowers, Number of fruits and Number of seeds per plant

It is apparent from the data as observed, difference among the treatments for Leaf area, number of flowers, number of fruits and number of seeds found significant. Maximum leaf area was found (11.12cm²) under T₂ (15t/h vermi-compost) treatment. Although in case of number of flowers per plant (26.67) this was recorded highest under T₅ (15t/h FYM) followed by 25.36 in T₂ (15t/h vermi-compost) treatment. However, T₂ again resulted maximum in number of fruit per plant (19.35). Although, the maximum average number of seed per fruit (19.86) was found under T₉ (Table 3; Fig.2).



Table 3 Effect of different treatments on growth character to Tomato (VL-1) during second year of experiment

Treatments	Field emergence (%)	Height of plant (cm)	Number of leaves	Thickness of stem (cm ²)	Leaf area (cm ²)	Root length (cm)
T ₁	31.48	44.96	40.56	4.63	6.00	22.1
T ₂	33.33	51.56	57.56	6.13	11.12	24.63
T ₃	29.63	44.46	49.06	5.70	7.28	19.23
T ₄	30.86	44.80	45.63	5.67	7.45	20.1
T ₅	29.63	46.20	49.73	5.36	10.42	22.43
T ₆	25.93	40.80	38.6	5.60	6.60	17.9
T ₇	17.90	21.76	5.80	3.50	4.25	12.84
T ₈	18.52	23.98	9.80	3.73	5.12	14.81
T ₉	16.67	19.84	8.00	3.50	4.40	12.81
T ₁₀	17.90	14.83	10.46	3.40	4.69	12.06
T ₁₁	19.14	17.02	9.53	3.76	4.17	11.70
T ₁₂	12.96	16.33	11.13	3.13	3.75	10.65
T ₀	11.11	13.30	9.46	4.72	3.54	10.53
SEm±	2.22	4.22	5.81	0.31	0.71	1.44
CD at5%	1.62	8.11	11.84	0.55	0.88	1.73

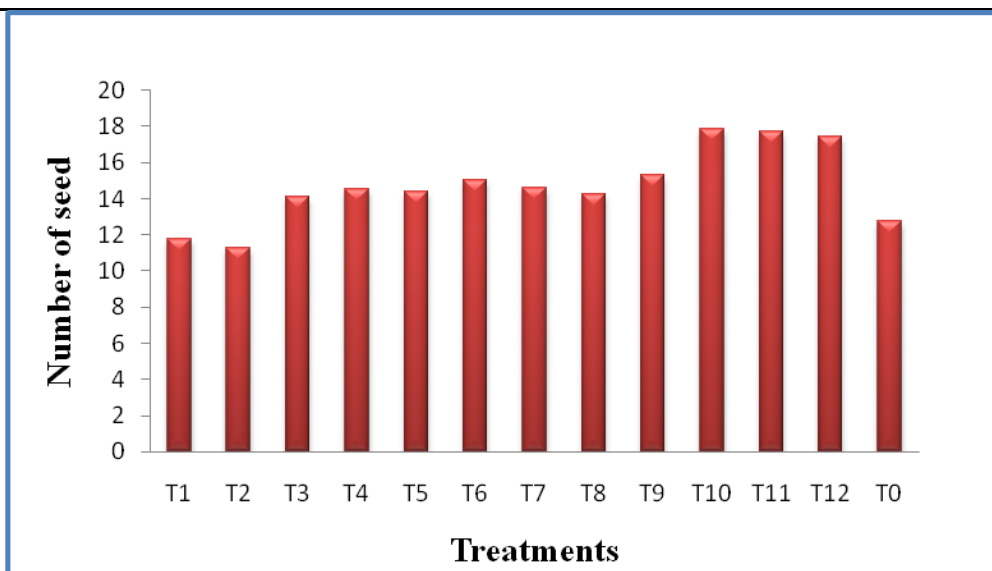


Fig.2: Effect of different treatment on number of seed at harvesting time.



A



B



C



D



E



F

Plate.1. VL-Tamater-1: (A) habit (B) Flowers (C) Counting of Fruit (D) Observation of young fruits (E) Mature fruit (F) Collection of harvested fruits.

3- Fresh weight of fruit, Root length, Yield per plot (in kg) and Yield per plot (q/ha)

T₂ treatment has shown better performance on Fresh weight of fruit, Root length, Yield per plot (kg) and Yield per plot (q/ha) attributes. The highest weight of fruit (51.07g), maximum average diameter of roots per plant (24.63cm), maximum plant yield (21.90 kg/plot) and plant yield (219.0 q/ha) have been observed under T₂.

4- Fresh weight of fruit, Root length,

During the second year of the experimentation, T₂ (15t/h vermi-compost) treatment has resulted in the highest weight of fruit (34.20g) and average diameter of roots per plant (14.65cm).



Discussion

The experimental results of the present investigation provides a detailed account of performance of *Lycopersicon esculentum* Mill cv.VL-1 through organic farming on “seed production and seed quality evaluated by various seed quality test parameters.

Organic farming is based on use of organic material and inputs of agriculture. The organic farming contains all process of farming which contribute towards environmental safety, social acceptability and economics and benefits. Organic farming is considered as the most widely recognized alternative farming system. A production system, which avoid or largely excludes the use of synthetically, compounded fertilizers, pesticides, growth regulators, and livestock feed additives as suggested by Sharma, 2005. The average yield of tomato in India is not according to the crop potential productivity. Various factors are responsible for its low yield; inadequate use of fertilizers is one of them. The crop, have high requirements of nutrients.

According to the results of the present study on the different growth parameters of *Lycopersicon esculentum* Mill cv.VL-1 indicated that the treatments have a remarkable significance on the plant growth.

VL-1 Firs year:

A close perusal of data indicated that the treatments have a significant influence on the field emergence, maximum average height of the plants, over control. The maximum field emergence per cent (32.10%) was recorded in T₂ (15t/h Vermi-compost) followed by (30.25%) in T₁ (10t/h Vermi-compost). Organic manures naturally influence the plant development which can be prepared from natural organic matter. These materials are the reservoirs of the nutrient that are required for the plant growth. These nutrients are in the form of complex, bound organic chemicals with strong bonds in most of these plant and animal debris. The findings supported by the publication of Ismail, (1997), and Ansari,

(2007). This treatment also has shown maximum average number of leaves per plant (55.86) which has signified the influence on parameter of number leaves and thickness of stem per plant. Similar observations have been recorded by Atiyeh *et al.* (2000) when 20% commercial horticulture medium was replaced by vermi-compost there was significant increase in plant height and root and shoot biomass in tomato crop. This is supported by the findings of Singh and Chauhan (2009) who observed the increased in germination, height of plant, number of leaves per plant, length of leaves, width of leaves, number of pods per plant, length of root, number of nodules, yield per plot (YP) and number of seeds per pod in Vermi-compost treatment. Singh and Cheema, (1997) studied the response of chilly to Vermi-compost and observed that application of Vermi-compost increases the microbial activities, which have its positive effect on the performance of plants as indicating by higher number of branches. Similarly, Thanunathan *et al.* (1997) reported that soil + mine spoil +coir pith vermi-compost (1:1:1) significantly increases plant height, number of leaves, root length, etc. in Onion.

Maximum leaf area was found (9.67 cm²) and maximum number of flowers per plant (34.6) under T₂ (15t/h Vermi-compost) treatment. Rao and Sanker (2001) also observed the similar results better than those of inorganic fertilizers in brinjal. Vivek *et al.* (2001) and Wange and Kale (2004) observed that there was significant improvement in number of leaves per plant in brinjal. T₂ treatment has resulted maximum number of fruit/plant (18.13) which is supported by the findings of Anburani and Manivannan (2002) However, the parameter of maximum number of seed per fruit (17.83) was found under T₁₀ (10t/h FYM + Recommended NPK (100:50:50) in comparison (11.26) to T₂ treatment.

The results were shown remarkable impact in gaining weight of fruit under the use of vermi-compost. The highest weight of fruit (48.86 g)



was recorded under T₂ (15t/h Vermi-compost) treatment. The results are in line with the findings of Ribeiro *et al.* (2000) who observed that dry matter content increased with increased vermi-compost dose up to 400g in sweet pepper cv. As far as the average length of roots per plant is concerned, it was found to be significant. The maximum plant yield (17.48 kg/plot) was observed under T₂

VL-1 Second year:

The effect of different treatment on field emergence in T₂ (15t/h Vermi-compost) found non-significant over control, however, exhibited better with regards to the maximum average number of leaves per plant and average thickness of the stem (6.13cm/plant). Similarly, T₂ (15t/h Vermi-compost) could not resulted best in leaf area and number of flowers formation/plant. The attribute as number of fruits per plant was found more significant on T₂ treatment that was maximum (19.35) Likewise, Arancon *et al.* (2003) reported a significant effect of vermi-compost on number of fruit in tomato where 100% vermi-compost treatment was resulted in fruit number four times more than the control.

The attribute like fresh weight of the fruit, the highest weight of fruit (51.07g) was recorded under T₂ (15t/h Vermi-compost) that was very significant as compared to other treatments. Camilia *et al.* (2006) studied the interaction effect between organic matter and different sources of phosphate fertilizers on the growth and uptake of nutrients by Spinach and Radish plants.

T₂ (15t/h Vermi-compost) treatment has proved very significant and the best that was maximum in plant yield (21.90 kg/plot) followed by other treatments. The influential findings have also been reported by Mishra *et al.* (2005) which showed that vermi-compost had beneficial effects on growth and yield of rice, especially caused significant increase of many growth parameters, seeds germination, chlorophyll concentration and yield. The results of this experiment showed that the

increase in growth and yield of tomatoes with addition of Vermi-compost is associated with greater uptake element nutrients such as: P, K, Fe and Zn. The available nutrient status of soil was greatly enhanced by the application of vermi-compost as an organic source (Prabha *et al.*, 2007). Rao and Shankar (2001) have also observed that the effect of organic manures on yield characters were significantly better than those of inorganic fertilizers in brinjal.

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